THE EXPERT'S VOICE® IN FINANCE

Managing Derivatives Contracts

A Guide to Derivatives Market Structure, Contract Life Cycle, Operations, and Systems

Khader Shaik

Foreword by Professor Moorad Choudhry

Apress®

For your convenience Apress has placed some of the front matter material after the index. Please use the Bookmarks and Contents at a Glance links to access them.

Contents

PART

I

The Big Picture

CHAPTER

1

The Derivatives Market

Derivatives play a vital role in today's global economy. They are powerful and versatile tools. Derivatives enable financial institutions, large corporations, and high-net-worth individuals to manage their exposure to financial risk in its manifold forms. The global derivatives market operates seamlessly around the clock, trading a constantly mutating variety of complex instruments on rapidly changing technology platforms.

The pace and direction of these changes have been hastened and shaped by the financial crisis of 2008 and its recessionary aftermath. These events exposed systemic shortcomings and catastrophic perils in the derivatives market and antagonized public perception of it. The phasing in of root-and-branch regulatory reform of the derivatives market has prompted transformative adaptations in derivative instruments, technology platforms, and the management and operation of the whole derivatives contract life cycle.

Unlike most books on derivatives, which deal with the mathematical techniques and models of risk management, this book focuses on what nonquantitative derivatives professionals need to know about the end-to-end derivatives life cycle. It shows such professionals, who outnumber the cadre of quants by an order of magnitude in the typical derivatives organization, how to adjust successfully to the new and emerging product, technology, and regulatory conditions of the post-2008 derivatives market.

The objectives of this foundation chapter are briefly to

- define the financial derivative
- outline the structure and size of the derivatives market and its submarkets

- set out the need for derivatives and their benefits to the economy and capital markets
- explore the systemic dangers and risks of derivatives
- survey the ongoing regulatory changes in the derivatives market
- identify the operational and technical challenges of managing derivative contracts in the emerging new regulatory landscape
- discuss the importance of information technology in each area of derivatives contract management

Financial Derivatives

A *derivative* is an instrument derived from at least one other elementary instrument known as the *underlying*; the value of a derivative instrument depends on the value of the underlying. Examples of underlyings include stocks, bonds, exchange rates, interest rates, credit characteristics, indices, commodities, and other derivative instruments.

From a practical standpoint, the derivatives contract is simply an agreement between two parties, and its performance is derived from the underlying—hence the name *derivative*. An example of a derivative is an *option contract* on a stock issued by some corporation, in which the value of the option is derived from the performance of the stock. Another example of a derivative is an *interest rate swap*, whose value is derived from the underlying interest rate index on which it is based.

Derivatives can be divided into two major categories: *financial derivatives* and *commodity derivatives*. Financial derivatives are derived from financial instruments such as stocks, bonds, interest rates, and currency rates. Commodity derivatives, on the other hand, are derived from underlying commodities such as precious metals, agricultural products, and commodity indices. This book is concerned only with financial derivatives. The term *derivatives* and its various synonyms—*financial derivative instruments*, *derivative contracts*, *contracts*, *derivative products*, and *derivative instruments*—should be understood throughout this book to refer to *financial derivatives*.

Derivative instruments are distinguished from other financial instruments by the following characteristics:

> **Life span.** Unlike a securities transaction (stock or bond) that is settled at once, a derivatives contract starts on a certain date and stays in effect until some later date with one or multiple settlements during that period. The life span of a derivatives contract may vary from a few weeks to many years.

Settlement. Derivative contracts are settled either financially (*cash-settled*) or through physical delivery (*delivery-settled*). Most derivative contracts are cash-settled regardless of the underlying. This enables participants to trade various types of derivatives without owning the underlying assets. However, a small proportion of derivative contracts are physically settled by delivering the actual underlying assets. Contract terms specify method of settlement and eligible assets that can be delivered in case of physical delivery.

Investment. Derivatives—even those with large *notional value* (the nominal or face amount of contract)—typically require only a nominal investment such as an initial margin, whereas securities (such as stocks, loans, and bonds) transactions require upfront investment.

Positions. Technically, market participants do not buy or sell derivatives in the same way that they transact other financial instruments. Rather, they *enter into* (*open)* and *terminate* (*close)* derivatives positions. During the contract term, most derivative contracts are valued using market prices; others are valued using mathematical models. Derivative contracts are often managed on a portfolio basis, combined with other assets or derivatives.

Credit risk. The credit risk involved in derivative transactions is different from the credit risk carried by other financial instruments. For example, with a loan, the amount at risk is the principal paid to the borrower. The credit risk is *unilateral*, meaning that only the lender is exposed to risk from the borrower. In contrast, the credit exposure in most derivative transactions is *bilateral*. Because the value of a derivative may swing to either side, each party involved may be exposed to risk at various points over the life of the contract.

Cash-flow direction. During the term of most derivative contracts, two-way cash flows are common. Most other financial instruments have only one-way cash flows.

Risk exposure. Derivatives enable participants to trade risk exposure from an underlying asset without actually owning that asset.

Position management. The risk of holding a derivatives contract may be dissimilar to the risk of holding its underlying. For instance, the risk involved in purchasing a bond is not necessarily the same as the risk involved in purchasing a derivatives contract on that same bond. As a result, managing derivative positions is quite different from managing the position in the underlying.

The Derivatives Market Structure

The derivatives market is broadly divided into two submarkets: the *listed market* and the *over-the-counter* (OTC) *market*. These submarkets are differentiated by their products and their regulatory and operational requirements, as depicted schematically in Figure 1-1 and described in the following sections.

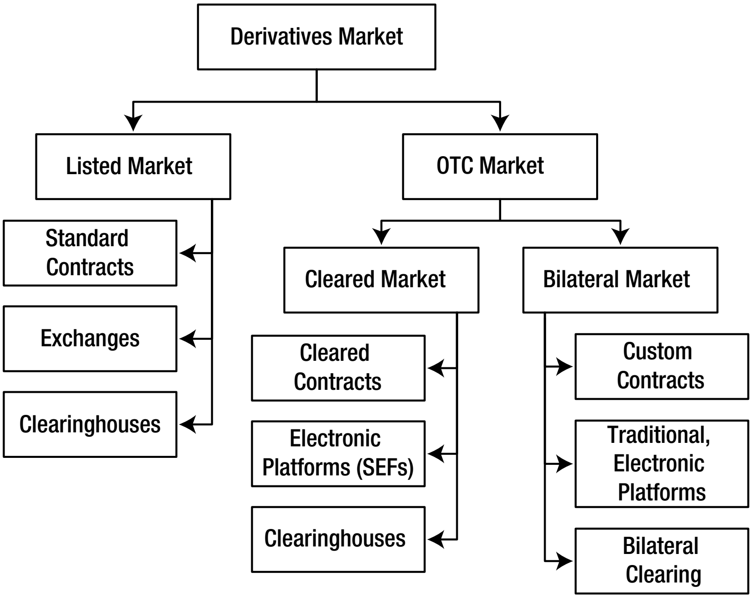

Figure 1-1. Derivatives market segments

The Listed Market

The *listed market* consists of standardized contracts traded on exchanges. A *derivatives exchange* is a regulated entity that provides a trading facility to its members. The derivative products on the exchange are standardized with specific delivery and settlement terms. Today's derivatives exchanges trade a wide variety of contracts, ranging from simple stock options to interest rate swaps. As financial instruments evolve, exchanges continue to introduce variety of products.

The listed market is also called the *exchange market*, the *regulated market*, or the *organized market*. The products traded on the listed market are variously called *listed derivatives*, *listed contracts*, *on-exchange derivatives*, or *standardized derivatives*.

Traditionally, trading on exchanges took place on a physical trading floor through a face-to-face auction process. Today, most derivatives exchanges have replaced or supplemented their floor-based trading with electronic trading.

Trading on exchanges is limited to standard contracts. All listed products are cleared by a designated *clearinghouse*, which guarantees the fulfillment of contractual obligations. Central clearing virtually removes the credit risk from listed contracts. Since these contracts traded on exchanges, they provide higher liquidity.

The major benefits of listed markets are the following:

- The obligations of listed contracts are guaranteed by the clearinghouse. As the *central counterparty* (CCP) to a listed contract, the clearinghouse eliminates *counterparty credit risk*.
- All contracts are highly standardized in nature. For instance, the expiration date, underlying entity, settlement style, and all other key attributes of contracts are predefined by the exchange. Hence, the exchange market is efficient and provides multilateral trading and substantial liquidity.
- Exchange trading leads to lower transaction costs.
- Clearinghouse and clearing members use a margining process to manage the risk. All positions are *marked-to-market* on a daily basis (sometimes even more than once a day). This virtually eliminates counterparty risk.
- Exchange-traded derivatives have greater price transparency because all trading prices are publicly available.

Despite the many benefits of the listed market, listed contracts are still not sufficient to serve the fundamental needs of those trading derivatives. Listed contracts may not serve all the risk management needs of a portfolio in terms of duration and quantity. In addition, in certain situations, it may be more expensive to hedge the risks that exist in a portfolio using listed contracts. The next section explains how the OTC market fulfills certain needs that are not adequately met in the listed market.

The Over-the-Counter Market

Over-the-counter (*OTC*) is a term used to describe trading activity that does not take place on a regulated exchange. In the OTC market, contracts are negotiated (traded) in different ways. The OTC market divides into two parts: the *bilateral OTC market* and the *cleared OTC market*.

The Bilateral OTC Market

In the bilateral OTC market, trading takes place directly between two parties with terms designed to suit the needs of the contract seeker. Trading in OTC markets takes place over traditional channels including telephone, email, electronic, and proprietary dealer trading platforms.

Bilateral contracts—also known as *negotiated*, *nonstandard, unlisted,* or *bespoke contracts*—are not cleared through any clearinghouse. Both parties remain as counterparties to each other until the termination of the contract. Typically, these contracts are traded between institutional clients and investment banks (*broker-dealers*) and may be customized to address any specific exposure (underlying, contract size, maturity, embedded options, and so on) of the institutional client.

In principle, bilateral contracts can be formed in an unlimited number of ways because each one can be customized. As a result, bilateral markets trade a broader range of contracts than the listed markets. However, bilateral OTC contracts carry credit risk and the risk of the counterparty defaulting on its obligations.

The Cleared OTC Market

In recent years, OTC markets have introduced *cleared OTC contracts* (also known as *cleared contracts)*, which are standardized and cleared through a CCP. These contracts are quite similar to listed contracts in that both parties in the trade use a clearinghouse as the counterparty guaranteeing the fulfillment of obligations of these contracts. As a result of Dodd-Frank regulations that mandate the clearing of certain OTC contracts (see Chapter 9), many electronic trading platforms and CCPs have evolved to clear a wide range of OTC contracts.

Market Venues

Derivatives trading takes place in several major venue types:

Exchanges. Orders from buyers and sellers are matched using open outcry auctions or electronic order matching systems.

Dealer market. Dealers either act as counterparties to trades or *broker* (arrange) trades between customers.

Electronic trading platforms. *Electronic trading platforms* (ETPs) are computerized systems that bring multiple customers and dealers together and accommodate execution electronically, either automatically or through negotiation over the electronic channel. ETPs promote low transaction costs and multilateral trading (multiple market-maker bids and offers). There are two major classes of ETPs: *regulated ETPs*—such as *swap execution facilities* (SEFs) and *multilateral trading facilities* (MTFs)—and *unregulated ETPs*—such as those run by dealers and other firms.

Interdealer broker. This venue is a market in which only dealers can participate. Dealers trade with each other using both dedicated electronic platforms as well as traditional bilateral channels.

Market Size

There is no perfect or universal method for measuring the size of the derivatives market. Commonly used measures are *notional*, *exposure* (*at-risk capital*), and *amount of money spent* (*cost of transactions*). The notional measure has been widely used until recently, but it suffers from the deficiency that the actual value of exchange of assets or cash resulting from these contracts does not in general correspond to their notional value. As a result, the *gross market value* (also known as *exposure* or *at-risk capital*) measure—representing the cost of replacing all outstanding contracts at current market price—is increasingly used. Different organizations track different aspects of the size of the overall derivatives market. For example, the Bank for International Settlements (BIS) reports the total global notional amounts of the derivatives market, whereas the International Swaps and Derivatives Association (ISDA) reports the transaction volumes in OTC markets. Similarly, local agencies report on derivative markets by sector: for instance, the US Office of the Comptroller of the Currency reports the derivatives volume by all banks, and the National Association of Insurance Commissioners reports the derivatives volume by the insurance industry.

According to a June 2013 survey by BIS, the outstanding notional of global OTC derivatives was $693 trillion, and their gross market value was $20 trillion;[1] while the outstanding notional of global exchange-traded derivatives was around $68 trillion.[2]

Market Players

The derivatives market is predominantly a professional wholesale market whose main participants are classified as banks, investment firms, insurance companies, and corporations. Figure 1-2 shows various players in the derivatives market in the context of the market structure.

[1]Bank for International Settlements, "OTC Derivatives Statistics at End-June 2013," www.bis.org/publ/otc_hy1311.pdf, November 2013.

[2]Bank for International Settlements, "Derivatives Traded on Organized Exchanges," http://www.bis.org/statistics/r_qa1312_hanx23a.pdf, November 2013.

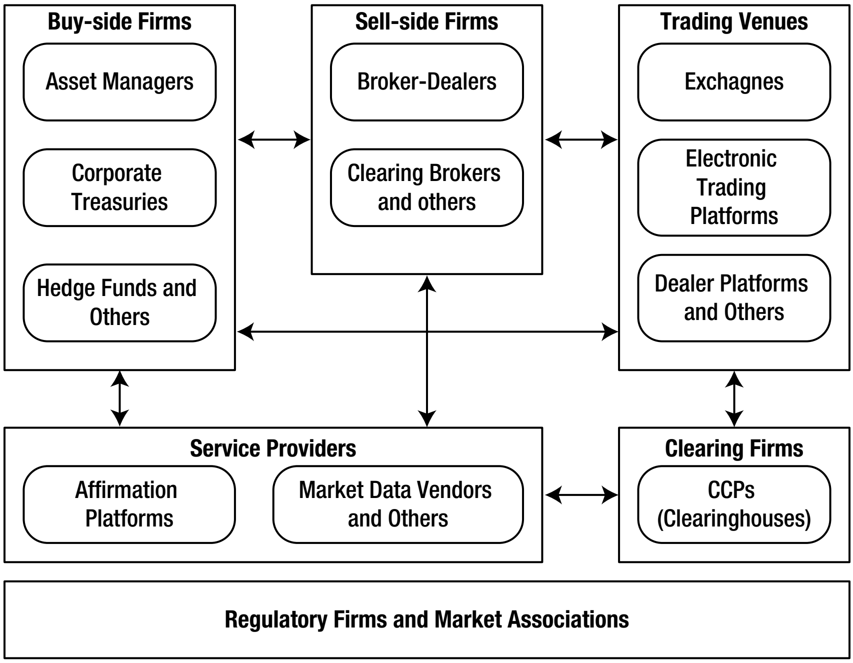

Figure 1-2. Derivatives market structure and players

The following list details the categories of market players that can be found in the derivatives market. The various players' roles are explained in detail in Chapter 5.

Buy-side firms. *Buy-side firms* are also known as *institutional investors* or *end users*. They include hedge funds, private clients, banks, loan portfolio managers, insurance firms, asset managers, corporate treasurers, arbitrageurs, speculators, and scalpers (day traders).

Sell-side firms. *Sell-side firms* are also known as *broker-dealers*, or simply *dealers*. They include all types of brokerage firms, including market makers, execution brokers, and clearing brokers (futures commission merchants).

Trading venues. Trade execution venues include derivatives exchanges and various types of electronic trading platforms such as SEFs, dealer platforms, and interdealer platforms.

Clearing firms. Institutions that clear trades and serve counterparty to both sides of the original trade as *central counterparties* (CCPs) are *clearing firms,* also known as *clearinghouses.*

Service providers. Institutions that provide various types of services include affirmation platforms, custodians, banks, payment processing institutions, data vendors, and transaction processing firms.

Regulatory and market associations. Various governmental and nongovernmental organizations regulate, monitor, and assist overall market function.

Note Although many retail customers participate in derivatives trading, they trade listed products through retail brokerage firms. The retail market is highly automated and standardized, which keeps transaction costs low. Retail brokers provide all the tools needed for trading and other activities. Retail trading and related topics are outside the scope of this book.

Advantages of Derivatives

The financial markets perform a number of vital functions. The securities markets, for example, help promote trade, provide a venue for businesses to raise capital, and give opportunities for those who own capital to make a return on their money through investing. The derivatives market plays an important role in the global economy by enabling market participants to transfer risk, providing price discovery, promoting efficient markets, and lowering transaction costs.

Chapter 2 surveys the various types of derivatives and their respective uses, but a detailed description of uses is outside the purview of this book. The following list highlights some of the beneficial roles derivatives play in the financial markets:

Hedging against risk: Corporations, financial institutions, and other market participants use derivatives to manage (hedge) risks such as market risk stemming from such fluctuating factors as the price of raw materials, exchange rates, and interest rates.

Speculation. Derivatives allow investors to take positions on either side of the market. As such, they enable investors to profit either from correctly anticipating changes in the prices of assets or interest rates or from accurately predicting when credit events will occur. As a result, speculation promotes price discovery and efficient markets. Speculators deliberately take on the risks related to changes in prices and other market parameters for the purpose of deriving profit. They also contribute to the liquidity in the market.

Alternative investment opportunities. Derivatives provide an alternative to investing directly in assets such as stocks and bonds. They lower transaction costs while providing the risk and reward that are inherent to direct investment, thereby helping to preserve capital.

Risk trading. Derivatives such as credit contracts separate the credit risk component from investment, allowing institutions to transfer or trade just the risk.

Cash-flow management. Derivatives allow investors to change the nature of an investment without incurring the costs of actually replacing or trading the portfolio asset in question. In addition, derivatives allow firms to create payoff patterns that are compatible with their strategy and degree of risk aversion at a lower cost.

Price discovery. Asset prices depend on market conditions that affect the supply and demand. Futures contract prices in the derivatives market reflect these market conditions. The futures contract price is used in the discovery of the current (spot) price of the underlying asset.

Promotion of advanced strategies. The use of derivatives allows market participants to develop advanced strategies to manage risk and improve the performance of their portfolios.

Cost efficiency. Derivatives are cost-efficient insofar as they reduce expenses when creating portfolios with specific parameters and enhance the liquidity and price efficiency of the markets.

Better protection. Ongoing expansion of cleared OTC products offers the best of both worlds: the contract variety of the OTC market and the lowered counterparty risk of the listed market.

Despite all of their advantages, derivatives contracts come with risks of their own. Collectively, derivatives may increase systemic risk in the financial markets, which is part of the reason why they have drawn widespread criticism in recent years. The "Dangers and Challenges of Derivatives" section discusses some of the drawbacks of derivatives.

Advantages of OTC Derivatives

The previous section identified the benefits of derivatives and noted that these financial instruments have drawn harsh criticism for the risks they present not only to their users but also to the global financial system. This section explains why OTC derivatives in particular are necessary despite their inherent dangers.

The fundamental purpose of derivatives contracts is to manage risk. Risk exposure can arise in various ways, and it is not possible to design and trade standardized derivatives that address all possible forms of risk exposure. It is important for the investor to find the right derivative—preferably a single contract that covers almost all of the risk exposure at the least expense. OTC derivatives offer a solution that fills this need.

The OTC market provides such advantages as product flexibility, market liquidity, legal certainty, standard credit risk management support, confidentiality, and a large dealer network, elaborated as follows:

> **Custom products and cost.** OTC contracts can be designed to manage any risk, whether that involves interest rates, inflation, or credit for any duration. As a result, overall transaction costs are less than for multiple standard contracts.
>
> **Dealer network, liquidity, and competitive pricing.** OTC markets are driven by a large dealer network, and these dealers play a critical role by assuming exposure for the risks that market participants want to transfer. Dealers also provide needed liquidity by taking the opposite position in client trades. The existence of a large network of dealers across the globe promotes competitive pricing in the OTC market.
>
> **Legal certainty and credit risk management.** OTC markets have fixed many shortcomings by introducing standard contract terms as well as processes to improve the legal certainty of contracts and manage counterparty credit risk. OTC markets have resulted in the creation of legal frameworks and risk management tools, such as netting and the use of collateral.
>
> **Transaction confidentiality and anonymity.** OTC derivatives contracts are confidential agreements between two counterparties. This confidentiality provides great protection for participants in the OTC market, and it also protects their business strategies. However, recent regulations have introduced certain transparency measures while maintaining the confidentiality inherent to the OTC market.
>
> **New products.** Due to the flexibility and heavy involvement of dealers, the OTC market works as an incubator for new financial products.

Dangers and Challenges of Derivatives

The financial crisis of 2008 and the consequent Great Recession provoked a furious backlash against OTC derivative instruments. Although some of this criticism may be misplaced, derivatives undeniably present multiple and potentially catastrophic risks to the financial system. They can cause sharp changes in the value of underlying assets, lack transparency, enable speculative bets that fail, and be inappropriately marketed. When these vulnerabilities are actualized on a large scale, derivatives can dangerously destabilize the entire financial system, especially when major participants fail (see the next section).

Dangers and challenges of derivatives include the following:

Complexity. Many derivatives are highly complex and opaque, exposing investors to irresponsible marketing and insufficient understanding of the products.

High levels of exposure. Many derivative products have the potential for large financial losses. If these instruments are used for speculative purposes or without a full understanding, they may cause serious losses.

Complex risk measures. Although derivatives are used to manage the risk, a derivatives contract itself can also create risk exposure. Failure to effectively assess and hedge that exposure may lead to major losses.

Complicated hedging strategies. Some market participants have resorted to the use of complicated hedging strategies with derivatives. If these strategies do not succeed, they may result in major losses.

Systemic risk. Some OTC market participants use too much leverage, which can create great systemic risk. In addition, lack of transparency may increase the risk in multiple folds.

Large size. The notional amount of outstanding positions in the global derivatives market is quite large. Problems in any part may result in a major impact on the total global financial system.

Regulatory complexities. Due to a lack of transparency and the complexity of products, it is hard to efficiently regulate and supervise the derivatives market. However, new regulations are designed to address transparency issues.

Price discovery challenges. Lack of transparency and uniformity in the bilateral OTC market make price discovery more challenging than for exchange-traded instruments.

High-Profile Failures

Over the past two decades, derivatives have been implicated in a numerous high-profile corporate failures that had significant impacts on the global financial markets, such as the following:

> **AIG.** After the asset markets collapsed in 2008,AIG was exposed to a large number of derivatives positions that brought the company to the brink of collapse. The US government intervened and rescued AIG with massive loans.
>
> **Lehman Brothers.** In 2008, Lehman Brothers—a major counterparty (dealer) in the OTC derivatives market—defaulted, creating a major systemic risk. The eventual collapse of Lehman Brothers led to a default on obligations that existed under OTC derivatives contracts, among others.
>
> **Enron.** In 2001, Enron filed for bankruptcy. Enron was holding derivative contracts based on the prices of oil, gas, and electricity. These transactions were largely unregulated and had no reporting requirements. Speculative derivatives losses concealed by fraud eventually led to the collapse of Enron.
>
> **Long-Term Capital Management (LTCM).** In 1998, LTCM, a high-profile hedge fund, incurred massive losses when their strategies failed amid the East Asian financial crisis and the Russian bond default. The failure of the hedge fund's derivatives strategies caused the firm eventually to collapse.
>
> **Orange County.** In 1994, Orange County, California, was forced into bankruptcy when exposure of its derivatives positions to rising interest rates resulted in major losses.

The systemic effects of major failures such as these led to the introduction of new regulations and restructuring of the derivatives market, surveyed in the next section.

The Changing Regulatory Landscape of Derivatives Market

Since its inception, the derivatives market has undergone continual change to improve its efficiency and safety. In the wake of the 2008 financial crisis, governments around the world have been introducing new regulations to mitigate the dangers and challenges posed to their economies by the derivatives markets.

Listed derivative markets are regulated by national government agencies—such as the US Commodity Futures Trading Commission (CFTC) and US Securities and Exchange Commission (SEC), discussed in Chapter 5—international regulatory organizations, and industry associations. Listed markets have been around for some time and, as a result, they are well regulated within sound risk-management frameworks. In addition to the market regulations, each exchange and clearinghouse maintains its own set of rules to help promote strong and healthy markets.

The big challenge arises in OTC markets. As discussed in the two preceding sections, complexity and lack of transparency in the OTC market have been widely blamed for excessive systemic risk, market abuse and manipulation, and catastrophic failure. To mitigate risk and check abuses, regulators need transparency.

Post-2008 regulations of OTC markets notably include *Title VII* of the *Dodd-Frank Wall Street Reform and Consumer Protection Act* (the *Dodd-Frank Act*) in the United States and *European Markets Infrastructure Regulation* (EMIR) in Europe. These regulations focus on oversight of OTC markets with the goal of giving regulators actionable insight into market participants' trading activities and risk exposures by affording greater transparency and better tools for reining systemic risk.

These new regulations phase in the following key changes to OTC markets:

- Certain OTC contracts—namely, *cleared OTC contracts*, or *swaps*—are standardized.
- Electronic trading platforms—namely, MTFs and SEFs—are established.
- All standardized OTC contracts must be executed on regulated exchanges or SEFs or MTFs and cleared through a CCP.
- Each counterparty must post collateral, as required by the CCP.
- All OTC derivative transactions (both cleared and non-cleared) are subject to regulatory oversight.
- Central trade repositories—*swap data repositories* (SDRs)—are established for the purposes of recording market transactions and providing required reports to regulators and limited information to the public.

These regulatory reforms are fostering rapid growth in the cleared OTC market. Chapter 9 explains them in detail.

Importance of Information Technology

Today's financial markets could not accommodate their staggering market volume, complex business models, myriad regulatory requirements, millions of market participants, and the various functions without their information technology (IT) infrastructures. Only well-designed and well-built IT platforms can deliver the required performances, accommodate the required volumes, and comply with regulatory requirements.

In particular, technology has fueled continuous innovation in the derivatives market. Because derivatives are the most complex type of financial instruments, they rely more than any other type on technological infrastructures throughout their life cycle. The role technology plays in the derivatives supply chain is outlined as follows and covered in depth in Part IV of this book:

> **Structuring and pricing.** The structuring and pricing of most complex products relies heavily on the use of computer models. Accurate implementation and timely execution are crucial to the successful use of these instruments by businesses.
>
> **Electronic trading.** Trading in listed markets is done completely over electronic platforms. Even pit trading relies on systems that deliver data and allow traders to stay on par with the electronic side of the trading. OTC trades are increasingly being executed on electronic platforms, too. The impetus of the movement of the derivatives market to electronic trading is ineluctable.
>
> **Post-trade processing and straight-through processing.** In listed markets, end-to-end trade processing is fully automated by *straight-through processing* (STP) and runs on most advanced IT infrastructures built by exchanges and clearinghouses. In OTC markets, many third-party service providers are hosting post-trade and middle-office services. Demand for these services has been growing in response to regulatory reform. Owing to the complexity of these operations, many small and midsize firms have been moving to these service providers. To keep costs down, service providers rely on technologically advanced systems. Automation helps to reduce transaction costs.
>
> **Central clearing.** Central clearing is the backbone of stable markets. Timely processing of collateral is the key to the successful risk management of clearinghouses. IT infrastructure plays a major role in processing daily transactions and maintaining collateral both at clearinghouses and clearing brokers.

Settlements. In today's markets, most of the settlement process is done electronically. Most end clients, custodians, and banks are electronically connected, and their settlement processes are automated.

Contract management. The most important part of managing the derivatives contract is making sure that it serves its original purpose throughout its life cycle while managing the risks associated with holding a specified derivatives position. Contract management requires continuous valuation, calculation of profit and loss and risk analytics, collateral management, simulations, and stress testing. The results of all these processes rely heavily on underlying models, which in turn depend on underlying IT infrastructure.

Regulatory oversight. Regulations demand intensive and timely reporting of market activity. The trade repositories and clearinghouses maintain transaction warehouses in order to comply with the reporting requirements established by regulations. These warehouses cannot function without advanced technological platforms.

Marketwide connectivity. The derivatives market has adopted a wide range of standards and protocols—including FpML, FIX, and SWIFT (Chapters 18 and 19)—to achieve universal connectivity. The market cannot operate without the proper infrastructure to enable message processing and connectivity.

Timely data delivery. Trading, collateral management, and other activities rely on timely and accurate data. Today a very large volume of data is transmitted efficiently among market participants. The requisite speed, accuracy, and volume are impossible to attain without modern IT infrastructure.

Operational and Technological Challenges

In addition to the dangers of derivatives already considered are the following operational and technical challenges that can arise when dealing with derivatives contracts, detailed in Part IV of this book:

Post-trade processing issues. Timeliness and accuracy are crucial for successful order processing. Although most operations are automated, there are still certain areas that are in part manually done owing to the complexity of the products involved. Because any manual involvement increases the operational risk involved, it is critical to employ automation as much as possible.

Collateral management. This is an important counterparty risk management tool. Systems and models must be accurate, and underlying data must be accurate and timely to generate collateral reports. Producing the least number of mismatches is a key challenge.

Automation. The automation of electronic communication and transaction processing among all market players is essential to speed and cost efficiency. Marketwide STP is complicated by the many different types of institutions involved, each running on different technology platforms. The widespread adoption of standardized protocols such as SWIFT, FIX, and FpML helps in addressing these challenges. Still, many firms are struggling to catch up with advances in this area.

Contract workflow automation. To mitigate operational risk, firms must adopt a robust and comprehensive workflow while supporting end-to-end automation to achieve STP.

Reconciliations. Firms must employ knowledgeable personnel who can resolve issues and mismatches promptly to reduce operations and financial risk and avoid any compliance violations.

Costly infrastructure and resources. Derivatives processing demands more powerful and sophisticated IT infrastructure. In addition, people with derivatives expertise are in high demand.

Electronic connectivity. Maintaining the electronic connectivity with various servicing institutions is critical in achieving STP.

Large operational risks. As a result of complex processes and manual operations, firms are exposed to substantial operational risk.

Nonstandard OTC market operations. To manage OTC positions, each participant must own (by virtue of building or buying) technology infrastructure. Developing this infrastructure requires expensive expertise in areas such as accounting, valuation models, collateral processes, portfolio reconciliations, and derivatives analytics.

Summary

This chapter outlines the derivatives market. Derivative instruments are used to manage risk exposure by prudently mitigating it or speculatively exploiting it.

There are three major market segments: listed markets, in which standardized products are traded in a highly controlled and safe exchange environment;

traditional OTC bilateral markets, in which both parties directly enter into the contract; and OTC cleared markets, in which certain OTC products are traded on a registered trading venue and cleared through a clearinghouse. Most of the derivatives market is driven by large financial and non-financial institutions.

In spite of heavy criticism in the wake of the 2008 financial crisis, derivatives continue to play a major role in today's financial and nonfinancial markets for risk management. Regulatory reform aims to improve market transparency, to control fraud and abuses, and to codify strong financial risk and operational risk management practices that will preserve the value of derivatives as incredibly powerful financial instruments. This chapter looked in particular at how regulatory reform is transforming the OTC market.

Except where otherwise indicated, each of the topics touched on in this chapter will be treated at length in subsequent chapters. The next chapter delves into the various types of derivatives instruments.

CHAPTER

2

The Derivative Products

This chapter surveys at a high level the products traded on the derivatives market outlined in Chapter 1.

Recall that the preceding chapter defined a *derivative* as "a contract whose value derived from some underlying, such as a financial instrument or asset." By this definition, a derivative comprises two key components: the contract itself and the underlying. An essential feature of the contract is that it lasts for a prescribed time period. During that period, the contract's value varies based on the performance of the underlying. Another essential feature of the contract is that it grants and imposes specified rights and obligations on both parties to the contract.

This chapter articulates the various schemes for classifying derivative products based on fundamental characteristics such as derivatives contract class and underlying asset class. It also supplies the basic terminology of derivative products at both general and class-specific levels. On the most general level, it distinguishes derivatives from nonderivatives and from derivative-like products.

This chapter does the following:

- defines the basic terms required to understand derivative products
- classifies derivatives in several dimensions, including product class, underlying asset class, complexity, and clearing model
- defines the terminologies used for specific products and asset classes

- compares and contrasts products with similar features
- differentiates derivatives and derivative-like products

Product Terminology

The following sections discuss the basic terminology essential to understanding derivative products.

Security vs. Derivative

Common securities are stocks (equity) and bonds (debt). The fundamental objective of a securities market is to raise capital. Securities are issued by various types of corporations to raise capital. New securities are sold to the public through *public offerings*. These securities are then traded in a secondary market, in which securities change hands. In addition, corporations also raise capital on a smaller scale from private clients by selling different types of securities.[1]

The fundamental objective of a derivatives market, by contrast, is to manage risk using various types of contracts. Although derivatives transactions may result in financial settlements, they are not a source of capital for contract holders. The secondary objective of derivatives trading is speculative gain resulting from market movements rather than capital generation.

Product vs. Instrument

An *instrument* is a tradable derivatives contract. Each instrument instantiates a certain derivatives product type. For instance, an IBM stock option that expires on a specific date is an instrument instantiating the product type of stock option with a specific expiry date. An otherwise identical IBM stock option but with different expiry date is a different instrument.

Contract

A derivatives agreement is a *contract*. Every derivatives deal is a contract, regardless of product type or market, and includes the legal prerequisites of an enforceable agreement.

---

[1]This book treats securities and derivatives as two distinct financial product categories, as is the common usage. It should be noted, however, that some treat derivatives as a type of security and use the term *derivative securities* to refer to derivatives.

Interest Rate: Fixed vs. Floating

A *fixed rate* is a predetermined rate that may not change during the term of the contract. A *floating rate*, on the other hand, may change over the term of the contract. Typically, floating rates are pegged to the *London Interbank Offered Rate* (LIBOR) benchmark. They are computed at intervals and by methods specified in the contract.

Note LIBOR is the interest rate paid on interbank deposits in international money markets. It serves as a reference rate for many financial instruments.

Derivatives Classification

Derivatives are variously classified according to the dimensions of interest. The following sections focus on the following dimensions: the *derivative product class* (including futures, forwards, options, and swaps); the *underlying assets class* (including equity derivatives, interest rate derivatives, currency derivatives, credit derivatives, and commodity derivatives); the *clearing model* (including listed, cleared, and bilateral contracts); the *market* (including futures, OTC, cleared, currency, credit, and commodities markets); and the *payout complexity* (including vanilla and exotic products).

Product Class

A common classification is based on the type of derivatives payoff—in other words, what kind of protection is provided by the contract. For example, to lock in the price of an underlying some time in the future, one may use a *futures* contract. Alternatively, to protect against unexpected price changes in an underlying, one may use an options contract. Product classes are differentiated by the behaviors that are structured into the product contracts.

The four product classes (also known as *product families*) consist of the following (we will discuss each class later in this chapter):

> **Futures.** A futures contract is a standardized agreement between two parties—a buyer and a seller—whereby the parties agree to transact the underlying at a predetermined price at a later date.
>
> **Forwards.** A forwards contract is a futures contract that is traded in an OTC market and customized to suit individual client needs.

Options. An option is an agreement between two parties, giving one party the right to buy or sell an underlying at a fixed price in the future, as specified by the contract terms.

Swaps. A swap is an agreement between two parties to exchange cash flow(s) (payment stream) at specified future times according to predetermined conditions.

Asset Class

Every derivatives product is derived from some underlying, and the value of the derivatives contract depends upon the value (price) of that underlying (asset or reference). Derivative products are commonly classified based on their underlying assets into the following five classes and subtypes (we will discuss each one later in the chapter):

Equity derivatives. Derivative contracts whose underlying is an equity product such as stock or a stock index. Subtypes of equity derivatives include *equity options, equity index options, equity index futures, equity forwards,* and *equity swaps*.

Interest rate derivatives. Derivative contracts whose underlying value is affected by or associated with interest rates. Also known as *fixed-income derivatives*, interest rate derivatives include the following subtypes: *bond futures, bond options, interest rate futures, futures on swaps, options on bond futures, options on interest rate futures, bond forwards, forward rate agreements, interest rate swaps, caps, floors,* and *swaptions*.

Currency derivatives. Derivative contracts with currencies as underlying. Also known as *FX derivatives,* currency derivatives include the following subtypes: *currency futures, currency forwards, currency listed options, currency OTC options*, and *currency swaps*.

Credit derivatives. Derivative contracts associated with credit risk from obligation of one or more entities. Credit derivatives include the following subtypes: *credit default swaps, credit options, credit forwards, digital default swaps*, and *tranche credit default swaps*.

Commodity derivatives. Derivative contracts with commodity products as underlying. Commodity derivatives include the following subtypes: *commodity futures, commodity forwards, commodity options*, and *commodity swaps*.

Clearing Model

Based on trading venue, clearing-model contracts are classified into the following three categories:

Listed contracts. Derivative contracts traded on an exchange or other organized facility. Also called *exchange-traded contracts,* listed contracts are created, authorized, and traded on derivative exchanges. All terms and other characteristics of the contract are standardized. All listed contracts are cleared by the clearinghouse.

Cleared contracts. Derivative contracts traded on licensed trading venues known as *swap execution facilities* (SEFs) or multilateral trading facilities. Also known as *OTC-cleared contracts*, cleared contracts are cleared by a clearinghouse.

Bilateral contracts. Derivative contracts that are privately negotiated directly between counterparties. Also known as *OTC bilateral contracts*, bilateral contracts involve no clearinghouse, and counterparties face each other.

Markets

Historically, the derivatives market comprised several distinct segments based on contract types and practices. Distinction among the segments gradually blurred as exchanges and other servicing firms expanded their businesses across product lines throughout the derivatives market. Because the historical distinctions linger in concept and terminology, however, it is helpful to list the following traditional derivative submarkets:

Futures market. Includes all listed products traded on an exchange, including options and futures on all types of assets. Also known as the *listed market.*

OTC market. Includes all OTC bilateral contracts. Also known as the *swap market* in the derivatives world.

Cleared market. Combines a portion of the listed market and an OTC market. While OTC dealers are providing liquidity (taking one side of the trade), clearinghouses from a listed market are providing clearing services.

Currency market. Includes global FX trading and other activities involved in FX products. Also known as the *FX market.*

Credit market. Includes trading and other activities involved with credit products.

Commodities market. Includes trading and other activities by the numerous exchanges and service providers specializing in commodity products.

Complexity

Based on the complexity of their payout structure, derivatives are considered either *vanilla* or *exotic*, defined as follows:

Vanilla. Vanilla products are characterized by simple and straight payout structure, usually with no options attached. Also known as *plain vanilla* products.

Exotics. Exotic products have embedded options and other custom, nonstandard, or complex features attached to them, such as amortized notional, mutual put, and callable/cancellable options. Exotics are traded in OTC markets.

Futures

A futures contract is an agreement between two parties—a buyer and a seller—whereby the parties agree to transact the underlying at an agreed price at a later date. Underlyings include securities, financial instruments, indices, commodity, and currencies. The transaction price, known as the *futures price* or *strike price*, and other characteristics of the underlying are predetermined and standardized. According to the contract, both parties are legally obligated to fulfill the transaction: one party to deliver and the other to receive.

Futures contracts are traded exclusively on exchanges. Contract terms and conditions (such as size, quality, grade, and trading months) are standardized, and contractual obligations are guaranteed by a clearinghouse.

Based on the type of underlying, futures contracts are further classified into two major groups:

Financial futures. Futures contracts based on financial instruments such as stock, foreign exchange, interest rates, and other financial indices.

Commodity futures. Futures contracts based on commodities such as grains, metals, and energy products.

Futures Terminology

Key terms associated with futures contracts include the following:

Buyer. The party of the futures contract who is agreeing to receive the underlying. The buyer is known as the *contract holder,* the *long position holder,* or the *going-long.*

Seller. The party of the futures contract who is agreeing to make the delivery of the underlying. The seller is also known as the *contract writer*, the *short position holder*, or the *going-short.*

Contract price. The price agreed upon for the transaction. Also known as the *strike price*.

Delivery date. The date on which a transaction is going to take place. Also known as the *settlement date*.

Underlying. The set of details fully defining the underlying asset, including its specifications, quality, and quantity.

Settlement method. The method for settling the transaction, whether by delivery of the actual underlying or by cash.

Initial margin. The deposit made by both the buyer and the seller as guarantees of their respective commitments. The initial margin is typically a small percentage of the current value of an underlying of the contract (Chapter 11).

Daily settlement. Settlement made at the end of each trading day, when the contract is valued *(marked-to-market)* and any resulting profit or loss is settled.

Nearby futures contract. The contract with the expiry date that is nearest to the current date.

Most distant futures contract. The contract with the most distant expiry date.

Active contract. The contract with the closest expiry date. Typically, futures contracts with multiple expiry dates are traded at the same time. Also known as the *on-the-run contract.*

Closeout. Closing the position with a contract that is equivalent to, but in an opposite direction of, the original contract. This property of futures contracts is known as *fungibility*. Closeout is also known as *offset.*

Applications of Futures

Futures offer the following benefits to the functioning of the market, of which price discovery of the underlying and hedging of risk are especially important:

Price discovery. Futures markets help market actors, producers, and consumers make better estimates of the future prices of the underlying.

Hedging. Hedging is the primary purpose of futures trading. Futures transactions are key tools for firms to hedge their risk from price movements in their inputs and outputs. Hedgers transfer price risk.

Speculation. Although speculation confers no social benefits in itself, it may, in some circumstances, have the beneficial effect of helping markets by supplying liquidity and assisting in stabilizing prices. Speculators absorb price risk.

Transaction costs. Futures trading is cheaper than trading the underlying asset itself. This allows participants to take exposure to assets (having the same effect as trading the real asset) with lower costs.

Contract Types

Futures contracts are available on most financial instruments and trading assets. The most common futures contracts are the following:

Equity futures. Futures contracts on stock and stock indices.

Interest rate futures. Futures contracts on interest bearing instruments such as corporate bonds and treasury bonds.

FX futures. Futures contracts on currencies and currency instruments.

Commodity futures. Futures contracts on commodities and commodity instruments.

Forwards

Forwards are OTC contracts that are quite similar to futures contracts that trade on exchanges. A forward is an agreement between two parties to carry out a transaction on a future date. Forward contracts are based on a wide variety of underlyings, including any financial instrument or asset. Because forwards are OTC contracts, they are highly customizable in their underlying and transaction details, including date, price, quantity, quality, and settlement dates.

Forwards fall into two major categories: *deliverable contracts* and *nondeliverable contracts*. Deliverable contracts need the underlying to be delivered on maturity, whereas nondeliverables are cash-settled. In cash-settled contracts, the difference between the contract price and the prevailing price of the underlying on maturity is settled.

Terminology

Most of the terms discussed in the section on futures contracts are equally applicable to forwards. To these, the following item may be added:

Forward rate or forward price. The price (or rate) that is fixed at contract initiation to carry out the transaction on contract expiration.

Types of Forwards

Common types of forwards contracts include the following:

Equity forward. A contract to buy or sell an individual stock, stock portfolio, or stock index at a later date with a predetermined price.

Bond forward. A contract to buy or sell at a predetermined rate an individual bond, bond portfolio, or bond index at a later date but before the instrument matures.

Currency forward. A contract to exchange currencies of some notional (principal amount or contract amount) at a predetermined rate on a later date.

Forward rate agreement (FRA). A contract to exchange interest payments on a specific obligation, beginning at a later date. The pay-and-receive interest rates, notional value of obligation, and duration are predetermined. One of the interest rates is typically a floating interest rate, while the other is a fixed rate.

Commodity forward. A forward contract based on commodity, commodity portfolio, or commodity index.

Options

An *option* is a derivatives contract giving the buyer a right to execute the transaction with a seller on a future date. The transaction may include the purchase or sale of some underlying such as financial instrument, commodity, and foreign currency. The party obtaining the right (buyer) pays the premium (option price) at the start. The option contract defines characteristics of the underlying and transaction details. The contract buyer is also known as the *option holder* and the seller is known as the *option writer*.

Options are written on a wide variety of underlying items such as equities, commodities, currencies, interest rates, various types of futures, swaps, caps, floors, and other instruments.

If the option is not exercised, the option holder simply loses the premium paid. If the option is exercised, however, the option writer will be liable for covering the costs of any changes in the value of the underlying that may benefit the option holder. Thus, options function more like an insurance policy protecting against adverse market movements. This characteristic of option contracts sets them apart from other classes of derivatives.

Option contracts with basic features are known as *vanilla options*. Most listed options are vanilla options. Contracts with additional features are known as *exotic options*.

Terminology

The following list explains key terms associated with an options contract:

Option buyer. The buyer gets the right but is not obligated to exercise it (to execute transaction). The buyer is said to be a *long position holder*.

Option writer (seller). The seller issues the right and is obligated to fulfill the right if the buyer exercises that right. The seller is said to be a *short position holder*.

Strike price, exercise price, or contract price. The price of the underlying that both parties agree to execute the transaction when an option is exercised. The strike price of a call (put) option is the contractual price at which the underlying will be purchased (sold) when the option is exercised.

Expiration date (maturity). The last date that the contract is valid.

Option premium, or premium. The price the buyer pays to the seller for granting the right. This is paid at the time of the option purchase. It is not a strike price.

Put option type. A put option gives the buyer a right to *sell* an underlying at a strike price, as stated in the contract.

Call option type. A call option gives the buyer a right to *buy* an underlying at strike price, as stated in the contract.

Exercise style. Option contracts have the following variations in terms of exercise:

- **American style.** The option may be exercised on any day during the contract period.
- **European style.** The option may be exercised only at the expiration of contract.
- **Bermuda.** The option may be exercised on a few specific dates prior to expiration.

Intrinsic value. The value of the option if it were exercised today, which is the difference between the strike price and the underlying asset price. It cannot be negative; if there is no value, the intrinsic value of the option is said to be zero.

Time value. The difference between the current price of the option and its intrinsic value.

In-the-money (optionality). If the strike price of a call option is less than the current market price of the underlying, the call is said to be *in-the-money*. A call contract holder can exercise and make profit. Similarly, the put option is in-the-money if a put option has a strike price that is greater than the current market price of the underlying.

At-the-money (optionality). If the strike price equals the current market price of the underlying, the option is said to be *at-the-money*.

Out-of-money (optionality). If the strike price of a call option is greater than the current market price of the underlying, the call is said to be *out-of-money*. Exercising such a contract would not profit the option holder. Similarly, the put option is *out-of-money* if a put option has a strike price that is less than the current market price of the underlying.

Options series. Exchanges list option instruments in the form of a *series*. An option series represents a specific option type (put or call), expiry date, strike price, exercise style (American or European), and underlying details. Each series is treated as one type of instrument for all practical purposes.

Applications of Options

Options are one of the critical contracts in risk management. Typically, an option is exercised only if it is profitable to the holder. In case of a call option, the holder's profit potential is theoretically unlimited, where maximum profit is the difference between the price of the underlying and the strike price. However, the loss potential is limited to the premium paid. Consequently, the call option writer's loss is unlimited and gains are limited to premiums received.

In general, market participants use option contracts in two different ways:

Hedging. Option contracts enable buyers to limit their risk exposure while profiting from upside market movements. Essentially, option contracts work as insurance against adverse market movements, unlike pure hedging instruments. Assume an asset manager is exposed to the risk that his asset value will decrease. He can buy the put option (similar to buying insurance) if exposed to the risk that some security prices increase, which would hurt the value of his portfolio, or he can buy a call option on that security.

Speculation. Options provide great opportunities for speculators. Options offer an extreme leverage, such that one can be exposed to an asset without owning the asset. Although options have high risk, with proper strategies investors can limit that risk. Speculators adapt various strategies (known as *combinations* or *spreading techniques*) that involve trading one or more contracts simultaneously. Some of the popular strategies include *straddles, strangles, bull spreads, bear spreads*, and *butterfly spreads*.

Option Types

Option contracts are traded on exchanges as well as in OTC markets. Options on commodities are known as *options on physicals* and options on financial instruments are known as *financial options*.

Listed Options

Listed options are traded on regulated exchanges and all contract terms are standardized by the exchange. The contract is standardized in terms of underlying asset, quantity, expiration date, strike price, settlement type, and other terms. Listed options are also known as *plain vanilla options*.

Most listed options are a type of *American* or *European* style. Also, most options on financial instruments are cash settled, while only few involve actual delivery.

Exchanges trade option contracts on a variety of underlying assets and with different maturities.

The following list shows popular option contracts listed by the type of underlying:

Equity options. An option contract to buy or sell equity instruments such as stock, bond, or stock index.

Currency or FX options. An option contracts to buy or sell currency at a specific rate.

Interest rate options. An option contract based on interest rate instruments such as corporate bonds, treasury securities, and other interest rate instruments. All major exchanges write interest rate options on their 90-day interest rate futures contracts.

Commodity options. An option contracts on commodities such as wheat, oil, soybeans, or precious metals.

Options on futures. An option on various futures contracts such as equity futures, bond futures, and currency futures.

OTC Options

OTC markets trade a large variety of options created on various underlyings including securities, interest rates, currencies, commodities, swaps, and baskets of assets.

OTC options are highly customizable, allowing customization of characteristics such as exercise price, style, maturity, settlement or delivery terms, size of contract, and characteristics of underlying. Most OTC trades are executed by broker-dealers as a counterparty.

OTC options can be divided into two major categories—*simple options* and *exotic options*.

Simple options. Simple options are similar to listed options but have modified features such as extended maturity, size, exercise type, and delivery mechanism.

Exotic options. Options with nonstandard features are referred to as *exotic options*. Exotic options are usually formed with complex rules and payout structures to suit the specific needs of one of the parties.

Exotic Options

There are many types of exotic options, not all of which are widely traded. The following list contains some of the common exotic options:

Asian option. An option where the payoff is dependent upon the average value of the underlying asset for a specified period of time. This is also known as an *average option, average-price* option*, or average-rate option.*

Barrier option. An option where the payoff depends on whether the underlying asset reaches a designated level during a designated period of time. Besides the strike price, a barrier option also specifies a *trigger price*, or *barrier*. When the trigger price is hit, the option will either become effective *(appear or knock-in) or ineffective (disappear or knock-out).*

Knock-out option. A barrier option that sets a cap to the level an option can reach in favor of the holder. It limits the profit potential for the option buyer and loss potential for the option writer. If the limit is exceeded, the option expires as worthless.

Knock-in option. A barrier option that becomes effective (comes into existence) only when the barrier is reached. The barrier is the minimum price limit that is in favor of an option holder.

Lookback option. An option where the payoff depends on a maximum or minimum price of the underlying during the life of the contract. This allows the holder to exercise at the most favorable price that has occurred during the life of the contract.

Binary option. An option where the payoff is a predetermined fixed amount if it ends up in-the-money, regardless of the actual price of the underlying at the time of exercise. The resulting payoff nature is either all or nothing, unlike that of a standard option where the payoff has no limit. There are many variations in binary options.

Bermudan option. An option that can be exercised only at specific dates. These options are often embedded with other contracts such as *callable* or *puttable* contracts.

Swaption. A swaption provides the holder a right to enter into specific swap deal on a future date. It is only a right, not an obligation as in a forward swap.

Cancellable swap. A swap with an embedded Bermudan option, where the holder can cancel the swap on one of the set exercise dates.

Swaps

A *swap* is an agreement between two parties to exchange certain financial obligations at specified periodic intervals with predetermined terms. Financial obligation may include simple cash flows, assets, liabilities, currencies, securities, or commodities.

Essentially, a swap is equivalent to a portfolio (or strip) of forward contracts, each with a different maturity date and the same forward price. Most swaps are cash-settled contracts.

Typically, swaps enable a holder to alter the cash flow characteristics of their assets or liabilities without liquidating. For instance, an investor holding a common stock can exchange the returns from that investment for a lower-risk, fixed-income cash flow—without liquidating his stock. He basically owns the stock, but his returns are not linked to stock returns but rather they are fixed-income cash flows. This investor now holds two positions in his portfolio—stock and swap contract.

The swaps market is one of the important segments of an OTC market. As a result, the OTC market is also known as the *swap market*. The major players of the swap market are all types of bond portfolio managers, financial firms and large corporations. The driving force behind the swap market is the nature of the swap products and altering cash flow characteristics.

Most swap instruments are traded in OTC markets. Recent regulations are dividing the OTC swap market into two segments—the *cleared swap* and *bilateral swap market* (see Chapter 9).

Cleared Swaps

Cleared swaps are executed on an authorized execution venue (SEF) and cleared by the CCP. This will provide the same efficiency and benefits as contracts traded on exchanges. The benefits include credit risk remediation and the ability to offset (*close*) a position with any counterparty.

Most terms—such as the contract month cycles, price quotation, and minimum tick size and values of cleared swaps—mirror the terms of exchange traded instruments (mainly futures). In addition, cleared swaps are cash-settled instruments.

Like futures, cleared swaps are marked-to-market daily and margin is maintained by a clearing broker and the CCP.

Bilateral Swaps

Bilateral swaps are highly customizable to suit the needs of large institutions. This market is mostly driven by broker-dealers known as *swap dealers*. Dealers create swaps on an as-needed basis to suit the requirements of the end-clients as well as other dealers.

Swap Characteristics

The following list explains the general terminology and characteristics associated with swaps:

Legs. Swaps are structured as two legs, where the first leg is one party's obligation and the second leg is the other party's obligation.

Tenor. Tenor is the length, term, or duration of the contract.

Start date or effective date. The start date of the contract terms.

End date or maturity date. The end date of the contract term.

Settlement frequency or payment frequency. This is how often parties exchange payments.

Notional amount or principal. The amount that swap payments are based on—not necessarily the amount exchanged between contract parties.

Settlement date(s). Each date that parties exchange payments throughout the term of the contract.

Netting. Parties typically agree to exchange the difference between each other's due payments instead of making full payments. If the payments are in different currencies, parties usually make separate payments without netting.

Swap Instruments

Swaps can be classified into multiple categories based on the underlying asset, maturity, style, and contingency provisions. Swaps with simple terms are known as *plain vanilla* or just *vanilla swaps*. All non-vanilla swaps are known as *exotic swaps*.

Swaps with one month to a year in length are known as *short-term* or *short-dated swaps*. Swaps with more than a year in length are known as *long-term* or *long-dated swaps*. There are swaps in use that are up to 30–50 years long.

The following list shows the classification of swaps, based on various underlying assets:

Equity swap. Based on securities such as single security, basket of securities, and the security index.

Interest rate swap. Based on various interest rate indices.

Currency swap. Based on various world currencies.

Commodity swap. Based on commodities such as agricultural, energy, and metals.

The following sections discuss these contracts further.

Interest Rate Swaps

In OTC markets, *interest rate swaps* (IRS) are widely traded instruments. An interest rate swap is a contract to exchange future cash flow streams of interest payments on a specified principal amount, for a fixed period of time. The interest rate of payment streams is based on different sources; for instance, while the first is a fixed rate, the other could be a floating rate.

The principal amount is not typically exchanged between the counterparties, rather interest payments are exchanged based on a principal. The swap principal is also known as *notional amount, notional principal,* or just *notional.*

The most popular interest rate swaps are *fixed-for-floating*, under which cash flows of a fixed interest rate are exchanged for those of a floating interest rate, such as LIBOR.

In other words, an interest rate swap is just a series of cash flows occurring at known future dates, while cash flow amounts may or may not be known.

Typical uses of an IRS:

- to convert a fixed rate liability to a floating rate liability, and vice versa
- to convert a fixed rate investment (asset) to floating rate investment, and vice versa

Popular Types

Interest rate swaps are traded in most convertible currencies such as USD (US Dollar), EUR (Euros), JPY (Japanese Yen), and CHF (Swiss Franc). Swaps are available for maturities of up to 30 years. There are many different types of interest rate swaps; vanilla and basis swaps are the most traded.

> **Vanilla IRS.** The simplest IRS in which one party pays a fixed rate and the other pays a floating rate, both in the same currency. There is no exchange of a notional. This type of IRS is known as *vanilla IRS* or *coupon swap.* It is also known as a *domestic swap* if it is in local currency.
>
> **Basis IRS.** In a basis swap, both sets of payments are based on floating rates. They are usually based on two different currencies and are at different points along the yield curve, for instance, LIBOR 1m vs. LIBOR 6m. This is also known as a *floating-to-floating swap,* or a *yield curve swap* if it is in same currency.

Apart from these types, there are many exotic types of interest rate swaps listed under the swap types section.

Currency Swaps

A currency swap is an agreement between two parties to exchange different currency cash flows, based on a defined principal amount, for a fixed period of time. It is similar to an interest rate swap except that the cash flows are in different currencies.

For instance, in a vanilla currency swap, one party pays a fixed rate in one currency, and the other party pays a fixed rate in another currency. Alternatively, both may pay a floating rate in their respective currencies or one party may pay a fixed rate in one currency, and the other party may pay a floating rate in another currency.

The main distinction is, in currency swaps, the notional principal is typically exchanged at the beginning and at the end of the life of swap. Unlike in an IRS, cash flows are not netted because they are in different currencies. Instead, full principal and interest payments are exchanged. Typical uses of currency swaps:

- to convert a liability in one currency into a liability in another currency
- to convert an investment (asset) in one currency to an investment in another currency

Currency Swap Types

A simple currency swap is also known as a *cross-currency swap*. In a cross-currency swap, at the beginning of the contract the counterparties exchange equal principal amount of two currencies at the spot (current) exchange rate. During the life of the swap, the counterparties exchange fixed or floating rate interest payments in the swapped currencies and at maturity. At maturity, principal amounts are again swapped at a predetermined rate of exchange (usually at the initial spot rate).

Note *Spot rate* is the current exchange rate at which a currency pair can be bought or sold.

There are four types of basic currency swaps: *fixed for fixed, fixed for floating, floating for fixed*, and *floating for floating*.

In OTC markets, currency swaps are traded in many flavors. Currency swap contracts are also traded in many exotic forms. Most exotic swaps are discussed under the swaps section. Note that the *currency interest rate swap* is not the same as the *FX swap* discussed in the FX derivatives section.

Equity Swaps

An *equity swap* is an agreement between two parties to exchange a set of payments, determined by a stock or index return, with another set of payments from an instrument such as an interest-bearing (fixed or floating rate) instrument or another stock or index. The main distinction is that with an equity swap, at least one party pays the return on a stock or stock index. The cash flows in equity swaps are typically netted.

Equity swaps involve three possible combinations—one party paying a fixed rate, a floating rate, or return on equity, while the other party pays an equity return. Simple equity swap is also known as a *contract for difference* (CFD).

The other popular swap type is *total return equity swap*. According to this contract, capital gains, as well as dividends, are paid to the counterparty (total return receiver). No principal is exchanged and payments are based on contract notional.

Equity swap is used to substitute a direct transaction in stock. Equity swap can alter the cash flows from equity holdings (assets).

Commodity Swaps

Just as currency and other swaps, swap contracts are traded on commodities as well. In a commodity swap, cash flow streams are exchanged between two parties and at least one of the cash flow streams is dependent on a commodity or commodity index. Essentially, a commodity swap is equivalent to a strip of forward contracts on a commodity.

Some of the commonly traded commodity swaps are metals and energy swaps. Furthermore, there are swap contracts on many other types of commodities.

Exotic Swap Structures

In addition to plain vanilla and other simple swaps, there are many complex swaps traded in OTC markets. Some of these complex product structures are listed below:

Accreting swap. A swap in which the notional principal increases over time.

Annuity swap. A swap involving an initial payment or receipt, then an exchange of equal coupons during the life of the swap.

Asset swap. A swap in which the fixed payment stream is generated by an asset, such as a bond that is held by one of the contract parties.

Amortizing swap. An interest rate swap in which the principal amount decreases over time.

Discount swap. A swap with payments made on a discounted basis in advance.

Forward swap. A swap that takes effect from a future date.

Overnight index swap (OIS). A simple interest rate swap, fixed-for-floating, in which the floating rate is tied to an overnight rate (Interbank Overnight Cash reference rate), compounded over a specified term.

Rollercoaster swap. A swap where the notional principal fluctuates (both increasing and decreasing) over the contract term as agreed.

Zero coupon swap. A swap where the fixed coupon is discounted (accumulated) and is to be paid at the beginning (maturity).

Index amortizing swap. The notional principal, or term of the swap, varies according to some randomly changing interest rate indexes.

Index differential swap, or just "*diff*" swap. An interest rate swap with cash flows based on two floating rates in different countries, but are derived from the notional of only one of the currencies. For example, pay €-based LIBOR, and receive US$-b*ased LIBOR*, on a notional of US$20 million and all payments are in US$.

Note An *off-market swap* is a simple interest rate swap in which the fixed rate may be away from the market. Typically, it contains the initial payment to offset the difference.

Credit Derivatives

A credit derivative is a financial contract between two parties to exchange the credit risk of specific issuer (reference entity). In other words, a contract in which one party provides the protection to the other party from a credit event of a specific underlying (reference obligation). There are two sides to this contract—a protection buyer and a protection seller. The protection buyer pays a premium to the protection seller and, in return, the protection buyer will receive the protection amount in case of a credit event. Typically, a reference obligation is debt, such as a bond, issued by the reference entity.

Contract terms such as credit events, reference obligation, protection amount, and other details are predefined. The contract is between only two parties and does not directly involve the underlying issuer (reference entity) itself. (See Table 2-1.)

Table 2-1. Comparison of Credit Contract Buyer and Seller

Buyer	Seller
Buying Protection	Sell Protection
Pay Periodic Coupon	Receive Periodic Coupon
Short Risk (risk transferred to seller)	Long Risk (assumes the risk from buyer)
Receive Risk Notional (protection amount) in case credit event	Pay Risk Notional (protection amount) in case credit event
Same as short a bond or loan (sold)	Same as long a bond or loan (owning)

Basically, a credit event is an event that adversely affects the value of the reference obligation. Credit events are defined by ISDA. They include bankruptcy (or insolvency), failure to pay, debt restructuring, obligation default, credit rating downgrade below specified level, obligation acceleration, and repudiation (moratorium).

A credit derivatives contract is similar to an insurance contract on an obligation such as a corporation or sovereign entity's debt. The credit derivatives market is a critical part of the global financial market. Credit derivatives are widely used products to assume or reduce credit exposure, typically on bonds or loans of a sovereign or corporate entity. In addition, credit derivatives are used to directly trade credit risk.

Recent regulations enforcing the clearing of some of the credit derivatives (credit default swaps [CDS] and credit default indices [CDX]) are strengthening these markets by bringing increased transparency, standardization, and security.

Terminology

The following terms are the key terms associated with credit contracts:

> **Protection buyer (going short risk or sell risk).** The protection buyer is a *buyer* of the credit contract (for instance, CDS). Buying protection has a similar credit risk position of *selling a bond* or *shorting a loan.*
>
> **Protection seller (going long risk or buy risk).** The protection seller is a *seller* of the credit contract. The seller collects the periodic fee. Selling protection has a similar credit risk position as *owning a bond or loan.*

Reference entity (issuer). The underlying entity on which one is buying or selling protection, such as corporations, sovereigns, and municipalities.

Reference obligation (credit). The bond or loan that is being *protected* and issued by a *reference entity*. Typically, a senior unsecured bond is the reference obligation. Other obligations include municipal indexes, asset-backed indexes, leveraged loan indexes, commercial real-estate indexes, and other portfolios of bonds or loans.

Term, tenor, or maturity. Duration of the contract. Contracts are available with various maturities such as one year, three years, five years, ten years, and more.

Contract notional or principal amount. The amount on which credit risk is being transferred. It is also known as a *risk notional* or *protection amount.*

Spread or premium. The annual coupon or premium paid for providing the protection, quoted in basis points. Typically, payments are paid quarterly or semi-annually. The spread is also called the *fixed rate, coupon,* or *price*.

Contract legs. There are two legs—*fee leg* and *contingent leg*. The premium payment side of the contract is known as a *fee leg* and the protection payment side is known as a *contingent leg.*

Credit events. Events that trigger payouts, such as *bankruptcy, failure to pay, obligation default or acceleration*, and *debt payment moratorium.*

Applications of Credit Derivatives

The following are primary uses and benefits of credit derivatives:

Credit Risk Management. Credit derivatives provide an efficient way to manage the credit risk because credit contract cost represents just the cost of credit risk. Thus, credit risk is separated from other types of risk such as market risk.

Trade Credit Risk. Credit derivatives allow users to trade the credit risk either to eliminate the credit risk (hedge exposure) or to assume credit risk (negative credit view—speculation).

Flexibility. Credit derivatives allow users to customize contracts to suit their risk profiles (different maturities and others), and to customize the choice of credit products to address exposure from different components of capital structure, such as senior secured bond, senior unsecured bonds, and syndicated secured loans.

Product Availability. The credit market provides a large set of products such as single names, baskets, and tranches. Thus, investors can choose products to suit their risk profile.

Efficiency. The credit derivatives market is relatively large and quickly reacts to news and market events, resulting in efficient credit prices.

Tax Efficiency. The use of credit products allows users to avoid triggering taxation and accounting implications that may arise from the sale of underlying assets.

Efficient Markets. CDS and CDX instruments are standardized and widely traded, thus providing transparency, operational efficiency, liquidity, and reduced costs.

Capital Leverage. Credit contracts do not require contract notional investment and, thus, free up capital that can be used for other business activities.

Credit Instruments

There are many different types of credit products traded in credit markets. The following list shows some of the common contracts:

Credit default swaps (CDS). These are standard credit default swaps with reference obligations as corporate bonds and mostly senior unsecured bonds, loans, or sovereign debt.

Single name CDS. Protection on a single reference entity.

Credit basket (multi-name CDS). Protection on a basket or portfolio of reference entities.

Credit index (CDX) (multi-name CDS). Standardized CDS providing protection on a basket of entities.

Loan CDS (LCDS). A standard CDS contract but with a syndicated secured loan as a reference obligation.

Preferred CDS. A CDS contract with a preferred stock as a reference obligation.

Digital default swap. A standard CDS but in the case of a credit event, payment is 100% of notional or what is known at the time of contract inception.

Tranche CDS. A tranche CDS provides protection from a particular amount of loss on a portfolio of reference entities.

Forward CDS. A forward CDS is a CDS contract where protection starts at some future date ("forward starting"). For example, a 5y/5y forward is a 5-year CDS contract starting in five years.

Credit options. These are options on CDS, CDX, and tranches. A credit option is an option to buy or sell CDS, CDX, or a tranche on a specified reference entity at a fixed spread on a future date. A call option provides investors with the right to buy risk (receive spread), while put options provide investors with the right to sell risk (pay spread) at the strike spread.

First-to-default baskets (FTD). A FTD basket is a basket of credit swaps for which the protection buyer pays the fixed coupon throughout the life of the contract. On a credit event in one of the basket names, the swap terminates and the protection buyer delivers the notional amount of the FTD basket in bonds or loans of the defaulted entity to the protection seller. The protection seller then pays the buyer the notional amount of the trade in cash.

The most actively traded credit indices are the following:

- CDX North America Investment Grade
- CDX North America High Volatility
- CDX High Yield
- CDX Crossover
- CDX Emerging Market
- iTraxx Europe
- iTraxx High Volatility

- iTraxx Crossover
- iTraxx Europe Senior Financials
- iTraxx Europe Subordinated Financials

CDX Indices CDX indices are published and administered by Markit (www.markit.com). Markit also publishes list of reference entities and reference obligation identifiers.

FX Derivatives

The *foreign exchange* market is a fast-paced segment of financial markets. The foreign exchange market is global and a most liquid and transparent market. Most participants in this market are large financial institutions, corporations, central banks, and hedge funds.

The terms *FX, forex, foreign-exchange,* and *currency* are synonymous, and they all refer to the foreign exchange market. When the term *forex market* is used, it typically refers to the spot market. This section doesn't include spot markets because they are not part of a derivatives market.

FX products are divided into three major categories: *FX spot, FX forwards*, and *FX futures*. The FX spot market trades all spot transactions, the FX forwards market (OTC) trades forwards, and the swaps and FX futures market trades listed products.

As in the case of other derivatives, the FX market also trades most classes of derivatives including currency futures, currency forwards, currency options, options on currency futures, and currency swaps.

Terminology

FX-related terms include the following:

Currency code. Currencies are identified by the three-letter ISO convention such as *USD, GBP*, and *EUR*.

Exchange rate. This is the price or value of a currency expressed in terms of the units of another currency.

Direct quote. The domestic currency quoted for one unit of a foreign currency. For example, in the United States, 0.91 USD = 1 CAD (Canadian dollar).

Indirect quote. The foreign currency quoted for one unit of domestic currency. It is equal to *1/Direct quote*. For example, in the United States, 1.10 CAD =1 USD. It is also known as a *price quotation*.

Base currency. Currency in which the price is quoted. For example, if the dollar-yen rate is 108, it is 108 yen for one dollar.

Spot price, current exchange rate, or outright rate. The exchange rate of the currency at the time of the trade for immediate delivery. Most FX transactions settle in two days (T+2) after the trade date.

Forward rate. The exchange rate on some future date. Forward rates are typically calculated in relation to the spot rate. This is known as the *outright rate* or *NDF rate (NDF = nondeliverable forward).*

Quotation. Most currencies are quoted either in US dollars or euros. Typical market quote conventions are either in American or European terms.

- American terms. A number of US dollars per one unit of another currency. A US dollar is the numerator. For example, USD/GBP means units of dollars per British pound (arithmetic convention). However, according to market convention, it is written as "GBP/USD" and is called *Sterling-Cable*.
- European terms. The number of units of foreign currency per dollar. The foreign currency is a numerator. For example, JPY/USD means the unit of Japanese yen per dollar.

Cross-currency rate or cross-rate. One currency in terms of another, and neither of the currencies is the US dollar—for example, the euro-yen (EUR/JPY).

Forward point. The difference between the spot and forward rate of a certain maturity, also known as the swap point. Most FX derivative contract prices are quoted in points.

Straight date. Standard dates that contracts mature on are known as the *straight dates*. Odd-dated contracts are basically ones that do not mature on standard dates.

Value date. The date on which two parties actually exchange the two currencies.

FX Derivative Instruments

FX transactions and the exchange of one currency to another are known as *outright transactions*. If the exchange takes place immediately, then they are known as *spot transactions*. If it takes place in the future, then they are known as *forwards* or *outright forwards*. If two parties agree to *exchange and re-exchange* one currency for another, then they are known as *FX swaps*.

While spot transactions are not derivatives, forwards and swaps are derivative contracts. The following list briefly explains various types of FX derivative instruments:

Outright forward. A contract to exchange two currencies on a future date at a rate initially agreed upon. A future date is more than two days, as a spot settles in two days. There are two types of forwards—*deliverables* and *nondeliverable forwards (NDF)* or *forward contracts for differences* (FCD). In a derivable forward, upon maturity, currencies are exchanged. In an NDF, upon maturity, only the difference between the prevailing spot and the contract rate is settled. In practice, the *outright* term refers to a forward contract.

Forward contract for differences (FCD). An outright contract in which only the difference between the contracted forward outright rate and the prevailing spot rate is settled at maturity.

FX future. Standardized forward contracts traded on exchanges.

Currency option. An option contract sold for a premium that gives the buyer a right, but not an obligation, to buy (in case of a call option) or sell (put option) a specific quantity of a currency at a specified price at a specified later date.

FX swap or currency swap. A contract to buy certain amounts of base currency at an agreed rate while simultaneously reselling the same amount of base currency at a later date to the same counterpart at an agreed rate, or vice versa. Essentially, an FX swap is a combination of a spot deal and a reverse outright deal. It is either buy/sell (B/S)—that is, buy spot now and sell forward on future date—or a sell/buy (S/B)—that is, sell spot now and buy forward on future date. The first value date of a swap is known as a *near date;* the second value date is known as a *far date*.

Cross-currency swap. An interest rate swap contract to exchange streams of interest payments and principal on loans denominated in two different currencies for a specified period of time. The amounts exchanged are equal in value based on a predetermined exchange rate. It is not the same as an FX swap because it involves multiple cash flow exchanges.

Currency option. A contract that gives the right to buy or sell a currency with another currency at a specified exchange rate during a specified period. This category includes many exotic currency options such as average rate options and barrier options.

Currency swaption. An option contract to enter into a currency swap contract.

Note The spot legs of FX derivatives are treated as derivative transactions, not as spot transactions.

Applications of FX Derivatives

There are three major uses of FX derivatives:

Arbitrage. In arbitrage, an investor can create a profit by using simultaneous trades that result into the guaranteed (riskfree) profit from imbalances in market prices. Arbitrage opportunities are short-lived and limited participants profit from them.

Hedge. FX derivatives are useful for global firms to hedge the risk involved in foreign currency. A corporation can protect a business against adverse movements in foreign exchange rates and plan future cash flows and budgeting. In addition, for a corporation operating in foreign countries, swaps can lower funding costs and provide locked-in exchange rates for longer terms.

Speculation. Speculators can take a position (long or short) to realize a profit from their market view.

Interest Rate Derivatives

Interest rate derivative (IRD) contracts are those whose underlying value is affected by or associated with interest rates such as bonds and other interest dependent instruments. Interest rate derivative contracts are available either in a single currency or in two different currencies. Multi-currency derivatives are also known as *cross-currency derivatives*.

IRD Instruments

Interest rate derivatives are traded in all classes. The following list shows different types of contracts:

Interest rate futures. A futures contract on a debt instrument such as a treasury bill, corporate bond, or an interest rate. Interest rate futures on short-term instruments have an underlying security that matures in one year or less, whereas long-term instruments have maturities exceeding one year.

Forward rate agreement (FRA). A contract in which the rate to be paid or received on a specific obligation of certain maturity, beginning at some time in the future, is determined at the contract's inception.

Interest rate option. A contract that gives the right to pay or receive a specific interest rate on a predetermined principal for a set period of time. These contracts are traded on exchanges as well as in OTC markets. Listed contracts are mostly on interest rate futures. OTC contracts range from simple contracts to exotics such as *caps, caplets, floors, floorlets,* and *collars*.

Interest rate swap. A contract to exchange future cash flow streams of interest payments on a specified principal amount for a fixed period of time. There are many types of interest rate swaps.

Interest rate cap. An OTC option contract in which one party agrees to pay the other when the reference rate exceeds a predetermined level (strike rate).

Interest rate floor. An OTC option contract in which one party agrees to pay the other when the reference rate falls below a predetermined level (strike rate).

Interest rate collar. An OTC option contract with both the cap and floor options embedded.

Interest rate swaption. An OTC option to enter into an interest rate swap contract at a future date, purchasing the right to pay or receive a predetermined rate.

Equity Derivatives

Equity derivatives are derivative contracts that are based on stock, a stock index, or a basket of stocks. Equity derivatives are useful for risks and return management of a portfolio that is directly or indirectly linked to equity products.

Equity derivative products trade in listed as well as in OTC markets. The major equity derivative product classes are futures, forwards, options, and swaps.

Applications of Equity Derivatives

Equity derivatives are typically used by portfolio managers. The following list shows uses of equity derivatives:

Risk management. Modifies the risk characteristics of a portfolio.

Return management. Enhances the return of a portfolio.

Cost management. Reduces the costs associated with portfolio management.

Regulatory management. Achieves efficiency in the presence of legal, tax, or regulatory obstacles.

Equity Instruments

The following list shows various equity derivatives in listed and OTC markets.

Listed Equity Derivatives

- **Options:**
  - **Single stock options.** Option contracts on a single common stock.
  - **Options on equity indices** (such as S&P 500, S&P MidCap, Russel 200 Index, Nikkei 225, NASDAQ 100, and an NYSE Composite Index.)
  - **Options on equity futures contracts.**

- **FLEX (FLexible EXchange options).** Customizable options with an exchange guarantee—Equity FLEX Options, and Index FLEX Options.
- **LEAPS (Long-term Equity AnticiPation Securities).** Offers options with longer maturities ranging from one year to 39 months. Available on stocks and some stock indexes.

- **Futures:**
  - **Single stock futures.** Futures on a single stock.
  - **Equity index futures.** Futures on equity indices.

OTC Equity Derivatives

- **Stock option.** Option contracts on a single stock.
- **Option on basket of stocks.** An option on a portfolio of stocks.
- **Option on stock index.** An option contract on a stock index.
- **Warrant.** A contract with a right to buy underlying (stock) at a certain price until a predetermined, customized date.
- **Equity forwards.** A forwards contract to purchase a stock, stock portfolio, or stock index on a future date at a predetermined price.
- **Equity swap.** A swap contract in which one or both cash flow streams are linked to the performance of equity or an equity index such as S&P 500. The other stream is based on a fixed or floating interest rate.

Commodity Derivatives

Commodity derivative contracts are the oldest of derivatives. In commodity derivatives, underlying assets are commodities such as metals (precious and nonprecious), energy, and agricultural commodities. Energy products include crude oil, natural gas, heating oil, gasoline, propane, and electricity. Agricultural commodities include grains and tropical commodities.

Both listed and OTC markets trade a large volume of commodity derivatives. Commodity market participants range from commercial producers to local energy distribution companies to banks. Commodity derivatives are traded in all classes—futures, options, forwards, and swaps.

Synthetic Products

Synthetic products are typically a mixture of multiple instruments combined to create an effect and value as another asset. It is not an instrument itself, but a position. Synthetically created assets are treated as a single asset for risk-based capital or regulatory capital. A regulatory capital represents the minimum required liquid reserves to be held by an institution. The requirement is enforced by regulatory rules such as *Basel*.

This is a common strategy used by firms to add certain positions (assets) to their portfolio without actually owning that asset. They virtually create the effect and value as same as owning that asset. In most cases, derivative contracts are used to build various investment strategies.

For instance, purchasing a call option and selling a put option on one stock creates the same effect as actually owning that stock. Two more examples of this are explained below.

Swap as Asset

Swaps can be used to create the effect of owning a certain asset. For example, simple, fixed-to-floating interest rate swaps are identical to issuing a fixed rate bond and using the proceeds to purchase a floating rate bond.

Synthetic Asset Using IRS

Assume that firms own bonds with a coupon that may be fixed, floating, or a combination of the two. It can use an interest rate swap to convert the bond's cash flow from fixed to floating, and vice versa. The bond can also be denominated in a foreign currency, instead of in US dollars. A cross-currency swap is used to convert the bond's cash flow to fixed or floating as well as to exchanging the foreign currency for US dollars.

This is one of the *asset liability management* (ALM) strategies that end clients adopt in order to alter the characteristics of assets or liabilities.

Replication

A firm owning AAA rated cash bonds can combine CDS and replicate a corporate bond. Insurance firms use a replication strategy known as a *Replication (Synthetic Asset) Transaction* (RSAT).

Analogy

Listed, Cleared, and Bilateral Contracts

Table 2-2 presents a comparison of listed, cleared, and bilateral contracts.

Table 2-2. Product Comparison

Listed	Cleared	Bilateral
Traded on exchanges	Traded on SEFs	Traded bilaterally
Standardized contracts	Standardized OTC contracts	Customized contracts
Anonymous counterparty trading, each party faces a clearinghouse	Traded with the counterparty, but eventually faces a clearinghouse	Traded directly between counterparties. There is at least one counterparty dealer in most cases.
Daily settled and margined contracts.	Daily settled and margined contracts.	Collateral is typically maintained by counterparties directly.

Funded vs. Unfunded

Contracts that involve the investment of notional principal are known as *funded contracts*. On the contrary, contracts with no notional principal investment are known as *unfunded*.

Most derivative contracts do not need the notional to be exchanged between counterparties. For instance, in a vanilla IRS with a $100 million notional, counterparties never exchange notional. Instead, they only exchange the interest amount on this notional.

Options vs. Futures

The premium paid is the cost of a buying option or the cost of eliminating or modifying the risk. In the case of futures, all cash flows are either gains or losses.

Profit or loss from a futures contract is unlimited. The option buyer has limited loss and an unlimited profit potential. The option writer has limited profit (premium) and unlimited loss potential. Hence, the options can be used to hedge asymmetric risk (unlimited exposure), whereas futures can be used to hedge symmetric risk (limited exposure). If the value of the derivatives position is not proportionate to the change in the value of underlying, then exposure from that position is know as *asymmetric*.

A futures payoff is symmetrical (as underlying price changes, gain/loss changes dollar-for-dollar), whereas an options payout is skewed (first covers the premium cost and then profit).

Futures vs. Forwards

Futures and forwards are conceptually similar, but they differ in certain aspects. These differences include the following:

- Futures contract holders can realize gains and losses on a daily basis, while a forwards transaction requires settlement upon maturity.
- Futures contracts are standardized, while forwards are customized in order to meet the special needs of the parties involved.
- Futures contracts have virtually no counterparty risk (credit risk) because they are settled through an established clearinghouse, while forwards do have counterparty risk because they are settled between the counterparties directly (there is no clearinghouse).
- Futures that are being exchange-traded are subject to regulations, whereas forwards being OTC contracts are loosely regulated.

Swap vs. Forward

The difference between a forward contract and a swap is that a swap involves a series of payments in the future, whereas a forward has a single future payment. A swap is fundamentally similar to a series of forward contracts with different maturities. However, both are used to either limit or assume the exposure to market rate movements.

Option vs. Insurance

Insurance policies require the actual loss to occur for the payoff, whereas an option contract does not require any loss to occur. Rather, it is linked to the parameter, such as the price of the stock. To earn the payoff, the option owner doesn't have to own the underlying asset or become impacted by the change in the value of that asset.

However, for theoretical purposes, insurance is treated like a *put option* on an asset that we already own.

Accounting Treatment

The use of derivative instruments results into various transactions. While some transactions involve settlement of underlying or cash, others do not involve any settlement. The treatment of these transactions is critical for the purpose of taxation and internal and external reporting. The accounting treatment is prescribed by local and international accounting regulatory agencies such as the US-based *Financial Accounting Standards Board* (FASB) and the Europe-based *International Accounting Standards Board* (IASB).

Accounting standards treat transactions based on multiple factors such as hedging purpose, settled or unsettled, time of settlement, and the type of product. These rules include definitions such as how derivative positions are valued and whether a specific transaction is a *balance sheet* or *off-balance sheet item*.

What Is Not a Derivative

Before this chapter ends, it is important to understand the distinction between derivatives and nonderivatives. Some financial instruments resemble derivatives, but they are not derivatives. Some of those instruments include the following:

> **Insurance.** Insurance is not a financial derivative. Insurance contracts do not have market prices, and we cannot evaluate them in terms of price. They simply provide financial protection against the consequences of the occurrence of a specified event.
>
> **Contingencies.** Contingencies such as *guarantees* and *letters of credit* are not financial derivatives. These are simply predefined conditions that are to be met for a financial transaction to take place.
>
> **Hybrid products.** Standard financial instruments with embedded options features such as convertible options are not derivative contracts. The price of these instruments may be different due to an embedded feature; however, it still only refers to a primary instrument.

Summary

It is essential for all personnel in the derivatives area to understand the classification of derivative products and the comparative characteristics of the various types as presented in this chapter.

In summary, the four main classes of derivative products are futures, forwards, options, and swaps. While most contracts fall into one of these classes based on their fundamental structure, each contract is also based on some underlying asset class such as financial instrument or commodity. The classification from these two dimensions distinguishes the fundamental characteristics and behavior of a given contract.

This chapter does not treat the pricing of derivative products for the reasons supplied in the preface.

Derivatives product demand and innovation are driven by the needs of end users such as large corporations and financial institutions. These needs are conditioned by business activity, regulations, and political climate.

The next chapter introduces the use of derivative products for risk management and considers the risks and challenges created by the use of derivatives themselves.

CHAPTER

3

Derivatives and Risk Management

Historically, many failures led risk management to the forefront in financial and nonfinancial institutions. Corporations have been adapting a number of approaches and tools to manage and reduce various types of risks. The risk management function spreads across the organization and all business activities.

Although derivatives are typically used to manage risk, derivatives themselves introduce a new set of risks. Like other instruments, a derivatives contract is also exposed to typical market parameters, and the contract value is subject to change. This value change may impact the hedge being used and require a rebalance. Since the change is continuous, the risk management process becomes an iterative process. In addition to market risk, derivatives also introduce other risks such as credit risk, liquidity risk, and operations risk.

The preceding chapters introduced respectively the derivatives market and its various products. This chapter introduces the risk management function. Risk management is a broad area, and this chapter does not describe it in detail but rather provides an overview.

This chapter starts with the definition of risk and the context of risk management. It proceeds to explain enterprise risk management and risk management function, giving insight into how risk management works in an organization at different levels. It next defines various types of risk that are faced by financial and nonfinancial firms and shows how derivatives are used to manage financial risks. Finally, this chapter briefly explains some key risk measures and tools.

This chapter treats the following risk management topics:

- the various types of risks financial and nonfinancial corporations face
- how derivatives are used to manage financial risk
- risk introduced by derivatives
- enterprise risk management
- the risk management process and various risk measurements and tools
- various measures used to mitigate operations risk in managing derivative contracts

What Is Risk?

Risk pertains to anything that may prevent a company from achieving its objectives or that may have an adverse impact on the company's performance. All financial and nonfinancial corporations are exposed to risks in their everyday business activities from adverse movements and events in various contingencies, such as interest rates, foreign exchange rates, commodity prices, credit, liquidity, theft, weather, health, catastrophe, and competition. Risk may arise on different levels of an organization due to business activities, specific investments, internal operations, or other sources.

Risk that companies face can be broadly divided into two categories: financial and nonfinancial. *Financial risk* is associated with financial market variables such as interest rates, exchange rates, stock prices, commodity prices, credit, and liquidity. The major financial risk types are *market risk, credit risk,* and *liquidity risk. Types of nonfinancial risk* include *operations risk, legal risk, model risk, settlement risk, regulatory risk*, and other *business risks*. Each of these types of risk (Figure 3-1) is treated separately in the "Types of Risk" section of this chapter.

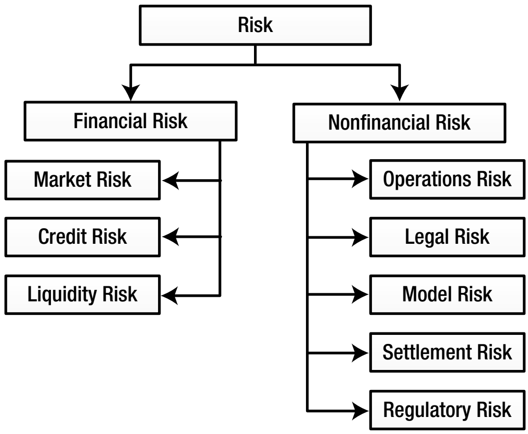

Figure 3-1. Types of risk

Why Manage Risk?

Although risk-taking is an inevitable condition of doing business, not all risks that a business faces can be treated same. Some risks must be differentially controlled to protect the business. Firms must control—or *hedge*—certain risks whose probabilities or possible costs they judge to be unacceptably high. Risk management aims to reduce preexisting or future risks, avoid financial distress costs, maintain an optimal capital budget, increase the debt capacity, stabilize cash flows, protect the company, and comply with regulations.

Risk Management Process

Risk management is the continuous process of identifying the *acceptable* level of risk (*risk tolerance*), measuring the level of risk that an entity currently has (*actual risk*) and taking actions that bring the actual level of risk to the acceptable level of risk. Other components of this process are continuously monitoring the new actual risk level and adjusting actions so that the current risk level remains aligned with the desired or acceptable level of risk.

Risk management is a proactive, anticipative, and reactive process that continuously monitors and controls the risk. Although hedging strictly reduces risk, risk can sometimes be increased to achieve business objectives. Risk management is thus a general practice that involves both reducing and increasing the risk, as required. It involves answering the following questions by reference to the following risk measures, which shall be explained in the course of this chapter:

> *What is the current trading position by trader, desk or portfolio, or firm level?* The answer is framed by reference to positions, instruments, key measures such as notionals, risk measures such as duration, and delta that describe various aspects of positions or portfolios.
>
> *How is day-over-day profit and loss (P&L) moving and why?* The answer involves identification of the various market factors that are driving those market value changes.
>
> *What could happen to positions or portfolios and the P&L if the market moves in different directions in the future?* The answer includes modeling various scenarios and their respective impacts on positions or portfolios.
>
> *What would be the effects of severe market movements on portfolios?* The answers are derived from appropriate stress tests.

Risk from Derivatives

Although the primary use of derivatives is to hedge the risk, derivatives themselves introduce a completely new risk. Like all other products, derivatives are also exposed to various market variables and operational issues. Derivatives are exposed to various risks similar to other financial instruments. In addition, if the derivatives contract is used for hedging, the change in the value of the contract itself would affect the hedge. The process of balancing the resulting imperfect hedge is a critical part of risk management function.

Moreover, risks introduced by derivatives are complex and difficult to understand, and they may be dangerous at times. Another component of derivatives is that they require a low investment, allowing firms to take greater risks. The misunderstanding of these risks or any unexpected market events may cause a much larger loss than first hypothetically envisaged.

Chapter 1 discussed some of the major failures that occurred because of a misunderstanding of the risks involved with derivatives or because of failed risk management functions.

Hedging

Hedging is the process of reducing or eliminating the risk. In practice, it could be described as simply balancing the level of existing risk to the desired level of risk. Most financial risks are hedged using financial derivatives. Later parts of this chapter explain how derivatives can be used to hedge risk.

This section, however, considers only the hedger who transfers risk to another party—whether a speculator or another hedger with the opposite belief or risk exposure.

The ideal hedging instrument is one that has perfect negative correlation with the asset being hedged. In reality, there may not be such an instrument available for hedging. The market price of both assets being hedged and the value of the hedging instrument are subject to change. As one or both of these change, the hedge will also change, resulting in an *ineffective* or *imperfect hedge*. To maintain the perfect hedge, the portfolio (or the hedge position) must be rebalanced continuously. The risk of loss from an imperfect hedge is known as a *basis risk* or *hedge risk*.

Enterprise Risk Management

Enterprise risk management (ERM) is the process of managing risk that the firm faces at an organization level, as well as the combined risk from the organization's individual departments or groups. In financial markets, it is also referred to as *corporate risk management, enterprise-wide risk management,* or *firm-wide risk management.*

ERM is a structured and disciplined approach of aligning strategy, processes, people, technology, and knowledge with the purpose of assessing and managing the risks that a company faces as it performs its business activity. It provides an organization a holistic view of risk, compliance, and governance—one that allows the organization to add value to its operations and create a competitive advantage while also addressing bottom-line efficiencies and redundancies. In addition, ERM places responsibility on a level closer to senior management, giving senior management an overall view of the company's risk position. Strategically, ERM is a key component of corporate governance.

Typical ERM functions include the management of different types of risks—such as market risk, credit risk, liquidity risk, operational risk, and settlement risk—capital requirements reporting, limits monitoring and control, enterprise collateral management, compliance monitoring and control, and enterprise reporting and audit. Figure 3-2 shows some of the key functions of ERM.

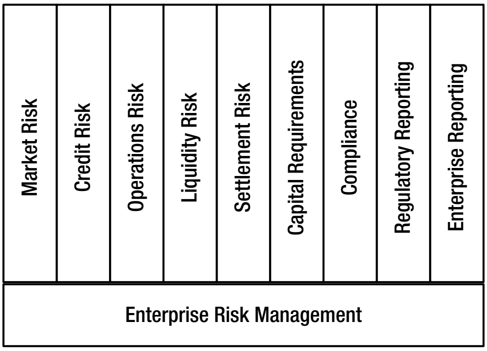

Figure 3-2. Enterprise risk management functions

The ERM function is performed by a single risk management group that monitors and controls all of the risk-taking activities of the organization, but may also have various subgroups that perform risk management activities at different levels throughout the organization. This group is responsible for the design, oversight and implementation of risk planning, policies, procedures and control processes.

The ERM group defines the enterprise-level risk management framework that includes risk framework for all its individual business units, divisions, and subsidiaries. The ERM framework essentially explains an approach to identify, assess or measure, manage, monitor, and report risks. It defines procedures and processes for each of these activities to be used by an organization at different levels. It also identifies the strategy used to respond to the identified risks. Figure 3-3 shows a typical ERM functional structure.

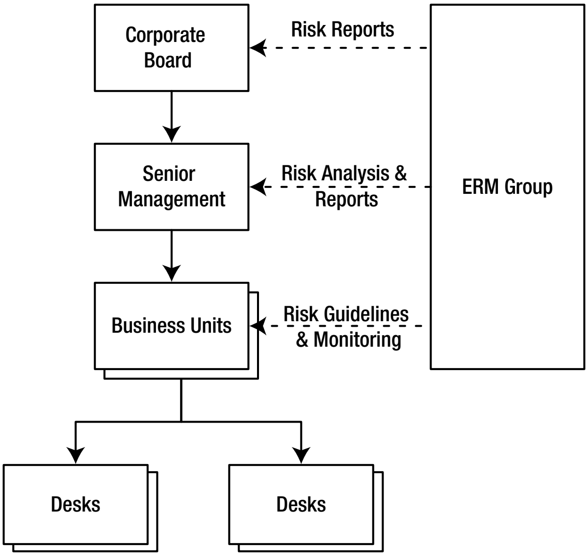

Figure 3-3. ERM functional structure

ERM uses various enterprise-level risk measures such as *value-at-risk (VaR), potential future exposure (PFE), credit valuation adjustments (CVA), economic capital, and regulatory capital*, and various tools such as *stress tests, scenario tests, and collateralization*. These various risk measures and tools are discussed in subsequent sections of this chapter.

Risk Management Function

The risk management function involves setting policies and procedures, defining the level of risk tolerance, identifying the risk, measuring the risk, and adjusting the level of risk. The whole process is defined in a firm's risk management framework. The *risk management framework* is comprised of risk management environment, risk strategy, risk management procedures and processes, and enterprise reporting, which are explained below. Figure 3-4 shows the different elements of risk management framework.

Figure 3-4. Risk management framework

Risk Management Environment

The risk management environment includes the risk philosophy, risk appetite, governance structure, policies, procedures, people, and other resources.

Risk Strategy

Risk strategy is a concise, high-level plan that articulates the vision and direction for risk management within the organization. The plan includes risk tolerance guidance, risk processes, and expectations for the risk management function.

Risk Management Process

The risk management process refers to the process of implementing the framework and executing the strategy. It includes processes and operational procedures that represent the execution of the risk management program. The key steps in the risk management process are risk identification, risk measurement, risk management, and monitoring the risk. Figure 3-5 shows these steps of the risk management process and its iterative nature.

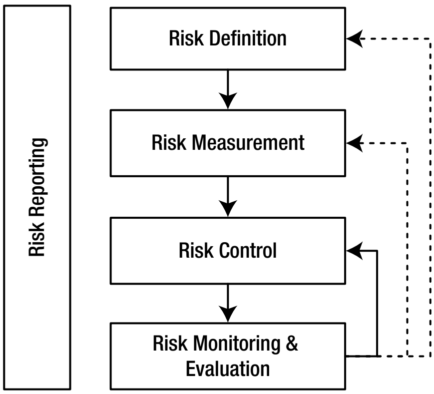

Figure 3-5. Risk management process

Risk identification. The ongoing process of recognizing the risk, its sources, and its nature.

Risk measurement. The process of assessing the magnitude of risk and its impact on the achievement of business objectives.

Risk strategy. The plan for how a firm would respond to a specific risk. Firms may respond to each risk using one of the following strategies:

> ***Risk transfer.*** The shift or transfer of risk exposure to another party or entity by, for example, a "hold harmless" contract.
>
> ***Risk acceptance.*** The acceptance of the likelihood and consequences of a particular risk. In terms of best practice, risk can only be accepted if it is within set risk appetite limits.
>
> ***Risk reduction*** or ***mitigation.*** Strategy used to measure in order to control or prevent an issue or adverse event from causing harm and thereby reduce the risk to an acceptable level.
>
> ***Risk insurance.*** An insurance policy that would prevent a loss of benefits in case covered losses do occur. However, not all risks can be insured, as it is either too expensive or such policies may not be available on the market.
>
> ***Risk avoidance.*** Avoidance of activities that expose the firm to selected risks.

Risk monitoring and performance valuation. The process of the ongoing and systematic tracking and evaluation of risk management decisions and actions against strategies, risk appetite, policies, limits, and key risk indicators. Based on the assessed results, the process may loop back into any of the previous steps—risk identification, measurement, or management.

Risk reporting. Another important function of risk management is reporting. Reporting is the communication of risk information in all phases of the risk management function. Risk reporting includes various details such as aggregate exposures and targets at different levels, compliance reports, key risk measures, evaluation results, and others.

Enterprise Reporting

Enterprise reporting provides a holistic view of overall risk management, including dashboards, various risk measures, and other details at an enterprise level.

Risk Management Team

The overall risk management function typically includes risk managers, compliance officers, regulators, auditors, supervisors, and ERM managers. The actual risk management organization structure varies by the type and size of a firm.

Types of Risk

Of the many types of risk described in the following sections, the most common are market risk, credit risk, and operations risk.

Market Risk

Market risk is the risk of a loss as a result of unfavorable changes in market prices such as foreign exchange rates, interest rates, equity prices, credit spreads, and commodity prices. In other words, market risk is the sensitivity of the price (value) of an asset or derivative to a change in the market price (source of risk). Based on the sources of risk, market risk can be refined into risk categories such as *interest rate risk* and *equity price risk*.

Many factors can cause market risk exposure. At each positional level, market risk is calculated using measures such as beta for stocks, duration and convexity for bonds, and delta and gamma, which reflect the price sensitivity of the derivative to movements in the underlying asset.

Typically, market risk at a portfolio level is measured using the statistical measure *value at risk (VaR)*. VaR is a single estimated number that represents the potential loss of a portfolio over a given time interval at a given confidence interval under normal market conditions.

The market risk for a derivative comes from the price movements of the underlying. The relationship between the change in the value of a derivative and the change in the underlying asset is complex. Assessing and managing the market risk of derivative contracts is consequently a relatively complex process.

Credit Risk

Credit risk is the risk of loss from a change in the credit quality of the counterparty to a contract or of a security issuer. Credit quality may include a simple downgrade of a rating agency or, in extreme cases, a default. Credit risk is typically measured by credit exposure, which is potential loss in case of an adverse event. Credit exposure at any point in time is the replacement cost of the contract or asset.

In derivatives, the primary method for managing credit risk is through monitoring the *net exposure* to the counterparties to contracts. Limiting exposure to a particular counterparty requires the trading activity to be conducted with multiple partners. It ensures that the firm is not taking too much risk from a single counterparty.

Credit risk exists in most financial instruments from simple loans to complex derivative contracts. The source of risk and total credit exposure varies by type of instrument. For instance, in a simple loan, there is a risk of loss of interest, principal, or both.

Counterparty Credit Risk

In derivative transactions, a major form of credit exposure is *counterparty credit risk (counterparty risk* for short). A counterparty risk is the potential loss in the event the counterparty does not honor its obligations because of a default or other event. The recent financial crisis has re-emphasized the importance of counterparty credit risk. The reforms have addressed most shortcomings of the OTC market. Reforms have introduced the central clearing of some of the OTC contracts, rules to improve transparency, and rules to reduce counterparty risk.

Counterparty exposure is generally defined as the amount that is lost in the event of counterparty defaulting. So, sometimes the counterparty risk is referred to as *default risk*. In simple terms, the credit exposure from any contract is the cost of replacing the contract.

In addition, there are three major components of counterparty risk. First, the *current credit risk* (current exposure) is a risk that the counterparty will not pay if an amount is already currently due. Second, *potential credit risk* or *potential future exposure* (PFE) is the risk that the counterparty will not pay the amount due in the future. Third, the counterparty might owe nothing now but could declare bankruptcy in the future because of liabilities currently owed to other parties.

Concentration Risk

Another form of credit risk is *concentration risk*, which is the potential loss from having investments or contracts with only a single source, such as counterparty or in a particular industry (market segment).

Operations Risk

By definition, *operations risk* (also known as *operational risk*) represents the risk of loss resulting from inadequate or failed internal processes, people, and systems, or external events. This includes legal risk, but excludes strategic risk and reputational risk.

Operations risk is very broad in nature and may originate from many sources, including the following:

People. Employee fraud, unauthorized activities, employment laws, loss of key employees, workforce disruption, and others.

Processes. Valuation and pricing (mathematically modeled risk), settlement risk, documentation, change management, reporting, compliance, and others.

Systems. Systems development and implementation, systems failures, security breaches, capacity, technology choices, and others.

External. Political and government risks, legal risks, disaster and infrastructure failures, and others.

Liquidity Risk

Liquidity is the ability of a firm to fund its obligations as they become due without incurring unacceptable losses. There are two types of liquidity risks. *Market liquidity risk* is the risk that the firm cannot easily offset or eliminate a position without taking a significant loss (trading below market price). *Funding liquidity risk* is the risk that the firm will not be able to efficiently meet both the expected and unexpected current and future cash flow and collateral needs without affecting the firm's financial condition or business activity.

It is difficult to measure liquidity risk. Derivative contracts can sometimes give rise to large and unpredictable cash flows, particularly margin calls for cleared products and collateral calls for bilateral products. This may create a liquidity crisis when there are drastic market movements or when the firm does not have a proper liquidity management plan.

Funding liquidity risk is typically managed at a corporate level by the finance department. Market liquidity risk is managed by individual risk management departments.

Legal Risk

Legal risk is the risk of loss from the unexpected application of a law or regulation or from a contract with a counterparty that cannot be enforced owing to legal limitations.

The legal risk of listed products is relatively small because operations are well defined and governed by exchanges, clearinghouses, and market associations. By contrast, the legal risks associated with products on OTC bilateral markets—even those covered by ISDA agreements—are considerable.

Model Risk

Model risk is the risk of loss from using mathematical (financial) models that do not produce the expected results or produce misleading numbers. Risk calculation and valuation of derivative instruments depend implicitly on the mathematical models selected for the computations. Some models are simple, while others are highly complex and factor in many variables with multiple limitations. Selecting the wrong model or inputting the wrong data entails the risk of acting on misleading results.

Settlement Risk

Settlement risk is the risk of loss from the failure of the counterparty after the transaction date (trade date or valuation date) but before the final settlement.

The most common form of settlement risk is the *Herstaatt risk*. In many transactions, the settlements are *two-way*, meaning each party pays the other. This situation creates a problem when one party is paying while the other is declaring bankruptcy and the paying party is not aware of that fact due to time zone differences. This type of settlement risk is known as *Herstaatt risk* after the Herstaatt Bank in Germany, which failed in 1974 when its counterparties from foreign countries were sending money to it but it did not reciprocate the payments as it should have done.

Currency swaps often involve trading partners from different countries operating in different time zones. Payments from both parties are not settled simultaneously. While one party that has sent irrevocable payment instructions to its financial institution is waiting for the payment to clear, the counterparty might declare bankruptcy. Such transactions are understandably exposed to settlement risk.

The market has, however, adapted many procedures and controls to reduce and eliminate the settlement risk for most types of situations. For example, *netting* (whereby only net cash flows are payable) reduces this problem for single-currency transactions such as simple interest rate derivatives. Settlement risk persists, however, in cross-currency transactions between parties operating in different time zones.

Systemic Risk

Systemic risk is risk of collapse of the entire financial system or a major market induced by the failure of one institution or a small group of institutions that are significantly interconnected with the whole system.

Derivatives are a source of systemic risk because of the large notional involved in a derivatives market and the fact that most large financial institutions around the world are heavily involved in derivative transactions. The financial crisis of 2007–2008 is a classic example of the triggering of systemic risk. The market reforms that followed are primarily focused on reducing or eliminating the systemic risk through a broad set of rules (Chapter 9).

Compliance Risk

Compliance risk (also called *regulatory risk*) is risk of loss from employee actions or business practices that violate government regulations, exchange rules, clearinghouse rules, or mandatory market practices. Compliance risk is managed through strategies that promote operational transparency, continuous monitoring, and other procedures.

Reputational Risk

Reputational risk is risk of loss from damage to the firm's image caused by factors such as actions of company personnel that adversely affect public perception of the firm's performance, strategy execution, integrity, product quality, commitment to safety, or ability to create shareholder value.

Such risky actions may cause loss of business and/or legal actions against the firm. Even if the firm escapes direct financial loss, reputational damage may hurt its future business and growth.

Derivatives and Operations Risk

Operational risk management is an important part of managing derivative contracts. Operational risk exposure exists throughout the life of the contract including pre-trade, trading, post-trade processing, and settlement. Operational failures may occur at any step resulting in consequent losses. The following list explains some key operational failures that may occur.

System failures. Failures such as IT infrastructure failures—including software and hardware malfunctions, telecommunication problems, and utility outages—that can disrupt the business causing subsequent losses.

Process or operational failures. Losses from failed operations such as errors in transaction processing, data entry errors, validation errors, collateral management failures, missing legal documentation, and access controls failures.

Internal fraud. Actions such as violating regulations and abuse of processes or fraud by employees, including theft, hiding transactions from internal or external regulators, insider trading, and manipulation of data and reports.

Operations risk is addressed at all stages of the contract and all parts of the derivatives business. In addition to regulatory controls, operations risk controls also include the firm's internal risk controls.

The Basel Accords (in particular, Basel II and Basel III) prescribe a comprehensive operations risk management framework for all banks. This framework defines operations risk and provides guidelines for operations risk management (which is beyond the scope of this chapter and will not be further discussed here).

The following list explains some procedures and controls used in derivatives contract management function.

Access controls. Derivative systems include various features such as access control, audit, and reporting to eliminate or reduce any potential fraud.

Four-eye validation. Critical operations designed to be reviewed by at least two people. For instance, every trade that is captured goes through at least two people (one person enters the trade and another person verifies and approves the trade). It is known as the *four-eye principle*. Similarly, every settlement is reviewed by at least two or more people before final processing.

Workflow automation. Most firms use end-to-end automation (or most operations) to avoid operational failures such as fraud or human errors. Automation also improves operational efficiency and compliance with regulations.

Independent risk group. The risk management function is carried out by an independent group that is separate from a business group and that reports to senior management. Its compensation is not linked to the performance of any specific trading or business group. Such separation is expected to reduce or avoid any internal fraud.

Regular audit. Internal risk controllers or auditors closely monitor derivative operations and trading activity at trading desks as well as treasuries. They also review all models used for activities such as pricing, risk management, and reporting.

Training. Regularly, mandatory training programs are provided to most operations staff in appropriate subjects that help to control operation risk exposure.

Note The Barings Bank Failure, which occurred in 1995, is a classic example of operational failure. A derivatives trader, Nick Leeson, single-handedly precipitated the collapse of this bank founded in 1762. He managed to hide his risky transactions, which caused the collapse of the entire bank when his bets failed. This collapse could have been avoided if the bank had had adequate internal controls and modest oversight in place.

Use of Derivatives for Risk Management

Chapter 2 surveyed the various derivatives product types and their contributions to financial and nonfinancial markets. Derivatives are crucial for corporations to manage the various risks that they face. In addition to the low cost of transactions, derivative contracts provide flexibility, liquidity, and quick access. Financial derivatives are key tools for corporations to manage financial risk.

Hedging in this context refers primarily to the process of offsetting a preexisting risk through additional derivative transactions. Financial risks such as interest rate, currency, equity, commodity price, and credit risk can simply be hedged or traded with other parties who are more willing, or better suited, to take or manage these risks.

As discussed in Chapter 2, there are four major types of derivatives: futures, forwards, options, and swaps. Most derivatives, including exotics, are of one of these types or are a combination of two or more of these types. The following sections briefly explain how these different types of derivative contracts can be used to manage risk. However, the use of derivatives is not limited to the description provided below. Complex contracts and strategies can be designed and used by participants to address a variety of risks at various levels.

Even if the derivatives are traded for speculation, a better understanding of risk from the derivatives that are being used is critical for all market participants. If a speculative bet fails or the risk is misunderstood, it may cause serious loss to the contract holder.

Futures and Forwards

Futures contracts are widely used in hedging preexisting risk. They can be used to reduce the overall risk as well as match expected returns. Chapter 2 explained futures contracts on various underlying assets and reference rates. These varieties of futures contracts can be used for hedging purposes in the following ways:

> **IR futures. Interest rate futures** can be used to hedge risks posed by fluctuating interest rates. For instance, banks can efficiently manage the asset-liability mismatches inherent in their funding of long-term assets consequent on the difference between the rate that it pays on deposits (liabilities) and the rate that it receives on its assets. This mismatch (also known as *interest rate sensitivity*) is alleviated by use of interest rate futures and other derivatives.
>
> **Equity index futures.** Equity fund managers can reduce their market exposure easily with low cost stock index futures.
>
> **FX futures.** Multinational corporations, importers, and exporters can manage their foreign exchange risk using foreign currency futures.

As explained in the preceding chapter, forwards are quite similar to futures but differ in that they trade in OTC market and are customized. Like futures, forwards are used to hedge preexisting risk. The ability to customize forward contracts to suit the specific needs of counterparties may reduce the overall transaction costs.

Options

Option contracts are widely used instruments in hedging portfolio risks. The option sensitivity measures (Greeks) that are explained in a later section will provide an important insight into constructing portfolio hedges with options. They not only characterize an individual option, but they can also characterize the risk exposure of a portfolio that includes options and other assets.

Although options are typically regarded as very risky instruments, in using complex strategies it is possible to create option positions that have a substantially lower risk than an outright position in an option.

There are many option strategies that can create a variety of new payoff profiles. Typically, option contracts can be used to neutralize the changes in the portfolio value from the underlying asset value changes (known as *delta neutral hedging*). In another strategy known as *portfolio insurance*, the portfolio value can be kept at a certain minimum amount using an options contract. This strategy combines the long position (buy position) in a put option with a long position in the underlying asset, ensuring that the value of the combined portfolio cannot fall below a given level.

Swaps

Like other financial derivatives, swaps can eliminate, decrease, or increase the risk. As discussed in Chapter 2, there are many types of swaps including interest rate swaps, equity swaps, currency swaps, credit default swaps, and exotics—each with specific risk characteristics, described in the following list. In addition to simple swaps, there are many exotics used by market participants to serve their risk management and other needs.

Interest rate swaps. Interest rate swaps can be used to manage the interest rate risk of a firm. For instance, a firm borrowing at the floating rate can convert it to a fixed rate if it decides to limit exposure from interest rate changes. Thus, a swap can easily align a firm's risk with the risk it desires.

Equity swaps. Equity swaps can be used to avoid risk from fluctuations in equity prices. For instance, a portfolio manager holding a long-term equity portfolio would like to avoid the risk of short-term price fluctuations. An equity swap to pay a floating rate on the equity side and to receive a fixed interest payment for a year can hedge the short-term risk—a year, in this case.

Amortizing swaps. An amortizing swap is a popular exotic swap in which the notional principal is reduced over time. This replicates the mortgage loan. In this structure, the interest payments will become smaller during the life of the swap, thus providing a useful tool for managing the interest rate risk associated with mortgages.

Swaption. This is another popular swap product. It is a combination of option and swap. The holder of a swaption has the option to enter into a swap in the future. For instance, a *receiver swaption* gives the holder the right to enter into a swap as the fixed-rate receiver. It is like a put option on an interest rate. The holder can exercise the right to enter into a *receive fixed-rate swap* if the floating rate declines.

Credit Derivatives

The credit market provides a wide variety of contracts, including credit default swaps on a single name, as well as a basket (index) of reference entities with various maturity periods. This allows market participants to manage their credit risk efficiently.

While the purchase of a corporate bond represents various risks, including interest rate, credit risk, and potentially other risks, *credit derivatives* represent pure credit risk. Thus, a credit contract allows participants to separate credit risk from other risks, enabling easier credit risk management. Furthermore, because of the separation of credit risk, one can trade (assume or transfer) credit risk easily.

Credit derivatives are key for banks to reduce their credit risk exposure to companies they deal with through loans and other transactions. Banks can hedge their credit risk through contracts such as *single-name credit default swaps, basket credit default swaps, and loan credit default swaps* (Chapter 2). Credit contracts also help banks to maintain capital requirements mandated by regulators. Similarly, other institutions such as hedge funds, asset managers, and insurance companies use credit derivatives to manage their credit risk as well as to trade risk for profit.

Risk Measures

There are many different measures used in practice to assess the risks from derivative and nonderivative positions. Risk measures are sometimes referred to as *sensitivities*. The following sections describe some of the common measures.

Greeks

Option sensitivities or risks are also known as *Greeks*. Greeks explain how the value of an option position changes in response to changes in the price of underlying, the passage of time, the risk-free rate, and volatility. These are key risk measures of all types of option positions:

Delta. The rate of change of the portfolio value with respect to the price of the underlying. Assume that the delta of the portfolio is 0.6. This means if the underlying asset prices change by $1, the portfolio value changes by $0.60. Delta is widely used to measure market risk.

Gamma. The rate of change of the portfolio's delta with respect to the price of the underlying asset. In other words, gamma is the second derivative referenced with respect to the underlying asset price.

Vega. The rate of change of portfolio value with respect to the volatility of the underlying asset. Higher absolute vega means the portfolio value is very sensitive to small changes in the asset volatility. Lower absolute vega means the portfolio value has little impact from underlying asset volatility.

Theta. The rate of change of the value of the portfolio with respect to the passage of time, with all else remaining constant.

Rho. The measure of the rate of change of the value of a position with respect to the interest rate, with all else remaining constant.

Durations and Convexity

Duration and convexity are key interest rate risk measures that describe exposure to change in market interest rates. They can be calculated for an individual position or entire portfolios that hold interest rate products. With single numbers, they summarize a bond's or a portfolio's sensitivity to changes in interest rates. Duration and convexity are tools for asset-liability management. Duration is the first derivative and convexity is the second derivative of that curvature of change in market interest rates. Since convexity is a second-degree derivative, it is a better approximation than duration.

Volatility

In general, *volatility* is a measure of the uncertainty of change in value of a variable, such as security price or the return on an asset. It is typically measured using such statistical measures as *standard deviation* and *variance*.

Another form of volatility is the *implied volatility* of an option, which is the volatility that gives the market price of the option when substituted in the pricing model.

Value at Risk

Value at risk (VaR) is the worst-case loss at a specific confidence level over a certain period of time. In other words, VaR is the maximum loss that a portfolio or a firm can face over a specified period with a given probability. Assume, for example, that the one-day VaR of a firm at a 95%-confidence level is estimated at $50 million. That means that with a 95%-confidence level, the firm might lose a maximum of $50 million owing to adverse market movements over the course of a day.

VaR is also computed at different levels in organization structure to understand the risk at different levels. VaR is commonly used to measure market risk.

Expected Shortfall

Expected shortfall (ES)—also known as *conditional VaR (CVaR), average value at risk (AVaR)*, *expected tail loss (ETL),* or simply *tail loss*—is an alternative risk measure to VaR. VAR answers the question, *"How bad can things get?"* ES answers the question, *"If things do get bad, what is the expected loss?"* VaR is the maximum loss over a specified period with a given confidence level (p), whereas ES is the average loss in the worst (1-p)% cases. In other words, ES is the average of all losses that are equal or greater than VaR.

Potential Future Exposure

Potential Future Exposure (PFE) is the maximum expected credit exposure over a specified period of time calculated at a certain level of confidence. PFE is primarily a counterparty credit risk measurement used to assess the expected exposure to the counterparty over a certain time horizon.

PFE is similar but not identical to VaR. VaR is an exposure due to market risk, whereas PFE is a credit exposure due to the increase in the value of a contract. VaR is typically computed for short-term horizon (in days), whereas PFE is computed for long-term horizon (in years).

Credit Value Adjustment

Credit value adjustment (CVA) is the difference between the risk-free portfolio value and the true portfolio value that takes into account the possibility of counterparty default. Essentially, it is the market value of the counterparty credit risk. It is one of the key measures used in credit risk assessment.

Economic Capital

Economic capital (also known as *risk capital*) represents the required capital amount that ensures that the firm stays solvent even in the worst-case scenario. It is the capital required to support the risk that the firm—generally, a financial institution such as a bank—is taking.

Economic capital is used by firms to manage their own risk, whereas *regulatory capital* is the minimum required capital by regulators. For banks, the regulatory capital calculation framework is prescribed by the applicable Basel accord (Basel II or Basel III).

Liquidity Coverage Ratio

The liquidity coverage ratio represents the proportion of highly liquid assets that must be held by a financial institution in order to meet short-term obligations. It is a regulatory requirement that mitigates the liquidity risks that firms face and is part of the latest Basel III accord.

Risk Management Tools

In addition to different risk measures, there are various tools or methods used in risk management practice. The following sections describe some of the common tools and techniques used in risk management.

Stress Testing

Stress testing is the process of estimating losses in case of abnormal market conditions. Abnormal conditions include historically worse market events or hypothetically worse market conditions. Stress tests are performed at different levels, such as the those of the portfolio or the overall firm.

Scenario Analysis

Scenario analysis is the process of studying the impact of market data movements on returns (profit and loss) and the sensitivities (risk measures) of portfolios. In this process, various simple and complex scenarios that represent the best and worst market conditions such as rates and prices are used to compute the profit, losses, and sensitivities of portfolios.

P&L Variance Analysis

Profit and loss variance analysis is the process used to study daily profit-and-loss changes from various events on a trade-by-trade basis. It is similar to scenario analysis but with a focus on trades and events such as the profit-and-loss contribution of each position, the contribution from a new position, or the unwinding a current position.

Sensitivity Analysis

Sensitivity analysis is the process of studying the impact on the target variable such as the portfolio value from different values of a single variable. For instance, sensitivity analysis includes the computing of the impact of interest rate changes on portfolio value.

Limits Management

Limits management is a key risk control tool used by firms. It is the monitoring and controlling of the limits of various trading and nontrading activities by variables such as trading notional, credit exposure, market risk exposure (VaR, Greeks), and settlement risk exposure. Firms may monitor and control limits either in real time or in periodic intra-day intervals. Typically, various limits are set at different levels such as trader, desk, portfolio, department, issuer, counterparty, and others.

Backtesting

Backtesting is the process of validating the models used to calculate various measures such as VaR. Backtesting is performed after the fact on historical data. In backtesting, typically historical data is used to compute the target using the model; this output is compared with real numbers from the market.

Netting

The most common tools used to mitigate counterparty risk are *netting* and *collateralization*. While netting helps to mitigate the current exposure, collateralization mitigates the potential future exposure.

In netting, counterparty exposure is reduced by offsetting amounts owed from each party to the net difference, wherein one party pays the other only a single amount.

Netting is a common feature used in two-way contracts such as forwards and swaps. It reduces credit exposure in swaps such as interest rate derivatives, but not in currency derivatives. Currency swaps often involve two parties in different countries and do not have a netting feature. They are exposed to settlement risk as explained in the "Settlement Risk" section of this chapter.

Periodic payments in two-way derivative contracts with a netting feature are netted. The party that owes the greater amount deducts the amount due from the other party and pays the net to the other party. This is also referred to as *payment netting*.

Netting also reduces the risk in case one of the parties defaults. All outstanding transactions between the two parties are netted to find the net exposure. This type of netting is referred to as *closeout netting*.

Central Clearing

Central clearing is a key player in reducing the credit risk in derivatives transactions. As discussed earlier, central counterparties (CCPs) clear all the listed and OTC cleared contracts. CCPs are well protected against the default as they use several lines of defense against their counterparty risk exposure. In addition, they use collateral to reduce their exposure by processes detailed in Chapters 5 and 11.

Collateralization

Collateralization is an effective credit risk mitigation technique used in derivatives and many other financial transactions. It is a practice in which market participants collect funds from counterparties as a security deposit and use them to recover losses in case of counterparty failures (Chapter 11).

Summary

As market conditions change, corporations must be able to respond quickly to risk management requirements. Derivatives are the most suitable instruments to hedge or to trade the risk in an efficient manner. In addition to financial risk controls, risk management includes strategies to improve operational efficiencies and to control operations risks. Risk management is a critical function in corporate governance, and firms adopt innovative strategies to deal with business as well as regulatory challenges.

Risk management function is a complex and extensive subject. This chapter introduced high-level concepts related to risk, risk types, risk management function, and the use of derivatives to manage financial risks. It also explained the enterprise risk management function and common risk measures and tools.

CHAPTER

4

The Derivatives Contract

This chapter introduces the derivatives contract, which is a legal agreement between its holders. The protean variety and inherent complexity of derivatives make the trading and managing of their contracts challenging. This chapter begins with an explanation of the general characteristics of a derivatives contract and an account of the successive phases of the contract lifecycle. The various functional units of an organization involved in contract management and the role of each unit are also discussed. Finally, this chapter touches on contract lifecycle variations across the major product types. The topics and terminology presented in this chapter serve as the foundation for more detailed discussion in corresponding chapters about specific product type (Part III). Chapter 10 will provide in-depth life cycle of contract.

The objectives of this chapter are to

- define and distinguish the terms *order*, *trade*, *contract*, *deal*, and *position*
- describe the general characteristics of a derivatives contract
- explain the marketwide derivatives contract workflow
- understand the various phases of a contract life cycle
- discuss the various organizational units and the functions they perform throughout the life of a contract

Contract Terminology

Each derivatives contract is made up of the elements presented in the following sections. Each element is associated with distinct terminology.

Order, Trade, and Contract

An *order* is a request or intention to purchase a financial derivative or enter into a contract. The order normally originates in a portfolio or from an investment management group. After its origin, it may go through an approval process before being sent to a trading desk for execution. The order is executed by a derivatives trader. This execution agreement is known as a *trade*. A trade is only an agreement of execution, and it is not valid or legally binding until the trade is fully processed.

The trade becomes an effective (*live*) agreement between counterparties after it is fully processed. This agreement is known as a *contract*. The contract life begins from the effective date of the contract and ends on its maturity date or date of termination. Figure 4-1 shows the progress from *order* to *contract*.

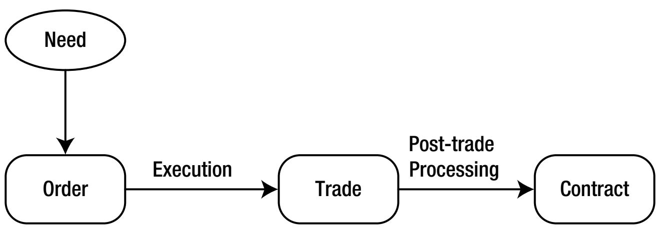

Figure 4-1. The contract life cycle from order to contract

The terms *contract* and *trade* are sometimes used synonymously, although this is not technically accurate. Other terms commonly used to refer to a contract are *deal* and *agreement*.

Position

Position refers to an investment (contracts) held by an institution or investor, and it can be either a financial security or derivatives contract. This is an aggregation (net) of all similar assets or contracts. For instance, if there are two similar swap contracts worth $100 million and $50 million, it results in a swap position worth $150 million. If the situation is opposite (long and short), then it will result in a swap position worth $50 million ($100–$50).

Financial Instrument and Product

A financial instrument refers to the financial contract that is actually being traded. Generally, *product* is used to refer to the category of the instrument. For example, while the equity option is a product, the specific stock option is an instrument. These two terms are also often used synonymously.

Characteristics of Derivatives Contracts

Derivatives contracts are complex and comprise many characteristics. This section describes common characteristics of derivatives contracts.

Notional

Notional refers to the principal amount of the contract. It is the amount used to calculate cash flow, but not necessarily the value of contract. This amount is not necessarily exchanged between the two parties. Take, for example, a simple interest rate swap (IRS) with a $1 million notional amount. This amount is not exchanged between the two parties, but all cash flow exchanged between the parties is calculated based on a $1 million principal, which is considered the notional amount of the contract.

A contract that has a notional transfer between counterparties is known as a *funded contract*. Other terms used are *notional principal*, *notional value*, *nominal amount*, *notional sum*, and *face amount*.

Effective Date

The *effective date*, or start date, is the date on which a contract term begins. All obligations of agreement take effect from that date.

Termination Date

The *termination date* (also called *maturity date*) is the date on which a contract term expires. Contract obligations end after this date.

Tenor

The *tenor* (also known as the *duration* or *length*) is the period through which the contract terms are effective.

Counterparty

A contract is between two parties, such that each party is *counterparty* to the other. Other frequently used terms for this arrangement are *other party*, *trading partner*, and *contra*. In general, *counterparty* is used to refer to each holder of a contract.

Currency

The base currency of a contract notional is generally the *currency* of the contract.

Legs

Many derivative contracts are comprised of multiple components, each resulting in an independent series of cash flow. These components are generally referred to as *legs*. For example, in an interest rate swap, there are two components. First, a fixed interest component, which results in a series of cashflow events based on a fixed interest rate. Second, a floating-rate component, which results in a series of cashflow events based on a floating interest rate. These components are the two legs of the contract.

In a *trading strategy*, there are normally multiple trades involved where each trade is a *leg* of the strategy.

Cashflow Schedule

Cash flow is the obligation stipulated in a derivatives contract. Many contract types undergo multiple cashflow events in their lifetime. The pay dates, amount, and other cashflow details are known as the *cashflow schedule*.

Third Parties

Apart from the two contract participants, there may be other entities involved in a contract such as the execution broker and the clearing broker. All entities other than the contract holders (counterparties) are known as *third parties*.

Portfolio

The *portfolio* is a collection of investments held by an institution. The collection may include securities, derivatives, or any other type of financial instrument. Normally, derivative contracts are organized and managed through a portfolio.

Legal Entity

Legal entity is the name of the entity registered with the local government. The legal entity's name of the contract holder is used in all official agreements.

Settlement

The *settlement* is fulfillment of the obligation of a contract holder. The obligation might be in the form of cash, securities, or underlying assets. Essentially, a contract holder that has an obligation transfers the asset or cash to its counterparty. Usually, the transfer of cash or assets is done between custodians of the two parties. In derivatives, there may be multiple settlements through the term (*life*) of a contract.

For instance, a swap contract involves periodic payments to be made between two parties. There is a settlement each time a payment is made by any party. In another example, margin is paid on futures contracts every trading day; hence, a settlement takes place every trading day.

Settlement Date

The *settlement date* is the date on which the settlement of a specific obligation takes place.

Transaction Date and Value Dates

Although settlements are supposed to happen on a date specified in the contract, the actual transaction may not happen on that exact date. In such scenarios, there are two different dates that are in use.

The date on which an actual transaction settles is referred to as *transaction date*.

The date on which a transaction is intended to settle according to the contract terms is referred to as the *value date*. Cash flows are computed as they are settled on value date.

Contract Life Cycle

A *derivatives contract life cycle* starts with trade execution and ends with its maturity or termination. This section briefly describes various phases in the life cycle along with stages of each phase. Chapter 10 explains the contract life cycle at length, and the remaining chapters of Part III detail the life cycles of each contract type in turn. In fact, the pre-trade phase which is related to the origination is also an important phase of a derivatives contract. This is why the pre-trade phase is also included into the life cycle of the contract.

Figure 4-2 illustrates the entire flow of a contract across market participants.

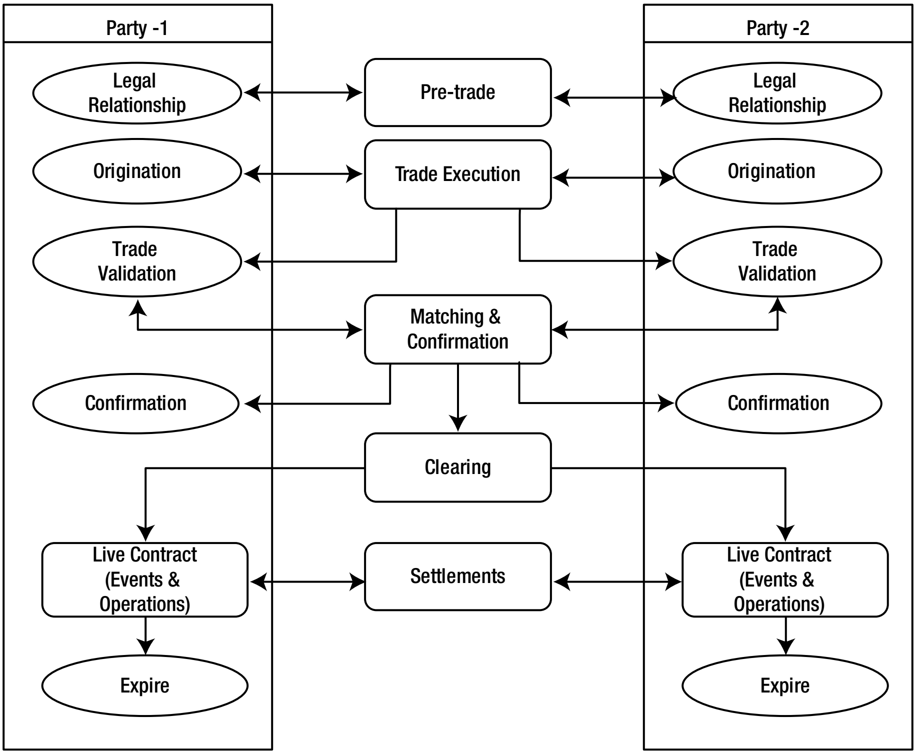

Figure 4-2. Workflow of a contract

The following steps summarize the contract workflow:

Pre-trade. During the pre-trade phase, market participants establish the trading relationship among each other, including the establishment of service providers.

Trade execution. Market participants execute their trade either bilaterally or on execution venue.

Matching and confirmation. After execution, trade details are matched from both sides to avoid any recording of other errors.

Clearing. Cleared contract trades are sent to CCPs for clearing.

Live contract. After clearing, the contract becomes live until either expired or terminated. During this period, both counterparties must fulfill their obligations. Derivative contracts may involve multiple settlements.

Expiry. Finally, a contract expires at the end of its term or early if formally terminated.

Bilateral contracts are between two end clients or between and end client and a dealer. Listed and cleared contracts are between a CCP and an end client or dealer. The following section divides the whole life cycle of a contract into multiple phases and stages and elaborates on each of them.

The Phases of a Contract Life Cycle

The life cycle of a contract is divided into five major phases, and each phase is further divided into multiple stages. Figure 4-3 shows the different phases and stages (*activities*) under each phase.

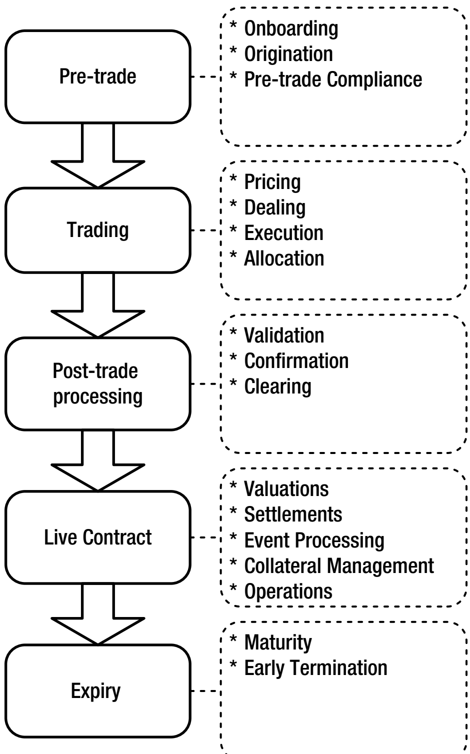

Figure 4-3. Phases and activities in contract life cycle

The following sections describe each phase of a contract life cycle and the various stages of each phase.

Pre-Trade

All steps before trade execution fall into the pre-trade phase. The following sections define each stage of this phase.

Onboarding

Onboarding is the process of establishing a trading relationship between trading partners and service agreements with all other market participants. These relationship agreements define the rules and regulations, type of relationship, trading limits, credit lines, and other legal matters. This process is also known as *documentation*.

Order Origination

Orders originate from financial institutions and other market participants (end users). The purpose of derivatives is explained in earlier chapters. Normally, trading decisions are made by a portfolio or asset management group. Orders are forwarded to a trading department (front office) for execution. Although this depends on the organization's structure, almost all requests go through a validation and approval process before execution (known as the *pre-trade compliance*).

Pre-Trade Compliance

Before execution, orders are checked to ensure adherence to internal and external compliance rules to protect the firm's interest and avoid any violations.

Trading

Orders are sent to a trading desk for execution, where they are executed by professional traders who have the knowledge of the markets and products they are navigating. *Trading* involves the dealing and pricing of complex products.

Pricing

Pricing is the process of identifying the fair market value of an instrument. Listed products are liquid, and their market prices are easily available from trading venues. Complex OTC derivatives, however, are priced by traders using theoretical models.

Dealing and Execution

Execution is the agreement between two parties to enter into a contract. To find the best possible price, traders may check different venues or negotiate with dealers. On an electronic exchange, trades are executed by an electronic matching system, but in bilateral trading, traders from both sides negotiate directly and execute the trade. *Executing an order* is also referred to as *filling an order*, and the *execution* is often referred to as a *fill*.

Allocation

Allocation is the process of assigning a trade to a legal entity (firm that will legally own the position) or to sub-accounts of a legal entity. Allocation is a necessary step of execution. Allocation is done either before or right after execution. Post-trade processing begins after an allocation of a trade.

Post-Trade Processing

Trade execution is only the initial agreement between two counterparties. This agreement remains ineffective until it is fully confirmed by all parties involved (counterparties, clearing member, clearinghouse, and so on). The trade is confirmed during the post-trade processing phase. After the trade execution, both parties forward the trade details to their respective middle offices (operations groups, as explained later in this chapter) for processing. The following steps explain all the stages of post-trade processing. At the end of successful post-trade processing, the trade becomes live, which is to say it is now a legally binding contract between two counterparties.

The duration of post-trade processing varies by the market. For instance, trades executed on exchange (listed market) may get processed within minutes and, in the case of an OTC bilateral, it may take from few hours to a couple of days. However, the objective is to process the trade as quickly as possible in order to avoid trade failures.

Trade Booking

After the execution, trade details are captured in a post-trade processing system for further processing. The *booking* can be done either manually or electronically. In electronic booking, trade details are fed directly into a trade processing system from a trading system.

Trade Validation

After trade capture, the trade details are validated. *Validation* may include simple data validation to proprietary rules that enforce various trading practices.

Trade Enrichment

Trade execution records normally contain only the key details of a trade. In the post-trade processing phase, trade records are enriched with various other data such as market conventions, instrument details, calendars, and third parties. This additional information is necessary for further processing in the life of a contract.

Matching and Confirmation

Confirmation is the official agreement of both parties to the trade terms. Before confirmation, both parties compare and match trade terms to determine if their recorded terms are consistent. This step eliminates any errors resulting from communication errors or from the trade capture. The official confirmation process establishes the contract as legally binding between both parties.

Clearing

In theory, *clearing* is the process of recording or registering and establishing the legal binding (legal obligation) between counterparties. This confirms the contractual obligations between the two parties. There are two types of clearing: *central clearing* and *bilateral clearing*. In central clearing, an agreement between the initial trading partners is transferred to a central counterparty (CCP, also known as *clearinghouse*). In this case, the original contract between counterparties is replaced by two contracts on the same economic terms as the original trade, as well as standard CCP terms between the CCP and each participant. After clearing, there is no contract between the original counterparties. In bilateral clearing, the initial trading partners interact with each other. Here there is no separate clearing step, as both parties face each other by default.

In practice, however, clearing typically refers to *central clearing*. Bilateral clearing is not a commonly used term; instead, those contracts are known as *bilateral*.

Clearing is the final step of post-trade processing. After clearing, a derivatives trade becomes a live contract. If a contract is bilateral, confirmation will be the final step.

Listed and OTC cleared contracts are centrally cleared through a designated clearinghouse. All other OTC contracts are bilaterally cleared.

Live Contract

After post-trade processing, the contract becomes live. It is effective from the start date and expires on a maturity date or earlier if the contract is terminated. A live contract may trigger periodic payments based on the terms of the contract.

In addition, various other operations may be performed on a contract. Some of these operations may modify or terminate the contract itself.

Settlement

Settlement is the process of fulfilling the obligations of a contract. Derivative contracts may involve multiple obligations (settlements) over the life of a contract. These obligations can be cash or other asset transfers, according to the contract terms. Obligations are settled through financial institutions such as *custodians, settlement agents*, or a *central bank*.

Amendment

Contract terms can be modified during the life of a contract by mutual agreement. However, not all types of contracts are modifiable. For example, listed products cannot be modified, but the position itself can be closed by an offset trade. After amendment, a contract normally undergoes post-trade processing again to confirm the new terms of contract.

Event Management

Events such as credit and corporate actions impact the life of a contract. These events are monitored, and impacted contracts are modified by counterparties to reflect these events.

Offset or Unwind

Offset is the process of terminating an existing contract through an offset trade (trade with opposite direction). Centrally cleared (listed and cleared) contracts can be closed through offset before they mature at the end of the contract term. This way, contract holders can avoid any required delivery by offsetting their position.

Unwind is the process of terminating an existing contract with the original counterparty before its maturity. Bilateral contracts can be terminated through an unwind operation. This is also known as *early termination*. This is the term commonly used in OTC bilateral contracts.

Partial Unwind

Partial unwind is the process of reducing the notional of a contract. A client can partially unwind a contract with the counterparty of the agreement. This operation will return the contract to post-trade processing. Note that not all types of contracts can be partially unwound.

Assignment or Novation

Assignment, or *novation*, is the process of transferring a contract from one party to another. This transfers all obligations to the new party.

Exercise

Exercise is the process in which an option holder claims the right (underlying asset or obligation) granted by an option. Based on the type of contract, the holder can exercise the contract either during the life of the contract or upon maturity. Exercise will trigger the settlement of underlying assets as per contract terms.

Expiry

The derivative contract has a limited life that starts on the effective date and ends on the maturity date. While certain types of contracts expire with ending ongoing obligations, others trigger the delivery on the expiry. The operations and events—such as *unwind, offset, credit event,* and *exercise*—all terminate the contract.

Maturity or Expiration

All derivative contracts expire on their maturity date. Based on the type of contract, some contracts simply terminate all obligations upon maturity while others may trigger a final settlement.

Compression

Certain OTC contracts are compressed or netted to reduce the overall risk exposure. This will result in termination of some live contracts that are similar and in an opposite direction.

Life Cycle by Category

As discussed earlier, derivative contracts can be classified into three major categories: listed, OTC cleared, and OTC bilateral. The following section briefly explains the contract life cycle of each category. Part III explains each life cycle in detail.

Listed Product Contract

As discussed earlier, listed products are traded on exchanges and cleared by clearinghouses. These instruments are standardized, and processing procedures are well-defined. Listed contract trading is governed by trading exchanges; clearing process is governed by the clearinghouse that clears the contract. Listed contracts can be traded on some electronic platforms apart from the listed exchange. However, all off-exchange trading is reported to the exchange and are cleared by the designated clearinghouse. The overall life cycle is very similar for most products listed on the various exchanges. Figure 4-4 illustrates the general life cycle of a listed contract.

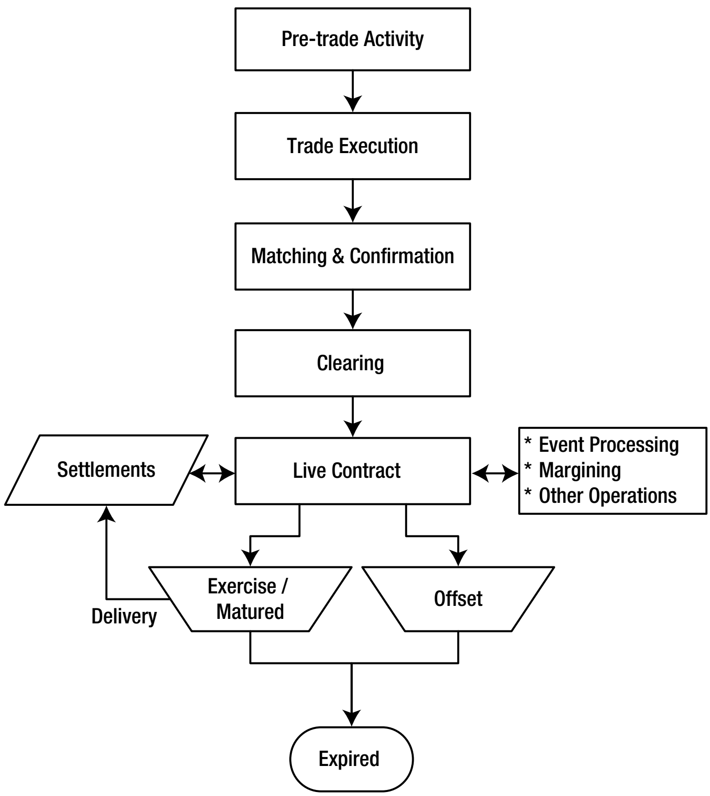

Figure 4-4. General life cycle of a listed contract

The following steps outline the life cycle of a listed contract. Each step will be treated in detail in Part III.

1. **Pre-trade activity.** Includes initial account setup and other legal agreement setup among clients, broker, exchange, clearinghouse, and other market participants before trading.
2. **Trade execution.** Clients send their orders to brokers; brokers in turn execute an order on an exchange or other execution venue. Execution details are sent back to the clients, and post-trade processing follows.
3. **Matching and confirmation.** Both parties (brokers) of the trade match trade details and confirm the trade execution through an exchange-provided confirmation platform.
4. **Clearing.** Confirmed trades are sent to the clearinghouse. The clearinghouse clears the trades and becomes the central counterparty, creating two trades, one with each original party. Notification of the cleared trade status is sent to all the parties involved, and the contract becomes live.
5. **Live contract.** Live contract may generate multiple settlements and subject to various operations and events.
6. **Settlement.** Ongoing settlements including initial settlement, periodic obligations (daily), fee, and other deliverables are processed.
7. **Exercise.** Option contracts may be exercised by a contract holder when they become eligible.
8. **Offset.** Contracts can be terminated by an offset trade.
9. **Margin management.** Listed contracts require collateral to be maintained in a margin account. Margin payments are computed and collateral is posted daily.
10. **Expiration.** Listed contract expires on maturity date or terminated by offset trade.

OTC Cleared Contract

The OTC cleared contracts are quite similar to listed contracts. These contracts can be traded on multiple trading venues such as exchanges and swap execution facilities (SEF). Regardless of the trading venue, the clearing CCP governs the lifecycle management of the contract. Part II of this book provides more details. The flowchart in Figure 4-5 illustrates the general life cycle of an OTC cleared contract.

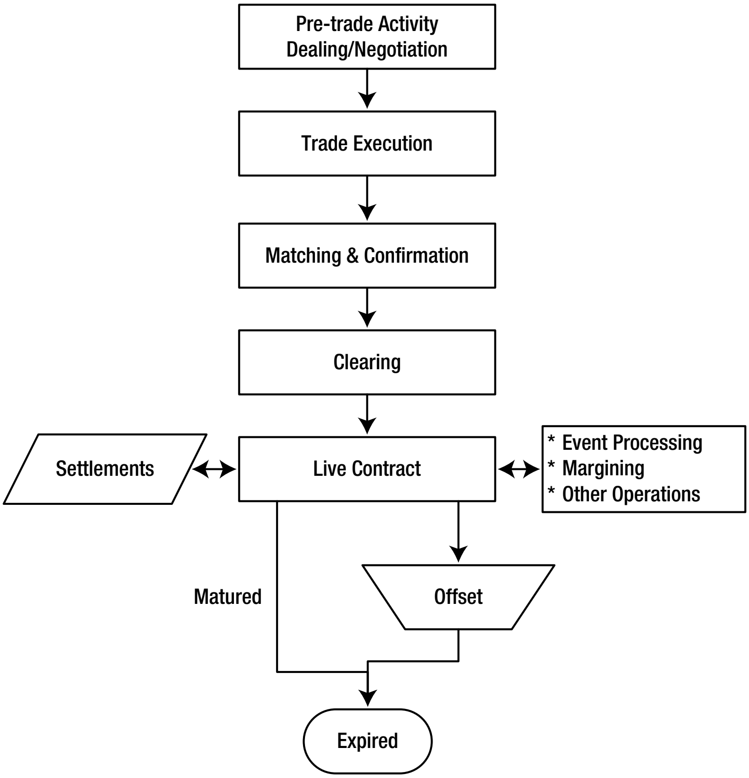

Figure 4-5. General life cycle of OTC cleared contract

The following steps outline the life cycle of an OTC cleared contract:

1. **Pre-trade activity.** Includes account setup and other activity between market participants before trading.
2. **Trade execution.** Market participants execute the trade over authorized execution facility and submit to affirmation platform for confirmation.
3. **Matching and confirmation.** Both parties match trade details and confirm the trade over an affirmation platform.
4. **Clearing.** The confirmed trade is sent to the CCP. The CCP clears the trade and becomes the counterparty creating two trades, one with each party. End clients clear their trades through a clearing member who is a member of the CCP.

5. **Live contract.** During the term of the life, contracts are valuated, and obligations are settled between contract holders. A live contract is also subject to certain events and may get terminated through an offset trade.
6. **Settlement.** Ongoing settlements including initial settlement, periodic obligations (daily), fee, and other deliverables are processed.
7. **Offset.** Live trade can be terminated by an offset trade.
8. **Event processing.** Events that affect the contract are processed, and contracts are updated to reflect the impact.
9. **Margin management.** Cleared contracts require collateral to be maintained in a margin account. Margin calls (initial margin and variation margin) are processed and collateral is posted daily.
10. **Expiration.** A cleared contract expired on the maturity date or was terminated by an offset trade.

OTC Bilateral Product Contract

An OTC bilateral contract is directly negotiated between two parties. Most bilateral contracts are arranged by dealers and, in most cases, dealers act as counterparty. The flowchart in Figure 4-6 illustrates the typical life cycle of an OTC bilateral contract.

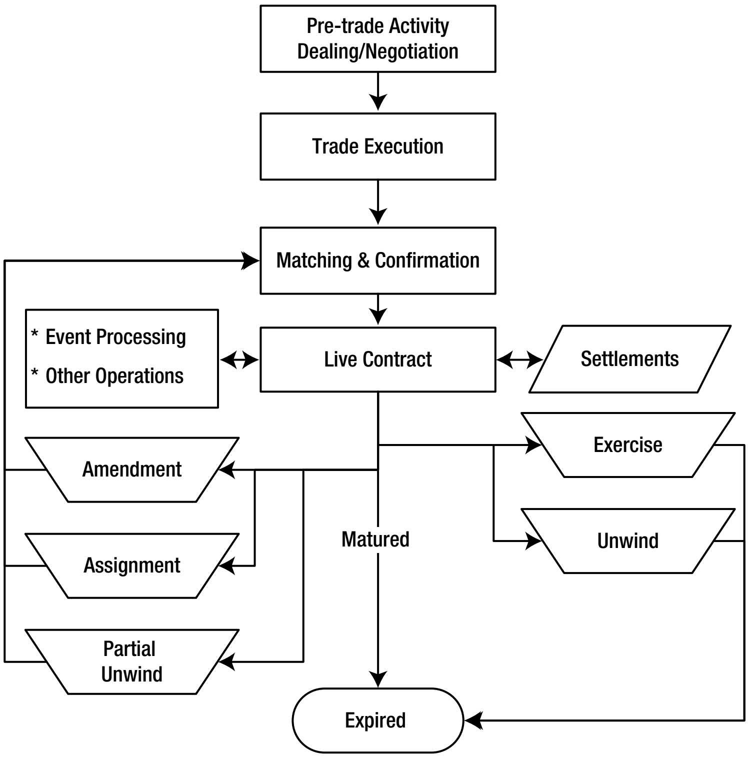

Figure 4-6. General life cycle of an OTC bilateral contract

The following steps outline the life cycle of an OTC bilateral product contract. Each step will be treated in detail in Part III.

1. **Pre-trade activity.** Relationship between counterparties is established through an ISDA Master Agreement (market standard) and other documents.

2. **Trade execution.** An OTC bilateral trade is directly negotiated and executed between two parties or on an electronic platform.

3. **Matching and confirmation.** Both parties match trade details and confirm the trade on an affirmation platform. Since there is no central clearing, trade becomes live after confirmation.

4. **Live contract.** During the term of contract, it is valuated periodically for obligation settlement, collateral management, and other purposes. Live contract is also subject to operations such as early termination, amendment, assignment, or exercise if it is option.

5. **Settlement.** Ongoing settlements including initial settlement, periodic obligations, fee, and other deliverables are processed.
6. **Event processing.** Events that affect the contract are processed, and contracts are updated to reflect their impact.
7. **Expiration.** The contract expires on stated end date, early termination, or assignment.

Organizational Units

Having surveyed the different phases and steps of a contract life cycle, let us examine where these activities take place in a typical organization structure. In general, from the contract lifecycle perspective, an organization is divided into three major units: *front office, middle office, and back office*. In addition, the middle office comprises multiple units such as *operations, risk management, legal, and compliance units*. The actual organizational structure may vary by type and size of the firm. Figure 4-7 shows the organizational units and different phases and steps of the contract life cycle practiced in most firms.

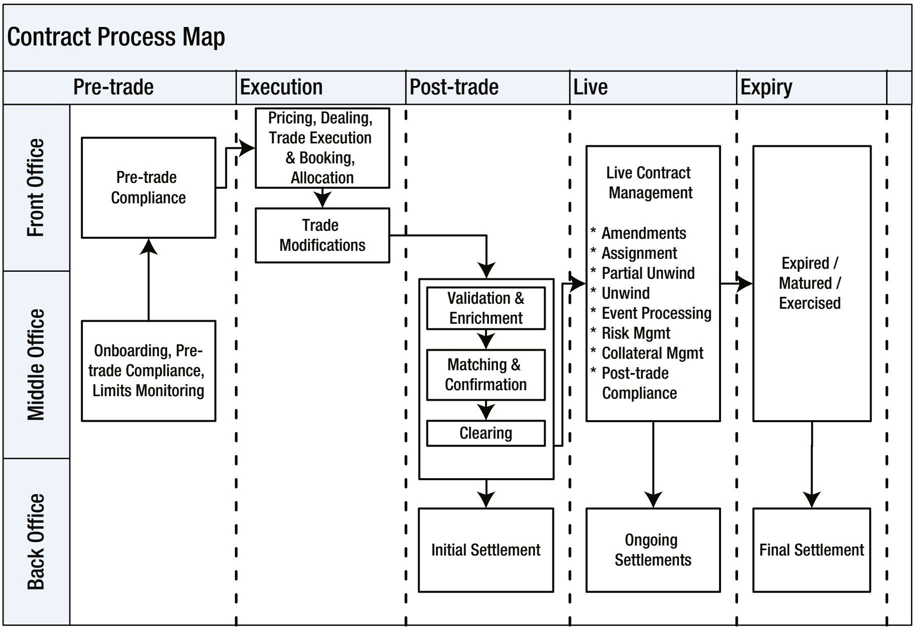

Figure 4-7. Contract management through front, middle, and back offices

The following section briefly explains the roles and responsibilities of each unit. They are further discussed in greater detail in later chapters on organizational structure of the different types of firms.

Front Office

The front office is primarily responsible for all trading-related activities. The front office's key responsibilities are the following:

- pre-trade analysis such as pricing
- negotiation and trade execution
- amending live contracts, trading offsets, and contracts to terminate positions

Middle Office

The middle office is comprised of multiple groups such as operations, risk management, and compliance (corporate oversight).

The major responsibilities of middle office groups include the following:

- validate, enrich, and confirm trades with counterparties or affirmation platforms as part of post-trade processing
- monitor the clearing process and resolve any issues that arise in post-trade processing.
- generate cash flows, validate and forward flows for processing by the back office
- perform end-of-day activities such as load market data and rate resets (fixing of new interest rates)
- generate all required reports: profit and loss, risk reports, activity reports, and so on
- manage the life cycle of the contract, resolve any disputes or issues, and perform updates or adjustments
- manage margin accounts and collateral with counterparties
- assess and monitor risk and advise or take the appropriate action
- develop and implement compliance framework for pre-trade and post-trade compliance

Back Office

The major responsibilities of the back office are to manage the firm's accounting and finances. With respect to derivatives processing, the back office's key responsibilities include the following:

- validate settlement instructions
- process settlements and deliverables (cash and securities)
- manage accounting and taxation
- reconcile accounts and handling breaks, and resolve any disputes in payment processing
- manage cash and liquidity
- produce various financial reports

Summary

This chapter introduced this book's central topic—the derivatives contract and its life cycle. The contract life cycle is divided into five major phases spanning across different organizational units. This chapter covered the five phases of the contract and the various stages within each phase, together with the loci of the corresponding activities in the organizational structure. The front office performs pre-trade and trading functions, The middle office's primary role is to perform post-trade processing, risk management, and collateral management. The back office is responsible for settlement and accounting-related functions.

Because the focus of this first part of this book has been to provide the big picture, this chapter presented only an overview of the derivatives contract without delving into much detail. Part III will examine the contract life cycle comprehensively, describing in detail the life cycle of each derivative contract category. Part II, which begins with the next chapter on derivatives market players, will explicate the respective organizational structures of buy-side and sell-side firms, describe the roles of various other players in the derivatives market, and consider the market's evolving regulatory framework.

PART

II

Market Structure

CHAPTER

5

The Market Players

As a big-picture survey of the derivatives market, Part I of this book touched on market structure and market players at a high level. Understanding the market structure is an essential part of learning derivatives processing and operations. Accordingly, Part II delves into market structure, beginning with this chapter on market players.

This chapter outlines the various players and their market segments and discusses their respective roles in the market. Close attention is given to the key players: buy-side institutions, sell-side institutions, exchanges, clearinghouses, and service providers. Finally, regulatory and non-regulatory organizations from key world markets are discussed.

The objectives of this chapter are to identify and explicate, in the context of the global market structure of derivatives and cross-border trading, the following players, including each player's role in different derivative markets (listed, OTC cleared, and OTC bilateral markets) and the relationships among players:

- buy-side firms
- sell-side firms
- exchanges
- electronic and alternative trading platforms
- *swap execution facilities* (SEFs)
- *central counterparty* (CCP) clearinghouses

- custodians
- trade repositories
- regulatory agencies
- industry associations
- servicing firms such as confirmation and matching services, depositories, lifecycle managers, and prime brokers

Market Players

As the list in the preceding section shows, the derivatives market involves numerous and diverse types of participants, ranging from end clients to execution venues and service providers (Figure 5-1).

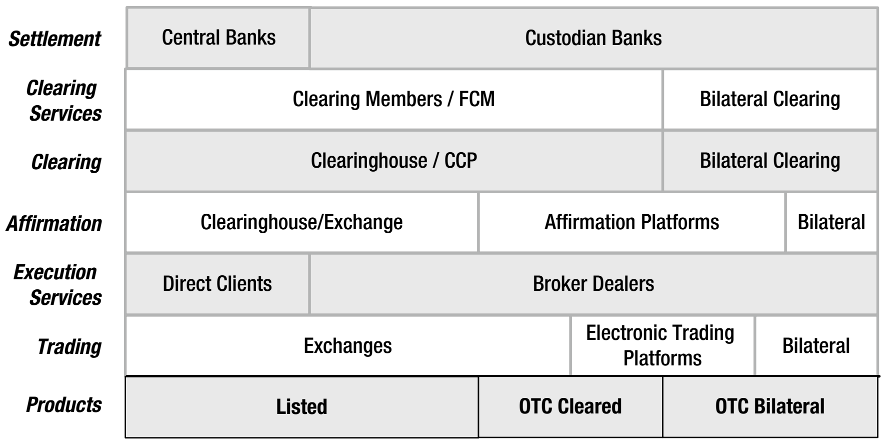

Figure 5-1. Derivatives market players

The following sections explain the roles of the various types and subtypes of market players and the relationships among them.

Buy-Side Firms (Clients)

A wide range of market participants trade derivatives, including financial institutions, manufacturers, hedge funds, asset managers, and other corporations. These entities are variously called *buy-side firms*, *institutional investors*, and *end clients*. Clients trade derivative contracts for various reasons, including risk management, speculation, arbitrage, and physical delivery of the underlying asset.

Clients are typically divided into two major categories: *hedgers* and *speculators*. Hedgers enter into a derivatives contract in an effort to hedge (eliminate) or reduce the risk. One of the risks they could potentially manage is a downside risk, which is the risk that the value of an asset could decline. Another risk they could potentially manage is an upside risk, which is a risk of the cost of inputs they use in their business, such as raw materials, potentially rising.

In contrast, speculators are looking to take advantage of events in a market in order to produce a profit. These market players could try to profit from a change in the value of an asset or in a market variable such as interest rate.

The following section explores each type of institutional investor that participates in a derivative market.

Asset Managers

Asset managers typically include managers of large mutual funds, *commodity trading advisors* (CTAs), *commodity pool operators* (CPOs), and other investment advisors.

Asset management activities include traditional fiduciary services, retail brokerage, investment company services, custody, and security-holder services. Asset managers use various distribution channels for their products and services. For example, a large banking company may establish an asset management group consisting of several interlocking divisions, branches, subsidiaries, and affiliates that provide a broad range of asset management products and services on a global scale. A small community bank may simply operate a separate *trust* division that provides traditional fiduciary services and that may also provide access to retail brokerage services through an unaffiliated third-party vendor located within the bank's branch network.

Asset managers typically use derivatives for either just hedging or for both hedging and profit-making (speculation), based on the size and nature of their business.

Banks and Loan Portfolio Managers

Banks and loan portfolio managers are exposed to credit risk from issuing loans (lending) to consumers and businesses. These entities rely heavily on credit derivatives in their effort to manage this exposure (credit risk). They often use derivatives such as *credit indices, credit default swaps*, and *interest rate swaps* to manage credit and market risks.

Hedge Funds

Hedge funds are large, relatively unregulated pools of capital open only to accredited investors. Financial institutions structured these as limited partnerships in order to comply with fewer regulatory requirements than other investment management institutions. Hedge funds try to beat the returns created by the broader market by harnessing a wide range of investment strategies including *long–short, global macro, event-driven,* and *value arbitrage*. These financial institutions often make high use of leverage in their efforts to produce robust returns. Hedge funds typically include a range of *alternative investment companies*.

Hedge funds are typically involved in trading both derivatives and cash products (securities). Due to the fact that these institutions face fewer regulatory restrictions, they are likely to take riskier positions by using derivatives.

These organizations require both risk management and sophisticated products to carry out their strategies.

Hedge funds depend on broker firms to supply most services needed, such as execution, clearing, financing, administration, and accounting. Note that broker firms provide personalized services to hedge funds.

Insurance Firms

Insurance companies need to manage not only their assets, but also several risks, including equity risk and interest rate risk. These entities use various derivatives in the hedging process.

Private Banks

Private banks engage in wealth management, advising wealthy individuals and corporations on legal and regulatory matters and investments. They offer innovative and lucrative investment portfolios to their clients. Most private banks include derivative instruments in their investment strategies for hedging, speculating, or both.

Day Traders, Scalpers, and Position Traders

In fast markets such as a listed market, there are speculators who simply take risk and profit from market movements. Apart from institutions such as hedge funds, there are other players that are known by the names of *scalpers, day traders*, and *position traders*, who engage in speculative trading.

A *scalper* offers to buy or sell contracts, holding the position for only a brief period of time—often from a few seconds to a few minutes. Scalpers attempt to profit by buying at the bid price and selling at the higher ask price.

A *day trader* holds the position open for longer but closes all positions by the end of the day, whereas a *position trader* holds positions open overnight.

Day traders and position traders are different from scalpers. Day traders and position traders try to profit from the anticipated direction of the market, while scalpers try simply to buy at the bid price and sell at the ask price, thus earning the spread (the difference between bid and ask).

Treasury Departments

Corporations are required to effectively manage and forecast cash, foreign currency, and commodity demands. The need to promptly address capital allocation and liability management issues are theirs as well. They face different risks from their business activities. In addition, these entities face risks that do not stem from their business activities. They are responsible for hedging the balance sheet and income statement against risks such as market risk, currency risk, credit risk, and liquidity risk, and for *asset-liability management* (ALM) (funding). They hedge their positions in commodities, foreign exchange, securities, and cash flow using derivatives such as swaps and option contracts.

Retail Investors

Retail investors include professional traders, private clients, and individual investors. They are mostly involved in trading listed derivatives on a small scale. They typically rely on retail brokerage firms to provide execution services and to maintain their accounts. Retail investors are beyond the scope of this book. In addition, topics discussed in this book might not be applicable to retail markets.

Sell-Side Firms or Dealers

A *sell-side firm* is a much broader term than it sounds. Sell-side firms are key players in the derivatives market and play many roles. In general, all intermediaries are known as sell-side firms. They include broker-dealers and other brokerage firms. They are also sometimes referred to simply as *dealers, brokerage firms, brokerage service firms,* or just *banks*. *Broker-dealer* is a term synonymously used with *sell-side firm*.

Sell-side firms are typically commercial banks or professional brokerage firms specializing in the capital market business. In financial markets, *commercial bank* is synonymous with *investment bank* because most commercial banks also engage in investment banking, although not all investment banks are commercial banks.

Sell-side firms play a critical role in running financial markets. They are even more crucial in the OTC derivatives market because they provide liquidity by acting as counterparties. Figure 5-2 depicts a sell-side firm and the other players with which it interacts. Sell-side firms provide the following services:

- execution broker (trade execution services)
- market maker (market-making operations)
- clearing broker (clearing and settlement services)
- prime broker (brokerage services to private investment firms such as hedge funds)
- local and global custodian
- treasury and liquidity management
- securities lending and borrowing
- cash management
- treasury and foreign exchange
- fund administration
- middle-office outsourcing
- proprietary trading

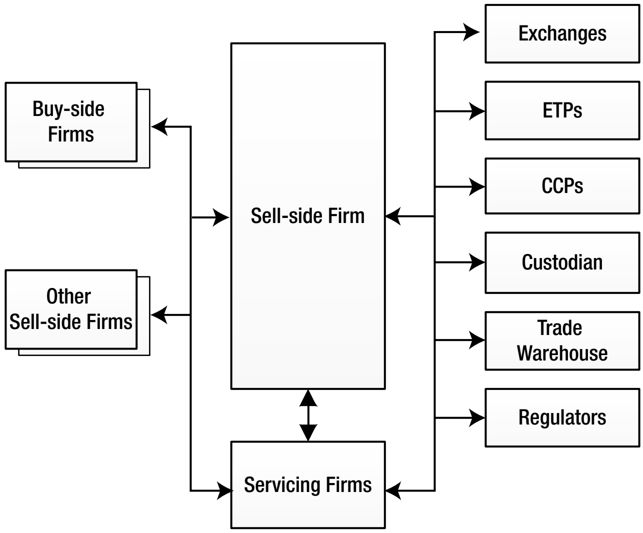

Figure 5-2. Sell-side firm

Based on the size of the brokerage firm, it may provide few or many of these different services.

In derivative markets, sell-side firms profit from service charges and the spread charged from their execution activities. Some of the main sources of their revenue are commissions from agency execution, commissions from clearing services, markups from principal transactions, and spreads from market making and fees paid for other services. The second part of this book explains the organizational structure and further details of a sell-side firm.

The following section explains the various roles and services provided by of sell-side firms.

Execution Broker

Execution brokers provide order execution services to their clients in various markets. Execution brokers are well connected to all execution venues. Brokers receive orders both over the phone, which is known as *voice broking*, and through proprietary *online platforms*. Online platforms enable clients to electronically send their orders to brokers. These platforms may also execute orders by matching orders from different clients.

Execution brokers provide high-quality, price-efficient access to the major world markets. They play different roles in executing a trade. Client orders are executed either on an *agency basis* or a *matched-principal basis*, as explained below.

Agency Execution

In an *agency role*, a broker simply routes the client order to the corresponding market—the listed product order to the corresponding exchange—and OTC product order to OTC market, where this order is matched with another order placed by a different participant.

If allowed by existing market rules, a broker-dealer executes trades internally instead of executing through an exchange or the OTC market. Doing so involves matching trades with those placed by their other clients.

Matched-Principal Execution

The broker executes an order on a *matched-principal* basis by entering into the opposite side of a client's trade. Consequently, the broker usually enters into an offsetting trade with another market participant, often within a matter of minutes or during the same trading day to cancel out (eliminate) market risk. Dealer firms may manage their risk at a portfolio level (on aggregate) instead of by each trade individually.

Principal Trading (Own Book)

Broker-dealers may also execute trades taking the role of counterparty (principal), possibly to hedge their own exposure (risk management). This is known as *principal trading*—also known as *for firm's book, position keeping*, and *proprietary trading*.

Clearing Broker

Derivative contracts can either be bilateral or centrally cleared. All exchange-traded contracts and cleared OTC contracts are cleared through a CCP. All other OTC derivatives remain between the trading partners on a *principal-to-principal* basis (*bilateral clearing*). It was also discussed that clearing is done through a clearing broker firm that is a member of a clearinghouse. Some of the sell-side firms act as clearing brokers, providing clearing services to their clients. Clearing brokers maintain their memberships on most popular derivative exchanges.

Most executing-broker firms also provide clearing services, but not necessarily both services. In other cases, a clearing firm may not be a member of clearinghouse and may use another clearing member who is a member of the clearinghouse. These firms are known as *non-clearing members* or *carry brokers*.

A financial institution can become a member of a clearinghouse by completing a pre-qualification process and depositing required funds with that clearinghouse. The money contributed is held as a security deposit towards the clearing fund maintained by a clearinghouse.

Clearing members are subject to regulatory and clearinghouse requirements on maintenance of client margin, minimum capital, and other related matters. Actual membership requirements vary by clearinghouse. There are many brokers, both domestic and foreign, operating in the derivatives market.

The clearing broker is responsible for the performance (obligation fulfillment) of its clients. The clearing broker follows clearinghouse guidelines to maintain client margin accounts. They hold client collateral in a margin account of each client. The clearinghouse maintains the aggregated collateral of each member in that entity's margin account. Normally, the collateral of a clearing broker held with a clearinghouse (member margin account) is maintained in separate accounts—one for end-client positions and another for proprietary positions. Typically, margin accounts hold liquid collateral such as cash and securities. The margining process and account maintenance are discussed in detail in Chapter 11. Figure 5-3 depicts the relationships among the clearing broker, client and clearinghouses.

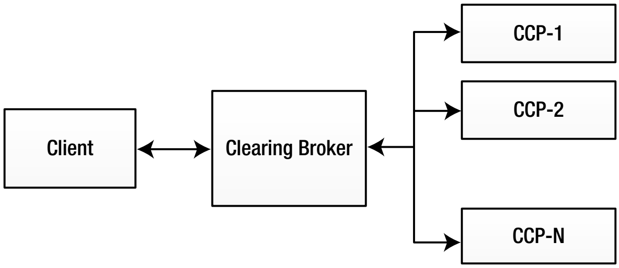

Figure 5-3. Clearing broker—a single margin account

Clearing brokers are known by other names such as *derivative clearing member* (DCM), *futures clearing member* (FCM), *clearing member firm* (CM), and *clearing firm* (CF).

Self-Clearing

There is another clearing model in OTC markets. In cleared OTC markets, clearing members have a similar role as in the listed market—they are members of a clearinghouse and provide clearing services to end clients. Alternatively, it is also possible that a clearing member firm may provide clearing services without going through the clearinghouse. But in this case, the clearing firm is taking all the risk. It continues to maintain the margin account and collect collateral from its clients. However, a limited number of firms provide this kind of clearing service.

Market Maker

Most broker-dealers are involved in *market making*. Market making is the process of executing trades by entering into the opposite side of a client's trade, and then quickly entering into an offsetting trade with another market participant. The institution involved in market making is called the *market maker*. Market makers publish both their bid and ask price at the same time, usually over electronic platforms.

The key objectives of market makers are to profit from the bid–ask price spread and provide liquidity. Although this spread is very small in most cases, they profit by trading large volumes. They operate both in listed and OTC markets. Usually, market makers are exposed to market risk. They are able to reduce this risk by quickly offsetting their positions. Market makers are more common in listed markets due to the speed and large volumes of trades executed there. However, market makers are large providers of liquidity in the OTC market as well.

The difference between market making and matched-principal trading is that market makers must provide both the bid price and ask price at any given time and must be licensed in each trading venue as market makers. On the other hand, in matched-principal trading, brokers can trade any side as needed. In addition, market makers always close their books, meaning they offset all positions, and they usually do so by the end of the trading day.

Designated Market Maker

Designated market makers (DMMs) are the typical market makers that are authorized by a specific exchange and the product. An exchange authorizes certain market makers to serve as DMMs to further increase the market liquidity of their products. DMMs need to follow the rules of the exchange in maintaining the two-way prices (bid and ask) and volumes during specified periods of the trading day. Sometimes, as in the case of the New York Stock Exchange, the term *specialists* also refers to DMMs.

Futures Commission Merchants

A *futures commission merchant* (FCM) is an exchange-authorized execution broker. An FCM is a member of a derivatives exchange and is allowed to accept orders for the purchase or sale of any products listed on the exchange. An FCM is subject to exchange membership rules.

FCMs originated in the futures market, which explains the name. Today's FCMs deal not only in futures but also in all types of products traded on exchanges.

Electronic Trading Platforms

Large sell-side firms have built their own trading platforms to allow their clients to execute their orders with other participants electronically and with broker assistance, as needed.

Trading platforms provide connectivity, reliability, and a choice of markets, products, clearers, and execution styles.

In addition, these platforms may also provide *straight-through processing* (STP) and easy integration with a variety of systems. They may also provide other required services such as access to real-time and historical market information, as well as the pricing of complex products.

Introducing Broker

An *introducing broker* (IB) is a person or institution other than an FCM that is engaged in soliciting or accepting orders for the purchase or sale of derivatives. The IB then passes these orders to other executing brokers or exchanges. An IB typically works as a simple intermediary (similar to an independent salesman) without being involved in the contract. An IB simply collects an IB fee. IBs introduce client accounts to FCMs on a fully disclosed basis.

After the execution, clients will deal directly with the execution broker and clearing broker who actually executed and cleared the trade. The IB generally does not accept any money or securities in order to maintain margin or for any other purpose.

Typically, the IB owns the relationship with the end client. Sometimes, the sales department of a large brokerage firm is referred to as an IB.

Prime Brokers

Prime brokerage is a full service provided by sell-side firms to buy-side institutions (mostly hedge funds). Prime brokerage covers a wide range of services designed to address most of the needs of clients.

In the derivatives industry, some of the services offered by prime brokers include the following:

- global execution (execution services for all types of derivatives in local and global markets)
- financing and securities lending (arrangement of loans for collateral needs)
- clearing, custody, and settlement services (trade processing and lifecycle management of client positions)
- portfolio management and administration services
- strategic advisory services
- technology services
- cash and liquidity management
- reporting (real-time P&L and position management, risk reporting service)
- collateral and margin management services

Figure 5-4 depicts the relationship between a primer broker and other players. There are several advantages to using prime broker execution services instead of directly dealing with multiple broker-dealers. The first benefit is reduced collateral requirements due to the netting (cross-product margining). This is due to the bilateral netting of all open positions with a single counterparty (such that the client faces one prime broker instead of multiple counterparties as in normal cases). In addition, some prime brokers offer various margining strategies (portfolio margining) to reduce overall collateral needs.

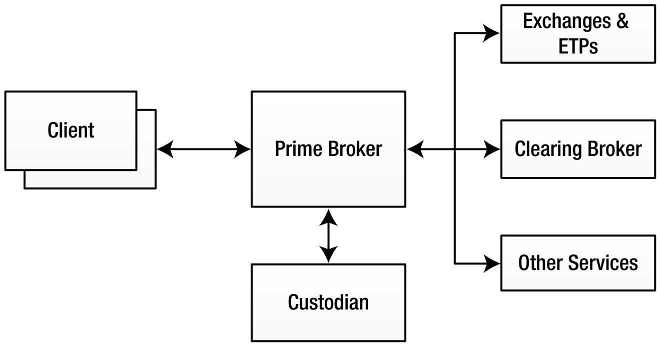

Figure 5-4. Prime broker

The next major benefit of using professional services by a prime broker is reduced operational costs and increased operational efficiency. Small and mid-size clients can delegate all operational functions to a prime broker.

Fundamentally, prime brokerage targets not only the large hedge funds, but also the hedge funds that are of modest size and institutional investors. Prime brokers typically provide funding through their extensive network of relationships with institutional investors, corporations, and private families.

To protect position information of their clients, brokerage firms strictly enforce access restrictions (referred to as *Chinese wall*) between the prime brokerage and other businesses such as sales and trading.

Fund Administration

Fund administrators provide professional services required to manage financial portfolios containing various financial products including derivatives. They offer various services such as portfolio valuation, position keeping, accounting, reporting, financial statement preparation, cash management, reconciliation, and regulatory reporting. Typically, small to midsize funds use professional fund administrators.

Other Services

In addition to the key services described above, sell-side firms provide many other services, including the following:

> **Local and global custody services.** Custodial services are explained in detail in later sections of this chapter.
>
> **Middle-office outsourcing.** Lifecycle management of client positions.
>
> **Securities lending.** Provides lending and borrowing services of securities to fulfill client needs.
>
> **Treasury and liquidity management.** Provides services such as cashflow management, payment processing, asset liability management, and trade finance services.

Exchanges

An *exchange* is an organized trading venue that provides the orderly trading of financial instruments. The key objectives of an exchange are to provide price transparency, standardized products, liquidity (bringing large numbers of buyers and sellers together), and guarantees of trade executions. Many exchanges around the world offer trading of standardized financial instruments, including derivative contracts. Exchanges employ sophisticated systems to provide robust and reliable trade matching as well as confirmation and other services.

Membership

Only authorized members can participate in trading on an exchange. All non-members must execute their trades through exchange members. Although large end clients can also obtain membership on exchange, execution brokers typically hold membership and provide execution services to their clients. In the derivatives industry, an exchange member is known as an *FCM* or *IB*.

Products

Historically, trading in exchange markets was restricted to standardized contracts based on traditional and physical commodities such as agricultural products. Today, however, these markets have expanded to cover different market sectors such as interest rate products, foreign exchange products, and stock indices.

Most popular types of derivative products on exchanges are futures contracts, options on futures contracts, and options on securities.

All exchange products are cleared through a designated clearinghouse that virtually eliminates the counterparty risk.

Execution Models

The exchanges themselves do not take any proprietary trading positions in derivative contracts. Rather, they simply link the buyer and seller and function as a neutral marketplace for their participants. The prices are determined by open and continuous trading. Exchanges do not set or control prices of any products traded.

An exchange may provide a physical location, computer-based electronic network, or both for trading. There are two trading models that are common on derivative exchanges: *pit trading* and *electronic trading*. The details of trading methods may vary by exchange. The following sections explain them in general terms.

Pit or Open-Outcry Trading

Originally, trading took place exclusively through face-to-face interaction on a physical trading floor of an exchange, also known as the *pit*, through an auction process known as *open-outcry* or *crowd trading*. In an auction market, prices are established publicly by participants posting bids (or buying indications) and offers (or selling indications). For instance, many derivatives products are traded on CME trading floors.

The exchange floor is organized into multiple pits, and each pit trades a set of products. Traders (floor brokers) are located around the pit in a crowd. Traders are either employed by an executing broker firm (member of exchange) or individually licensed by the exchange. A trader receives orders from an executing broker firm or directly from clients. The trader then participates in an auction with the crowd.

A specialist who runs the auction process controls each pit. Traders in a pit present their bids and offers in public to others. They use specific language and hand signals in this process. Trades are facilitated and recorded by specialists in centralized systems of exchange. After execution of the order, both traders (buyer and seller) create tickets that they pass on to their corresponding clerks. Clerks are the trader assistants who perform all the nontrading tasks supporting the trader. Clerks send trade tickets (execution) back to their firms for further processing. Figure 5-5 illustrates the pit model.

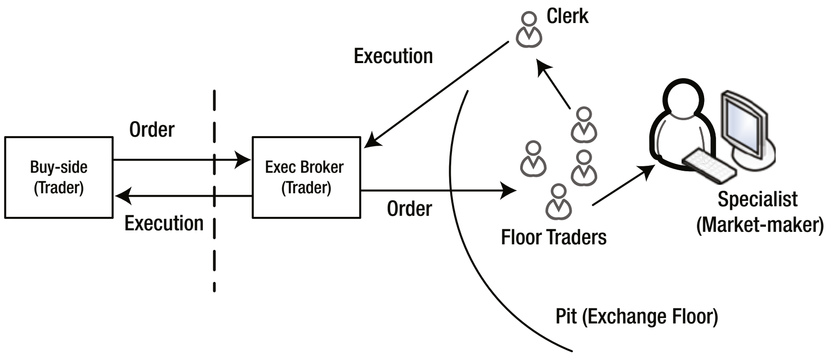

Figure 5-5. Pit trading model

The auction process on an exchange is anonymous. Although floor brokers may know each other intimately, they do not disclose the end client who owns the order they are executing. In addition to transactions between traders, traders also trade with specialists who play the role of market makers.

All details, including the price of an execution, are recorded with the exchange (either manually or electronically). The exchange, in turn, publishes trading prices to other participants as well as to the outside world continuously throughout the trading day. Furthermore, trade information is transferred to their corresponding firms electronically or by clerks.

Today's pit trading runs using the most advanced technologies, promoting high volume and fast-paced trading. Floor brokers use wireless, handheld devices that connect both to the trader's firm and exchange systems to automate the order, execution flow, market data, and communication.

Electronic Trading

As a result of technological advances, many derivatives exchanges have expanded their markets by replacing their floor-based trading systems with an electronic market or by supplementing open-outcry trading with electronic market access.

In listed derivative markets, there are many systems that stream live trading information, including market prices and volumes from exchanges to all licensed traders (executing brokers). These systems are known as *dealing screens* or *dealing systems*. Using dealing systems, traders (clients) submit their orders to exchanges. An exchange's electronic order matching system will then match orders and return the execution details to both side traders.

The vast majority of trading today is done over electronic matching systems. This is also known as *direct market access* (DMA). Many financial derivative markets no longer have pit trading. However, a large part of the commodities market still uses pit trading.

Market Data and Closing Prices

Exchanges publish market quotes throughout the trading day and the closing prices at the end of the trading day. A market quote includes bids, offers, quantities, last trade price, and so on. Closing prices are the final settlement prices of the day. These prices are used for all settlement purposes and to mark-to-market (valuation) the current positions at the end of day.

Regulations

Exchange members are regulated by their exchanges and governmental regulatory agencies. Exchanges are licensed and regulated by local governmental agencies. The exchange acts as a *self-regulatory organization* (SRO), implementing and monitoring with its own rules in addition to industry rules.

Popular Derivatives Exchanges

Table 5-1 shows some of the popular derivative exchanges around the world.

Table 5-1. Popular Derivatives Exchanges

Name	Country/Region
Chicago Board Options Exchange	US
International Securities Exchange	US
ICE Futures	US
Eurex	Europe
Euronext.Liffe	Europe
London Metals Exchange	Europe
ICE Futures Europe	Europe
Bourse de Montreal	Europe
Singapore Exchange	Singapore
National Stock Exchange of India	India
Multi Commodity Exchange of India	India
National Commodity and Derivative Exchange in India	India
Taiwan Futures Exchange	Taiwan
Tokyo Commodity Exchange	Japan
Korea Exchange	Korea

Electronic Trading Platforms

An *electronic trading platform* (ETP) is a nontraditional, electronic-based market for professionals and institutions trading financial instruments. ETPs are capable of matching buy-and-sell orders automatically without the intervention of a human broker, market maker, or an exchange. They increase the speed and transparency of trades while reducing the cost of the execution.

In the derivatives market, there are both fully automated platforms as well as hybrid platforms that allow participants to communicate via platform tools and execute their orders. Such platforms are known by various names including *alternative trading system* (ATS), *liquidity pool*, *electronic communication network* (ECN), *swap execution facility* (SEF), *organized trading facility* (OTF), and *multilateral trading facility* (MTF).

Types of Trading Platforms

Electronic trading platforms can be classified into the following different types based on the participants:

Single dealer. A broker-dealer provided trading platform for its own clients. On these platforms, clients can trade only with the dealer that provides the platform. These are known as *dealer platforms*.

Inter-dealer or dealer-to-dealer. A trading platform that is accessible only to broker-dealer institutions to trade among one another. These are typically known as *Alternative Trading Systems* (ATS) and *Liquidity Pools* (LP).

Dealer-to-client or multi-dealer. Trading platforms that are accessible to dealers as well as clients. These are typically known as *Electronic Communication Network* (ECN), *Swap Execution Facility* (SEF), *Organized Trading Facility* (OTF), and *Multilateral Trading Facility* (MTF).

Some popular derivatives trading platforms are listed below:

Electronic Trading Platforms

GLOBEX by the Chicago Mercantile Exchange

LIFFE Connect

IntercontinentalExchange by ICE Futures

Dealer-to-Dealer Platforms

Backbird

Creditex (CreditMatch)

e-MID

ICAP Electronic Broking

IDX Capital

Swapstream

Tullett Prebon

Dealer-to-Client Platforms

360T

Bloomberg

MarketAxess

Tradeweb

RediPLUS (Goldman Sachs)

Instinet

Swap Execution Facility

The SEF was created as a result of Dodd-Frank Act regulations. The objective of this entity is to bring transparency and more liquidity into OTC markets. These are simply dealer-to-client electronic trading platforms that adhere to the rules introduced by Dodd-Frank. These platforms trade OTC products that are treated as swaps according to these regulations. An SEF is also known as a *multilateral trading facility* (MTF). Like exchanges, SEFs are regulated by market regulators. Figure 5-6 depicts relationship between an SEF and other players.

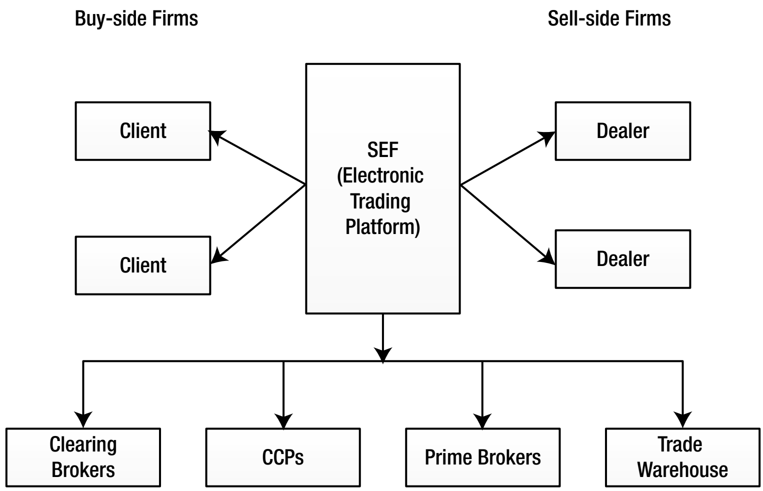

Figure 5-6. Swap execution facility

According to Dodd-Frank rules, an SEF's minimum requirements are to

- create an open trading environment by bringing bids and offers from multiple dealers, thereby providing the greatest number of choices to market participants
- promote pre-trade and post-trade transparency while maintaining liquidity
- maintain automated audit trails of bids, offers, and execution details
- follow other regulatory rules

The typical roles of an SEF are pre-trade compliance, trade execution, allocation, and surveillance. SEFs also provide additional services such as connectivity to clearing brokers, CCPs, trade warehouse, and service platforms.

Organized Trading Facility

Functionally. the *Organized Trading Facility* (OTF) is a European version of the SEF. The OTF was introduced as a result of the *European Market Infrastructure Regulation* (EMIR) (the European version of Dodd-Frank, if you will).

Central Counterparty (CCP) (Clearinghouse)

After the trade execution during the clearing process, the *central counterparty* (CCP) steps into the trade and becomes the only legal entity that market participants face. (Note that in the case of bilaterally cleared trades, there is no CCP.) This section explains the role of a CCP, how it operates, and the importance of this organization.

It is important to note that there are different terms used to refer to a CCP. Some even spell out *CCP* as *central clearing party* or *central clearing counterparty*. Other terms used are *clearinghouse*, *clearing corporation*, and *clearing organization*. The most widely used term is *clearinghouse*. *CCP* and *clearinghouse* are synonymously used in the industry. In addition, most people write *clearinghouse* as one word; however, some chose to write it as two words: *clearing house*.

Many traditional clearinghouses now serve OTC cleared markets along with listed derivatives. Figure 5-7 depicts the CCP and its market structure.

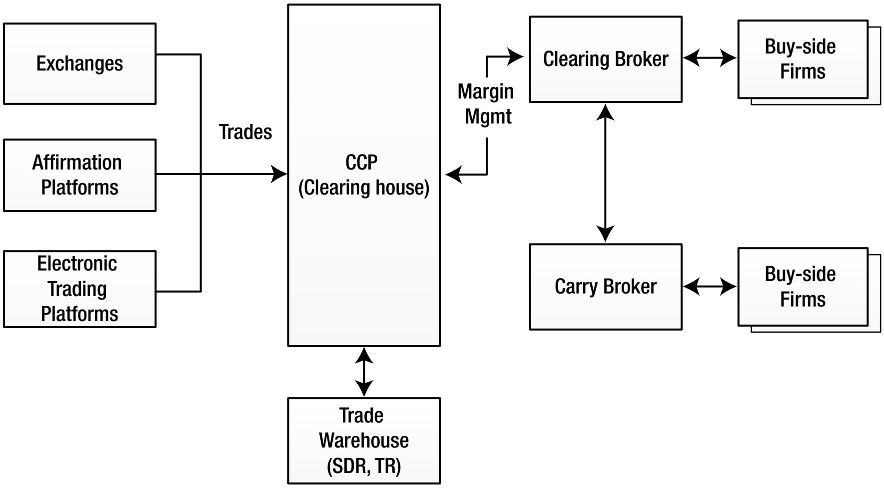

Figure 5-7. CCP (clearinghouse)

Unlike securities trading, derivatives trading involves no immediate transfer of assets. The life of the contract may extend over many years. This creates a counterparty risk that needs to be managed continuously until termination. CCP can step in to help market participants to mitigate this risk. CCP plays the role of a central counterparty and delivers the guarantee of contractual performance. However, market participants still face the counterparty risk from the CCP itself. This risk is usually considered to be negligible because CCPs are professionally managed and employ strong risk management strategies.

There are some clearinghouses that serve multiple exchanges and clear selected OTC derivatives as well. Some of the major responsibilities include the following:

Central counterparty. A CCP plays a counterparty role to both trading partners and creates two trades. Clients "face" the CCP instead of dealing with each other, which avoids incurring counterparty risk from each other.

Legal responsibility. CCPs are legally responsible for settling any counterparty's defaults or failure to honor their obligations.

Settlement netting. Positions are netted to reduce the number of open positions resulting from increased capital efficiency. This is known as *multilateral position netting*.

Position management services. Position updates, give-up, and take-up.

Exercise assignment and allocation. In the case of options, the CCP assigns each contract being exercised to a seller.

Extensive reporting services. CCPs provide various reports to clients as well as regulators.

Settlement routing. Most CCPs also provide the settlement instructions to its members.

Benefits of Central Clearing

The preceding section discussed the role of CCP. The benefits of central clearing include the following:

Contract performance and counterparty risk management. Both trading partners (buyer and seller) of the contract are guaranteed performance (obligation fulfilment) by the CCP. This virtually removes any counterparty credit risk.

Multilateral netting. Clients get the opportunity to close out the position with any other market participant when needed (known as the *fungibility* of contracts). This reduces the volume of open positions and, in turn, reduces total counterparty exposures. In addition, it will introduce operational efficiencies by reducing the total number and value of transactions to be settled.

Transparency. Central clearing promotes the uniform market through marketwide transparency. In cleared markets, transaction prices and exposures are all open to regulators and the public.

Systemic risk. Due to strong risk management strategies and the financial strengths of CCPs, systemic risk is virtually removed. Typically, CCPs calculate midday margins along daily margins to reduce the exposure. In addition, netting across multiple counterparties reduces the overall exposure by reducing the systemic risk (that is, the risk of knock-on failure from one counterparty to the next).

Capital efficiency. CCP may promote reduced regulatory capital for institutions through *cross-margining* (margin netting among multiple product classes).

Reduced costs. Due to heavy automation and larger volumes of CCPs, the overall cost of trade processing may be less.

Operational efficiency. CCPs introduce centralized, safe, and controlled post-trade process, increasing operational efficiency.

Limitations and Risks of CCP

Although clients are protected from credit exposures from other trading partners, they are still exposed to the risk of the CCP defaulting. Regardless of their strength, there is still a slight chance of the CCP itself defaulting. Historically, however, no CCP has ever defaulted.

Another fact is that there are a limited number of CCPs in the market, which results in a concentrated exposure to CCPs. Although CCPs are strong, defaults cannot be completely ruled out. CCP failure may create major damage to the entire system.

Most OTC products are complex and hard to standardize. As a result, CCP clearing is limited to plain vanilla contracts, leaving a large number of OTC contracts still in the bilateral market.

Types of CCPs

There are two types of CCPs: *traditional clearinghouses* and *independent corporations*.

Traditional Clearinghouses

Traditional clearinghouses are typically owned and operated by exchanges. Each clearinghouse clears all transactions of one or more exchanges (listed derivative contracts). They have also started clearing some of the OTC products (cleared OTC contracts).

Independent Corporations

In OTC markets, there are independent corporations that provide only clearing and/or settlement services. They run on their own financial backing. These firms are trying to adopt methods similar to traditional clearinghouses in order to manage their risk. Independent CCPs are growing, and these firms vary at their level of service and products they support.

Membership

End clients access clearinghouses through a clearing broker who is member of a clearinghouse. In case of listed markets, buy-side firms execute their trades through the execution brokers and use clearing services used mostly by the same firm or a different clearing broker firm.

Clients may also use clearing services from a broker firm that is not a member of clearinghouse (*non-clearing member*). This type of entity is also known as a *carry broker*. Non-clearing member firms, in turn, use other clearing member firms to access the clearinghouse.

Risk Management Strategies

CCP takes over counterparty risk from all its clients (clearing members). Besides counterparty risk, it faces other types of risks explained below. The CCP must be financially robust and adopt sound risk management practices.

Success of the CCP depends on its financial strength, risk management strategy, and underlying operational efficiency. Technology plays a key role in achieving operational efficiency. In general, CCP manages risk through its rigorous membership standards and adopts prudent margin requirements. It also maintains a large guarantee fund to provide confidence to its members. The clearinghouse collects deposits from each member which go toward its guarantee fund. Its members must also maintain certain standards and provide extensive data on financials and operations before obtaining membership. In order to cover its obligations, the clearinghouse maintains its own capital base and bank facility guarantees, and collects member margin payments. The following are key strategies used to manage credit risk by the CCP:

- a large guarantee fund used in case of member defaults
- initial margin for each transaction
- daily settlement of variation margin (losses and gains of the day)
- intraday margin calculations, collecting margin (making calls) if required
- liquidation of open positions when a trading party is in default
- equity capital of the firm

In addition to credit risk, the CCP faces the following risks:

- *Market risk* is the change in contract value from the change in market factors. The daily margining (daily settlement of losses and gains) mitigates the market risk. Margining also includes the deposits to mitigate the credit risk. Thus, margining covers both market and credit risks. The margining process is further explained in Chapter 11.
- *Liquidity risk* is the risk of fulfilling obligations in a timely manner. CCP uses margin or collateral posted by the defaulting member to mitigate this risk. Apart from this, the CCP also maintains large amounts of credit lines to fulfill obligations on time.
- *Settlement risk* is the risk of a custodian defaulting after the money is transferred from the member and received by the clearinghouse custodian (bank). While there is no full protection from this risk, strategies such as netting of payments and spreading the risk over multiple entities are used to reduce this risk.

- *Operations risk* is the risk due to system failure and human error due to the complexity and the criticality of the CCP operations. Errors or system breakdowns may lead to serious financial loss. Operations risk is managed through various strategies such as redundant networks, robust systems, employee training, business continuity planning, and execution.

Licensing and Regulatory Oversight

Since the clearinghouses are the most important entities in financial markets, they are licensed and regulated by industry regulators. For instance, the CFTC and SEC in US markets and the *Financial Services Authority* (FSA) in European markets issue license and regulate CCPs.

Default Handling Process

It is always possible that one of the trading partners or the clearing member can default. This section explains the general rules followed by CCPs. The membership rules, risk management, and default handling process vary by CCP and applicable regulations.

In case of default, the CCP uses the following sources to cover the losses in the order listed below:

- funds from liquidation of all open positions of the defaulting entity
- collateral obtained from a margin account
- funds from the guarantee fund
- credit insurers
- equity capital of the clearinghouse itself

These sources make it virtually impossible for the CCP to default. CCPs usually have the highest reputation for credit trust in the market.

Customers are also protected in case of clearing member defaults. First, clearing members are monitored and audited regularly by the CCP and internal auditors. They are required to maintain adequate capital and comply with the rules and regulations established by the CCP. In case of a member default, all client positions and collateral are transferred to another member. Any proprietary positions are liquidated to cover any losses incurred. If those funds are not sufficient enough to cover losses, the CCP may step in to assist.

In the case of a non-clearing member default, the corresponding clearing member tries to cover these losses from open position liquidation and collateral. For further losses, the CCP may step in.

If a trading party (client) defaults, first the clearing broker (member firm) will handle the default. It will liquidate client positions and use collateral to cover the losses. If those funds are not sufficient enough, the CCP may again step in.

A CCP's guarantee fund is used to compensate fellow CMs in case of any CM default, but not to benefit the customers of the defaulting CM. Further details on default handling are prescribed by the respective regulatory agencies.

Give-Up and Take-Up

Give-up is the process of the clearing member accepting the trade that is executed and submitted by the executing broker. The give-up process confirms that the clearing member accepts its role in the transaction. That means the executing broker is performing a give-up of the trade to the clearing member for the clearing services, and the clearing member is performing a *take-up* of the trade. Their corresponding clearing members take the two sides of the trade unless one clearing member represents both counterparties.

Popular Derivative CCPs

Popular CCPs in the derivative market include the following:

- CME Clearing (US) (owned by CME Group)
- ICE Trust (US)
- IDCG (US)
- CME Clearing Europe (UK)
- ICE Clear Europe (UK)
- LCH.Clearnet Ltd (UK)
- NYSE Liffe (UK)
- Eurex Clearing (Germany)

Cross-Border or Global Clearing

If the trade is cleared by a CCP located in a foreign country, it is known as *cross-border clearing*. A global clearing firm that holds membership in a foreign clearinghouse through a local counterpart normally arranges cross-border clearing.

Custodian

A *custodian* is a financial institution that holds cash and securities on behalf of its clients and provides services such as position management, dividend processing, taxation, transaction settlement, and collateral management. The custodian may also provide additional services to its clients in many different ways. These services are also referred to as *custody*.

Custodian services are usually provided by either a brokerage firm or a commercial bank. Brokerage firms maintain their own accounts and client accounts separately without leveraging clients' funds to their proprietary collateral or for any such purposes. Custody services are defined by the custody agreement between the client and its custodian.

In the derivatives market, custodians provide the following core services:

- **Safekeeping of client cash and securities.**
- **Payment and settlement**, including the following primary functions:
  - periodic cash flow and exchange of principal
  - collecting contingent payments in case of a credit event
  - close-out netting in case of a default by a counterparty or early termination of contract
  - processing the delivery of collateral and posting collateral amount on behalf of the client
- **Contract lifecycle management.** From origination to the expiry, including processing of events and corporate actions
- **Valuation and payment calculation.** Valuation of open positions and calculation of the payment obligations (cash flows) throughout the life cycle of the contract
- **Collateral management.** Collateral management service throughout the life cycle of the OTC, including calculating collateral, processing delivery, and receipts of collateral
- **Reconciliation.** Reconciliation of cash/collateral movements throughout the life cycle of the contract

- **Client reporting.** Supplying various reports to support client needs
- **Policy and process documentation.** Providing required documentation related to policies and procedures
- **Regulatory reporting.** Providing all reports required by regulatory agencies.

Apart from these core services, most custodian institutions offer other additional services, including the following:

- investment/fund accounting
- cash management, funding, and liquidity management
- record-keeping
- securities lending
- fiduciary and trustee services
- portfolio valuation/performance measurement
- collateral management
- middle-office outsourcing

Settlement Agent

A *settlement agent* is a firm (or branch of a firm) that manages the settlement process, determines the settlement positions, and monitors exchange of securities and payments. The payment of funds is generally done through a custodian or settlement bank (private or central). It is also common practice in some situations that firms exchange payments through check or certified check.

This function is sometimes provided by the exchange itself and sometimes by a *central securities depository*, as discussed in the next section.

CSD and ICSD

A *central securities depository* (CSD) is an institution holding securities in a central repository. It holds securities either in physical certificated or dematerialized/electronic certificated form to enable a book entry transfer of securities. CSDs prevent the movement of physical securities between owners. Also, securities in the form of electronic records make the transfer easier.

An *international central securities depository* (ICSD) is a typical central securities depository that settles trade in international securities as well as in various domestic securities. They usually deal with local CSD either directly or through local agents.

In some cases these institutions provide other services, too, such as clearing and settlement services. Although CSDs and ICSDs may not be directly involved in derivative transactions, derivative transactions result in securities settlement. Popular ICSDs include Clearstream, Euroclear, and the Depository Trust Company (DTC).

Global Custodian

In today's market, an institution's business is spread across the globe. Many institutions deal with international securities, derivatives, and their international counterparts. In global markets, custodians provide services safekeeping securities issued around the world and dealing with institutions located around the world. The term *global custodian* is becoming a synonym to the term *custodian*. The term *domestic custody* is used to refer to custodian services in local markets; *global custody* refers to custodian services in global markets.

Most large custodian firms operate globally. Typically, firms run their operations in many countries through their local franchises (known as *sub-custodians*).

SWIFT

The *Society for Worldwide Interbank Financial Telecommunication* (SWIFT) is a cooperative society owned by member financial institutions from around the world. SWIFT provides a messaging platform—including a network, standards, and applications, known as *SWIFTNet*—that enables financial institutions worldwide to send and receive information about financial transactions in a secure, standardized, and reliable environment.

Most of the world's financial institutions use SWIFTNet for local and international interbank communications for financial transactions. In addition, SWIFT also facilitates many other operational messaging services for securities processing, settlement, and financial operations.

Servicing Firms

The exchange and exchange-appointed clearinghouse facilitate confirmation and other post-trade processing. In an OTC market, however, multiple servicing firms provide post-trade processing, middle-office, and accounting services.

- Post-trade processing services include allocation management, trade matching, trade confirmation (affirmation platform), trade submission to CCPs, and regulatory reporting.
- Middle-office services (such as lifecycle management, P&L reporting, risk reporting, portfolio reconciliation, novation, event processing) and back-office services (such as fund accounting) are all provided by one or multiple servicing firms at different capacities.

Affirmation platforms (post-trade processing) have taken on major roles in OTC markets. Today's affirmation platforms employ advanced technology to provide a sophisticated servicing platform that serves clients of different sizes. Although their main focus is post-trade processing, they have been expanding by serving middle-office operations as well. Typical services include the following:

- allocation services
- electronic affirmation (affirmation and two-way automated matching in real time)
- services to support multi-asset class OTC products
- connectivity to custodians, CCPs, and regulatory agencies
- electronic connectivity and monitoring and administration systems for clients
- portfolio reconciliation services

Popular Service Providers

Table 5-2 lists some of the popular service providers.

Table 5-2. Common Services and Popular Providers

Service	Details	Provider
Affirmation Platform	Provides affirmation and confirmation services to market participants.	MarkitSERV, ICE eConfirm, SWIFT's Accord, SWIFT's Affirmations
Novation	Provides novation (assignment) services to market participants.	MarkitSERV
Credit Event Processing	Processes credit events—conducts auction and settlement activities.	Creditex
Fund Accounting and Administration Services	Provides fund accounting and administration services. Market participants can totally outsource accounting and administration functions to these firms.	Citco, BNP Paribas Fortis, State Street

Trade Repository or Trade Warehouse

The trade repository is the central trade warehouse that collects and stores all market transactions required by the regulators. The key objective of the warehouse is to provide information to authorities and the public that could promote financial stability and assist in the detection and prevention of market abuse while enhancing market transparency. The trade repository plays an important role in monitoring systemic risk.

As various market regulations were introduced over the time, a number of warehouses evolved for collecting different types of transactions. Today, many warehouses around the world serve different markets and product lines.

In a listed derivatives market, exchange and other entities involved directly feed to regulatory agencies. The OTC market has been anonymous and private until recently, and there was no transparency or full access to regulatory agencies. Dodd-Frank and similar regulations (EMIR in Europe) around the world have introduced trade repositories, otherwise known as a *Swap Data Repository* (SDR), to collect OTC transactions (see Chapter 9). In an OTC market, all confirmed trades (electronically executed, brokered trades, cleared, bilateral) are reported to the warehouse assigned to that market. Confirmed trades are supposed to be submitted to the warehouse in real time by one or more agencies such as the following:

- electronic execution platforms
- affirmation platforms
- clearinghouses (CCPs)
- inter-dealer brokers
- custodians
- other service providers mandated by regulators

Figure 5-8 depicts the flow between a trade warehouse and other players.

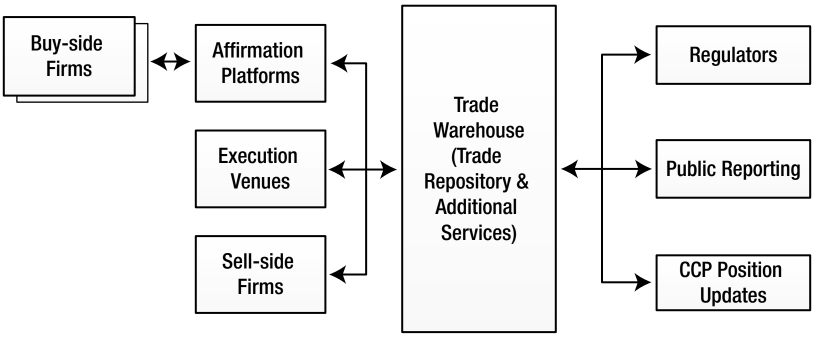

Figure 5-8. Trade warehouse

Trade repositories produce appropriate reports and feed to regulatory agencies. These reports include the details required by appropriate regulatory agencies—such as the SEC and CFTC in the United States and the European Securities and Markets Authority (ESMA) in Europe. To preserve counterparty confidentiality, public reporting is done anonymously and at an aggregate level. The warehouse may also promote central netting (offsetting) of payment obligations that may enable a significant reduction in the number of settlements.

The major player in this field is the *Depository Trust and Clearing Corporation* (DTCC), which runs various trade repositories through its subsidiaries in various regions of the world. The following list shows various DTCC-run warehouses:

> ***Trade Information Warehouse* (TIW)** (US). Operated by The Warehouse Trust Company LLC, TIW collects OTC credit product trades. The Federal Reserve and the New York State Banking Department regulate TIW. In addition to regulatory reporting, TIW provides post-trade lifecycle processing.
>
> ***Global Trade Repository* (GTR)**. The DTCC provides global repository services for the commodity, FX, equity, credit, and interest rate derivative asset classes. The repository supports Dodd-Frank regulation and complies with future global regulatory initiatives as well. Each of the asset classes roll up into DTCC's Global Trade Repository, providing regulators and the industry a snapshot of the market's overall risk exposure. DTCC's Global Trade Repository is based on its original TIW, which acts as one of the industry's first repositories for credit default swaps. GTR operates globally through its local agencies such as US DDR SDR, GTR-EUROPE, GTR-JAPAN, GTR-HONG KONG, GTR-SINGAPORE, and GTR-AUSTRALIA.

Data Vendors

Derivatives heavily rely on various data items for pricing, valuation, and processing. There are two major types of data: *market data* and *reference data.* In addition, information such as research, corporate events, and market news are used by organizations (see Chapter 8).

Market Data Vendors

Derivatives contract management depends on copious ongoing supplies of reliable market data to accurately compute pricing, valuation, risk analysis, and collateral management parameters (see Chapter 8). Firms acquire market data from multiple sources to fulfill their needs. While some sources provide free access, others charge subscription fees. Some of the important market data sources are Exchanges, Bloomberg, Markit, Reuters, Super Derivatives, US Federal Reserve, and local central banks.

Reference Data Vendors

Reference data is information on financial instruments, identifiers, market conventions, business calendars, and other details. It is also known as *static data*. Reference data is critical for transmission of contract and transaction details among internal systems as well as among market players. Reference data includes CUSIP, ISIN, RED Code, and other identifiers (see Chapter 8).

Major sources of reference data in the derivatives industry are exchanges, Bloomberg, Reuters, Markit, and Interactive Data.

Payment Processing Institutions

A *payment processing institution* (PPI)—also known as *payment processing service* (PPS) organization—provides safekeeping, transference, delivery, and settlement services. A PPI holds funds and securities in a client's account and transfers funds and securities between organizations. It is similar to a custodian, except that a PPI deals only with cash and securities and, for the most part, will provide no other service. Typical custodians are commercial firms that sell many other services in a package. The custodian in turn uses a PPI to process the actual cash and securities transfers.

Various institutions, including banks and non-bank financial institutions, provide these services. Most payment and settlements between institutions is done electronically using the SWIFT network. When PPI receives payment instruction, it actually transfers funds or securities from one client account to another. It may also send or receive funds or securities from an outside institution to deposit in a client's account.

Well-known PPIs include the following:

Fedwire securities service. A book-entry securities transfer system that provides participants cost-effective safekeeping, transfer, and delivery-versus-payment settlement services.

Fedwire fund services. A *real-time gross settlement* (RTGS) run by the US Federal Reserve serving US customers. It serves large-value domestic fund transfers and safekeeping and transfer services of US government, agency securities, and mortgage-backed securities. Fedwire is a credit transfer system, and each fund transfer is settled individually against an institution's reserve or clearing account that is maintained by each institution in the Reserve Bank.

National settlement service. A multilateral settlement service offered to depository institutions that settle for participants in clearinghouses, financial exchanges, and other clearing and settlement groups. It is owned and operated by the US Federal Reserve banks.

Clearing House Interbank Payment System (CHIPS). A privately owned online system used to settle foreign exchange spot transactions. Spot transactions usually settle within two business days.

Compression and Reconciliation Service

In addition to post-trade processing, derivatives management involves services such as portfolio compression and reconciliation, explained in the following sections.

Portfolio Compression

Portfolio compression (or simply *compression*) is a risk-reduction practice in which OTC dealers with substantial opposite (two-way or pay-and-receive) positions terminate offsetting contracts before they actually expire.

Portfolio compression reduces the overall notional size and number of outstanding contracts in a portfolio without changing the overall risk profile or present value of the portfolio. This is done through periodically terminating existing trades and replacing them with a smaller number of new trades that carry the same risk profile and cash flow as the initial portfolio, but that require a smaller amount of regulatory capital to be held against the position.

The benefits of compression include reductions in counterparty credit exposure and reductions in operational risk and cost, as well as lower legal and administrative expenses in the event of a default of any participating dealer.

Portfolio Reconciliation

Portfolio reconciliation is the process of reconciling the positions between organizations, so helping to minimize the operating risk of undiscovered discrepancies between counterparties and other sources. Frequent reconciliation processes help organizations in maintaining accurate transaction information and reducing operational risk.

Reconciliation service providers allow market participants to load contracts onto their platforms. They then reconcile positions by comparing details from different parties. The reconciliation results are then sent to clients.

Portfolio reconciliation helps the collateral management function by reducing collateral mismatches. The reconciliation process allows firms to detect and remove any discrepancies at the trade level.

The following sections describe some of the popular service providers.

TriOptima

TriOptima is an independent firm that provides services in OTC market as detailed below.

triResolve. A portfolio reconciliation, margining, and dispute prevention and resolution system, which provide the following services:

- *Proactive Portfolio Reconciliation* is a multilateral portfolio reconciliation service available for a variety of OTC instruments. TriOptima collects contract information from dealers and puts it in a central database. It then checks matching contracts from counterparties (legal entity level) with identical terms. This service provides key performance reports to clients.
- *Margin Call Management* follows ISDA's standard Credit Support Annex (CSA) in order to calculate and administer a margining process. Using triResolve, its clients can issue, accept, and dispute margin calls.

triReduce. A multilateral portfolio compression service. Using this service, trades can be terminated simultaneously across a number of counterparties (also known as a *tear-up* or *multilateral termination*). This reduces the number of outstanding trades, reduces overall notional size, and helps efficiently manage the counterparty exposure and capital.

triBalance. A post-trade risk management service that provides tools to manage portfolio risk proactively. It allows clients to simultaneously manage bilateral and CCP exposures. It also helps clients to allocate capital and collateral more efficiently.

Creditex

Creditex is an inter-dealer broker that provides portfolio compression services for credit derivatives in addition to other services such as execution. As explained in the "Portfolio Compression" section, the compression process reduces the overall risk in the derivative marketplace, especially among broker-dealers who hold relatively large portfolios.

Application Service Providers

Application service provider (ASP) firms provide all tools and technologies needed for clients to perform their business activities. ASP provides processing capability, connectivity, and other services, eliminating the need of owning and administering systems. This, in turn, provides cost benefits and mitigates operational risks that arise from performing those tasks in-house.

ASPs cover most services required by today's market participants. APSs tend to be the experts in the areas they serve.

Typically, ASP services are ideal for small to midsize asset management firms. However, even large firms outsource certain complicated tasks to professional firms due to the complexity involved in performing those tasks internally.

ASP services are also known as *hosted services* or *managed services*. In the derivatives industry, ASPs provide all or some of the following services:

- contract lifecycle management
- risk assessment and pricing services
- settlement and reconciliation services
- collateral management
- fund administration
- accounting and taxation services
- middle- and back-office processing (allocations, confirmations, valuations, settlements, and payment processing)
- connectivity to institutions involved in trade processing such as DTCC and MarkitServ
- regulatory compliance and reporting
- pricing and valuation

Regulatory Agencies and Market Associations

Various agencies monitor and regulate derivative markets around the world. Basically there are three types of agencies:

Government agencies. Formed by and given the authority to monitor and control the market through laws and regulations. Table 5-3 lists some of the major agencies around the world.

Table 5-3. Sample of Regulatory Agencies and Market Associations from around the World

Name	Country/Region
Commodity Futures Trading Commission (CFTC)	US
Securities and Exchange Commission (SEC)	US
National Futures Association (NFA)	US
Financial Industry Regulatory Authority (FIRA)	US
Investment Dealers Association (IDA)	Canada
Financial Services Authority (FSA)	Europe
Bundes Bank and German Financial Supervisory	Europe
Committee of European Securities Regulators	Europe
European Securities and Markets Authority (ESMA)	Europe
Monitory Authority of Singapore	Singapore
Dubai Financial Services Authority	Dubai
International Swap Dealers Association (ISDA)	International
Swaps and Derivatives Market Association (SDMA)—Financial Markets Trade Group	US
International Organization of Securities Commissions (IOSC)	Emerging Markets

Self-regulatory agencies. Nongovernmental and market participant driven agencies that control members through self-governance (in addition to government regulations). For example, all exchanges are SROs.

Market associations. Associations formed by market participants to share and introduce guidelines to operate businesses. They also work as intermediaries between market participants and regulatory agencies. Examples include ISDA and NFA (see Table 5-3).

Market regulations are enforced at different levels by various institutions starting from broker to governmental agency. Every client is responsible for having its own surveillance department (audit). Next, the broker is responsible for monitoring its clients' activity in varying aspects. Although the broker, exchange, and clearinghouses enforce their own rules, there are also industry regulations to contend with. Self-regulatory agencies and governmental agencies introduce and enforce laws and regulations of their own as well. They are involved in issuing licenses and performing overall market surveillance.

Each of the organizations in Table 5-3 promulgates the rules within its authority for the market participants to follow. For instance, the following links point to rule books of the popular US agencies:

NFA Manual: `www.nfa.futures.org/nfamanual/indexNFAManual.aspx`

FINRA Rules: `www.finra.org/Industry/Regulation/FINRARules/`

CME Rulebook: `www.cmegroup.com/rulebook/CME/`

Note Many derivative players may carry the term *futures* in their titles even though they support all types of derivatives product classes. Futures are the oldest derivatives and originated derivative markets, accounting for the retention of the term in most titles. Similarly, although NFA and CFTC cover all derivatives in the United States, their names retain *futures* term.

Cross-Border Trading

Since the derivatives market is global, it is common for financial institutions to spread their services across the world by serving clients from different regions. Although legal structures may differ from place to place according to local laws, the overall business structure remains simple. Figure 5-9 shows the structure whereby local and foreign institutions are linked and serve clients globally.

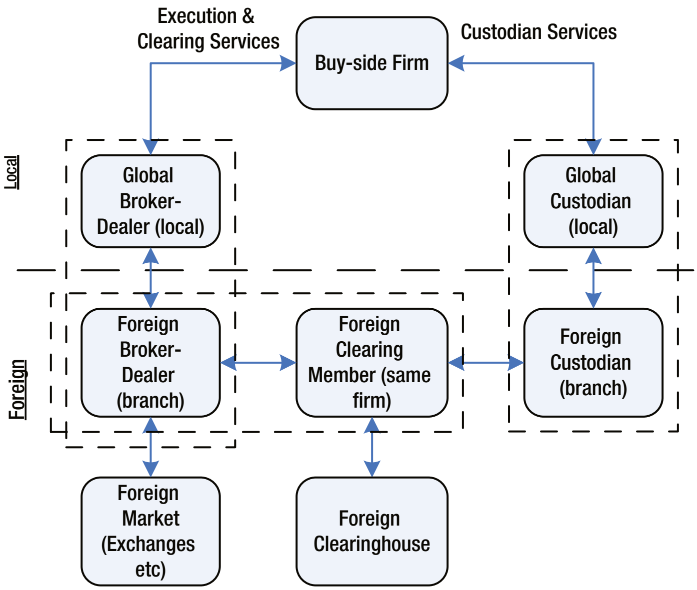

Figure 5-9. Cross-border trading

Summary

This chapter presented the cast of derivatives market players and their roles in the functioning of the derivatives market. A clear understanding of each player is critical to successfully managing derivatives contracts. Over the life of a contract, many players are involved directly or indirectly.

Buy-side firms (buyers or consumers) and sell-side firms create the market; exchanges, CCPs, and other players support this market and enable it to operate successfully. In addition to these players who are parties to contracts, regulators are players that monitor and control market activities.

This chapter detailed the general roles and responsibilities of each of the various players. Fine points vary with each specific player. Moreover, exchanges and CCPs are under constant pressure to introduce innovative features to their business models to gain a competitive advantage.

Recent changes in OTC markets have reshaped the derivatives market as a whole. As a result, derivative exchanges, CCPs, and broker-dealers are obliged to align business strategies and revamp their range of services.

The next two chapters explore in greater depth and detail the structure and functioning of two major market players: namely, the buy-side and sell-side firms.

CHAPTER

6

The Buy-Side Organization

The previous chapter provided an overview of the various players involved in derivatives markets and their respective roles. It focused particularly on two major types of players: buy-side and sell-side firms. To understand the derivatives market, it is critical to understand the structure and operations of these two types of organizations. This chapter analyzes the organizational structure of buy-side firms in respect of derivative-related activities. Buy-side organizations are the consumers of financial products, including derivatives. Chapter 7 performs a similar analysis of sell-side firms.

Because most operations are essentially the same across the industry, firms share a similar organizational structure logically based on the successive phases of the contract lifecycle from beginning to end, whereby organizations are structured into multiple departments each performing certain specific activities.

Chapter 6 mirrors the organizational structure of buy-side organizations. It starts by considering the departments where perceived needs for derivative contracts originate. The chapter proceeds through the three logical organization units – front office, middle office and back office—with particular emphasis on the risk management functions of the middle office. Finally, it discusses how a buy-side firms structure their global operations.

The objectives of this chapter are to

- present the different types of buy-side firms that participate in the derivatives market
- explain the logical organization structure of an investment unit of a buy-side firm

- discuss the role of various departments—portfolio management group, front office, middle office, back office, risk management, compliance and legal departments
- discuss how a global buy-side firm is structured

Classification of Buy-Side Firms

Buy-side firms include nonfinancial institutions—such as major corporations—and financial institutions—such as asset managers, banks, loan portfolio managers, hedge funds, and insurance firms. This classification is based on their core business activity.

However, buy-side firms are also classified from other dimensions such as regulatory requirements. Although the derivatives market is open, governments around the world control how public firms can use derivatives. This has been triggered due to dangers of derivatives and many debacles that led to the failures of some major corporations (see Chapter 1). Based on regulatory framework, buy-side firms fall into one of these two categories:

Regulated or hedge-only firms. These firms can use derivative contacts only to hedge their asset portfolios or to hedge the risks that arise from their core business activities. For example, certain types of firms (such as insurance companies) can use derivatives only according to the guidelines of industry regulators.

Unregulated firms. These firms can use derivatives for both hedging and profit-making (speculation). For instance, hedge funds are free to use almost any type of derivative.

Furthermore, under Dodd-Frank, all OTC market participants are divided into three major categories:

OTC derivative dealers. Primarily financial institutions acting as dealers in OTC markets.

Financial entities. All financial entities other than OTC derivative dealers.

Nonfinancial entities. Commercial entities other than those mentioned in two previous categories, performing some kind of business that uses OTC derivatives to mitigate risk from their business activity.

A buy-side category includes both the financial and nonfinancial entities mentioned above. All rules are defined and applicable based on the type of the organization. Essentially, this classification forces institutions to use only cleared contracts (in OTC markets) unless authorized by the regulators. Even if a particular institution is allowed to use non-cleared contracts, it is obligated to certain reporting requirements. In addition, Dodd-Frank adds that firms must be eligible to use cleared swaps (see Chapter 9). These participants are known as *eligible swap participants* (ESPs). In general, ESPs include the following:

- banks and investment companies subject to regulation under the Investment Company Act of 1940 (buy-side)
- commodity pools and broker-dealers subject to regulation under the Securities Exchange Act (buy-side and sell-side)
- *Futures Commission Merchants* (FCMs) subject to regulation under the Commodity Exchange Act (sell-side)
- corporations with assets exceeding $10 billion (buy-side)
- institutions such as hedge funds and private funds that are allowed to participate in almost any type of transaction

Organization Structure

This section briefly explains the logic of organization structure from the perspective of investment activities. It is not, however, the overall organization structure of a typical corporation. Also note that this structure is applicable to firms that perform core operations in-house. Other firms involved in derivatives outsource most operations to professional service organizations that are explained in Chapter 5.

Core activities related to derivatives trading of a buy-side firm include the following:

Trade management. Trading and post-trade processing.

Position management. Contracts life-cycle management.

Risk management. Risk analysis and management.

Delivery and settlement management. Processing of settlements.

Collateral management. Processing margin and collateral.

Figure 6-1 shows the overall functional units of a typical buy-side firm.

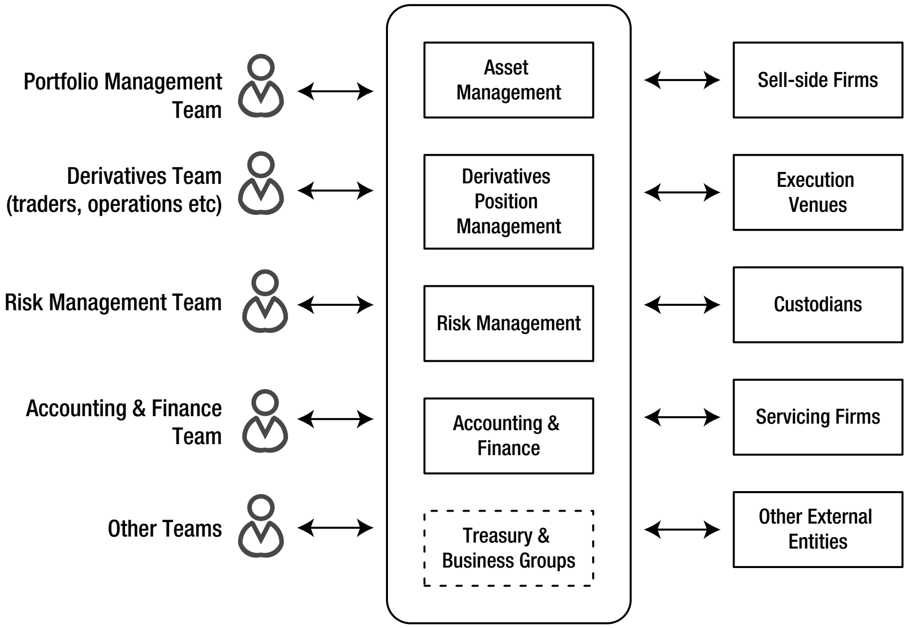

Figure 6-1. Buy-side organization units

Investment division (or trading department) is logically divided into three major groups known as the *front office*, *middle office*, and *back office*. Overall, the key departments are the following:

- portfolio or investment management group
- front office (trading activities)
- middle office (operations, risk management, and other)
- back office (accounting and finance)
- information technology (investment technology systems and services)
- other departments related to core business activity

Figure 6-2 shows logical division along with the portfolio management group.

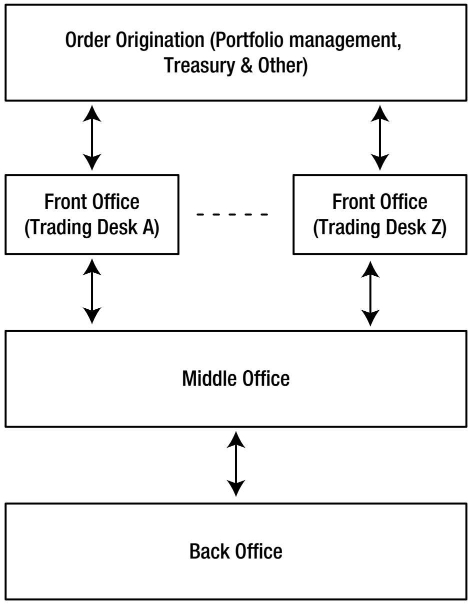

Figure 6-2. Logical units of an investment group

Chapter 4 briefly explained the contract life cycle and what actually happens in each of these departments. Figure 6-3 (repeated from Chapter 4 for the reader's convenience) shows the role of each department in terms of the contract lifecycle management. The following sections delve into the details.

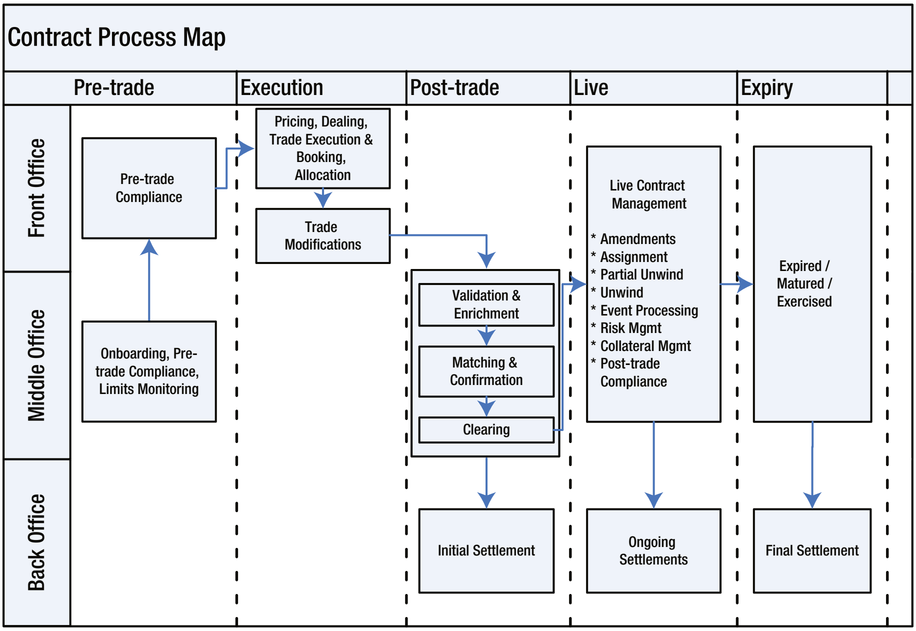

Figure 6-3. Contract workflow and organization units

Order Origination Groups

After the need for the derivatives contract is identified or the decision is made by a business to enter into a derivatives contract, the request known as an *order* typically goes through a formal analysis and subsequent approval process. The overall process, known as *order management*, varies by the organization's regulatory requirements and internal controls that are in place. In general, during this process, orders are validated from a compliance, hedging, and documentation perspective.

Portfolio Management Group

The *portfolio management group* is also known as the *investment management group* or *asset management group*. A *financial portfolio* is a collection of various types of assets including securities and derivatives. Portfolios are constructed in various ways with different objectives and supporting strategies.

An investment management group is typically formed with portfolio managers, analysts, and others. The core responsibilities of an investment management group include the following:

- establishment of investment objectives and policies
- development of investment strategy
- construction of a portfolio
- evaluation of the performance of portfolio regularly
- research and analysis

As a result, in addition to investing in assets, the investment management group makes the decision to add derivative contracts or to amend current live contracts in order to manage risks or improve the performance of the portfolio.

Corporate Treasury

Corporate treasuries are another type of a user of derivatives. They use derivative contracts to manage risks from their business activities as well as to address the needs of capital allocation and asset liability management.

Treasuries typically employ financial risk managers who develop risk management strategies, including the use of derivatives.

Unregulated Firms

In unregulated firms such as hedge funds, portfolio management teams typically make decisions. They may have fewer procedures and controls in place, unlike professional institutional investors.

Note Asset allocation is the process of distributing funds among different asset classes as part of the investment strategy. Asset allocation is driven by overall investment strategy; by regulatory, accounting, and taxation issues; and by client-specific constraints, if any.

Alternative asset classes are nontraditional investments other than simple stocks or mutual funds. Some are hedge funds, private equity, and venture capital and managed futures.

Front Office

Front office is a well-known term in financial markets. The most action happens in the front office. However, a derivatives front office is not as noisy as a securities front office. Front offices face the outside world and serve the firm's trading needs—hence, the name. A front office is made up of traders, trader assistants, and analysts supporting trading activities. The front office is also known as the *trading desk*. Typical functions of a derivatives front office include, but are not limited to the following:

Pre-trade analysis. Pricing, structuring, research and compliance.

Trading. Executing trades with counterparties or at execution venues.

Valuing live contracts. Computing the value of live contracts regularly.

Position keeping. Perform operations such as amend, offset, scenario analysis, and stress testing

Intra-day risk monitoring. Performing risk analysis during trading day.

The key objective of any trader is to get the best execution. Traders typically evaluate available venues and choose the best-suited venue or counterparty to execute the trade. Based on liquidity and complexity, a trader may perform complex pricing and market analysis before executing the trade. Most traders in the derivatives market specialize in a specific product class such as interest rate, credit, and currency derivatives. The front office maintains different desks based on these categories. Each desk contains a team of trading professionals and is called by its appropriate descriptor such as the *rates desk* for interest rate product trading, the *credit desk* for credit products trading, and the *currency desk* for FX derivatives trading.

Middle Office

The *middle office* covers a broad area comprehending multiple business functions such as operations, risk management, analytics, reporting, collateral management, and most other functions that are not part of the front office and back office. In practice, risk management and compliance are typically treated as separate groups due to their level of importance. They are discussed separately in the following sections. Middle-office responsibilities include, but are not limited to, the following:

Post-trade processing. Trade validation, matching, confirmation, clearing, and contract documentation.

Compliance. Pre-trade and post-trade compliance.

Market data management. Market data validation and maintenance and interest rate fixing.

Reference data management. Maintenance of reference data such as counterparty information, ratings, and security identifiers.

Risk management. Generates various risk reports for market risk and credit risk.

Limits management. Trading and exposure limits monitoring and enforcing controls.

Event processing. Process events such as corporate events and credit events.

Collateral and margin management. Activities such as processing margin calls, collateral exchange, reconciliation, and dispute resolution.

Portfolio analysis. Daily marked-to-market of positions and computation of official profit and loss.

Reporting. Generate reports such as daily trading activity, profit, loss, and risk reports.

Note Derivative Book or D-Book is the report showing the firm's derivative investments and the hedge effectiveness of each contract.

Back Office

In the derivatives world, the key responsibility of the *back office* is to process all cash and non-cash settlements generated from all derivative transactions. As discussed earlier, during the term of contract, derivatives result in various transactions including fee, margin/collateral, and periodic obligation settlement. All transaction entries are generated on a daily basis for the immediate and near future (as much as 30 days, in some cases). The back office validates these transaction entries before they are processed. All processed settlement entries are sent to the treasury and accounting department for the release of funds or assets and for bookkeeping. The key functions of back office include the following:

Trade validation. Validation of new trades from a financial perspective such as cash flow, fees, and other financial details during trade processing (before the contract goes live).

Settlements. Cash-flow validation and processing settlements (cash and securities).

Reconciliation. Resolve mismatched entries (breaks) of settlements and general ledger entries.

Reporting. Reconciliation reports, cash-flow projections, derivative activities, and other reports.

Investment accounting. Accounting of all transactions according to standards.

Cash management. Managing the cash flows.

Risk Management

Chapter 3 introduced risk management concepts. Typically, risk management is done at multiple levels and finally reports to a corporate level risk management department known as *corporate risk management* or *enterprise risk management*. While each business unit is responsible for managing its own risk, the corporate risk management sets up policies and oversees the risk management activities across all business departments. The key responsibilities of corporate risk management include

- setting up risk management policies
- researching and analyzing business risks
- monitoring the business risk
- providing reports to corporate boards and senior management
- providing training and required resources to individual departments

In the case of an institutional investor or a large investment division, the main business activity is investment management. Risk management activity, however, is the critical process. A dedicated department oversees the risk management of investments. This department is usually referred to as *investment risk management* or just the *risk management department*. It is considered a part of the middle office. The role of this department is to manage the risk arising from the assets the firm owns and the derivatives themselves.

The risk management group's key responsibilities include developing risk management strategies, monitoring, and advising investment management groups. The practice of using derivatives for risk management is sometimes referred to as *derivative trading programs* or *derivatives use plan*. The risk management group is responsible for defining and monitoring these derivative trading programs.

The derivatives program typically outlines the trading limits, type of instruments allowed, accounting, tax descriptions, and the purpose of the trade. Periodically, these programs are evaluated to ensure the effectiveness of the hedging. Over the period of the programs, due to change in the value of asset and/or derivatives contract, there may be an impact on the hedge. The valuation will expose any such changes.

In summary, the overall responsibilities of the risk management department include, but are not limited to, the following:

- developing risk management policies
- producing risk analytics, exposure calculations, and performs stress tests
- researching and analyzing risks such as market and credit risk
- setting up and overseeing investment compliance
- generating reports for senior management

Collateral Management

Collateral management is the most critical part of credit risk management. Most institutional investors run different groups to manage the collateral process. Logically, collateral management falls under middle-office responsibility, but some consider it a back-office function. Regardless of how it is structured, collateral management includes the following key activities:

- managing the inventory of eligible collateral including cash and securities
- evaluating positions to assess the current exposures
- processing margin calls
- reconciling margin calls with internal assessments
- reconciling collateral movements
- optimizing the use of collateral
- managing the risk arise from collateral such as concentration limits

Collateral management is discussed at length in Chapter 11.

Legal and Compliance

The purpose of the *legal and compliance department* is to provide oversight of investment and noninvestment activities within the firm while guaranteeing compliance with internal and regulatory requirements. Duties of the Legal and Compliance Department may vary based on the size of the firm and whether it is regulated or unregulated.

The key responsibilities of the legal and compliance department are the following:

> **Legal document management.** Reviewing and executing legal agreements between the firm and counterparties, dealers, service firms, and all other entities dealt with by the firm.
>
> **Compliance controls.** Develop and implement better monitoring, compliance, and control policies to satisfy corporate goals as well as regulatory needs.
>
> **Auditing.** Monitor and audit operations across the board, from the deal capture through the settlement and communication, in order to meet corporate as well as regulatory compliance.
>
> **Reporting.** Compliance and regulatory reporting to senior management and regulatory authorities.

Finance and Accounting

The *finance and accounting department* takes responsibility for performing the financial and accounting activities. The main responsibilities of this department include the following:

> **Bookkeeping.** Track all transactions of purchases, sales, and capital spending. These transactions are known as *ledger entries* in accounting terms. *Ledger* refers to an accounting book.
>
> **Reporting.** Generate financial reports such as the balance sheet, income statement, cash flow, and other management reports.
>
> **Management accounting.** Includes budgeting, performance evaluation, cost management, and asset management.
>
> **Compliance**. Complying with all accounting regulatory requirement such as IFRS.
>
> **Capital Allocation.** Addressing the capital needs of the firm.

All derivative cash flows are sent to the finance department after final approval. The finance and accounting department provides taxation, accounting, budgeting, and other services to the firm.

Information Technology Group

As we discussed in Chapter 1, derivative transactions are highly dependent upon IT systems. The IT group plays a major role in serving all departments of a corporation. IT key responsibilities include the following:

- defining the firm's IT platform strategy
- implementing systems to serve different functions of the business
- running, monitoring, and supporting all IT systems and infrastructure

Multibranch or Global Organization

There are many large buy-side firms with branches around the world. These firms have head offices located in one country. Each branch complies with the legal and regulatory system of the country they are located in while they report to their head office. Figure 6-4 shows how these organizations generally structure their derivative and/or investment management operations.

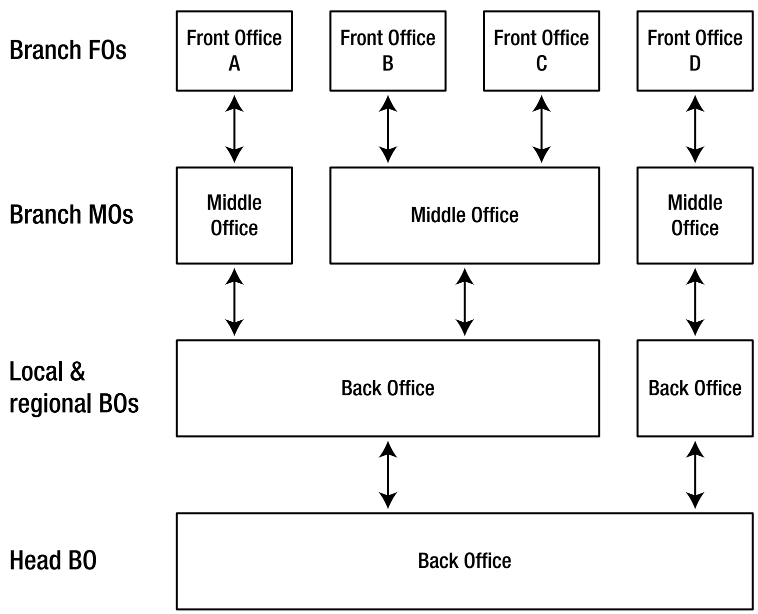

Figure 6-4. Organization structure of a global firm

Each branch typically operates its own front office serving the trading needs of the local market. Note that there may be certain front-office desks reporting to a single middle office, while all middle offices report to a central back office. In small branches, there might be only a front office, and a common middle office handles processing. Typically, the back office is a single, large organization processing transaction from all branches. However, certain back-office operations could split into multiple subdepartments and feed into a central head office. A front-office and back-office department from different branches may work together in certain transactions.

Small-Scale Buy-Side Firms

Most small-scale buy-side firms use hosted solutions or prime-broker services. Previous chapters explained how hosted services and prime-brokers operate (see Chapter 5). These firms rely on outside entities to serve their business for all infrastructure needs and other services. They primarily focus on their core business and investment management processes.

Summary

This chapter covered the structure of a typical buy-side institution. A contract request typically originates in portfolio management or a treasury department. A derivatives order is sent to the front office for execution. The front office executes the trade and pushes forward for post-trade processing. The middle office is responsible for this post-trade processing. In addition, the middle office also performs functions such as risk management and collateral management throughout the term of the contract. The back office is responsible for processing all deliverables such as cash, securities, and underlying assets resulting from derivative transactions.

Note that the logical structure is more for the purpose of understanding how derivatives business runs in a typical buy-side firm. In practice, each of these logical units is formed by multiple departments. In the next chapter, we will cover the organizational structure and operations of a sell-side firm—another key player in the derivative market.

CHAPTER

7

The Sell-Side Organization

Sell-side firms play a central role in financial markets, providing a variety of services and continually adapting to the changing demands of markets. Sell-side firms are large and complex. The focus in this chapter is on trading activities of sell-side firms that are especially related to derivatives.

The listed market is well developed with large volumes traded. In a listed market, end-to-end processes are automated. The sell-side typically provides execution and clearing services. In OTC markets, sell-side firms make up the foundation of market. In most OTC transactions, sell-side is one of the counterparties. In addition, sell-sides continually structure and innovate new forms of derivative contracts. The interdealer (dealer-to-dealer) market is a large part of the OTC market in which it is critical to remove or reduce risks. It is helpful to understand the overall structure of the sell-side organization.

Although derivatives trade processing and life-cycle management at a sell-side is fundamentally similar to a buy-side, the functional role, flow of transaction processing, risk management, and other aspects differ. This chapter will highlight some of these differences and how overall sell-side derivatives organization functions. This chapter will also outline the organization structure and activity in order to provide a clear perspective. Like buy-side firms, sell-side firms are divided into three logical segments—the front, middle, and back office. The respective functions of each of these segments are explained briefly. In practice, sell-side organization is made up of many small divisions delivering various services to external clients as well as internal business units.

This chapter ends with a look at information technology, global organization, and small-scale sell-side firms.

The objectives of this chapter are to

- explain the organization structure of the sell-side firm from the derivatives business perspective
- discuss the roles of the front office, middle office, back office, and other functional units
- discuss the front office sales department and client relationship management
- explore the function of research, product innovation, and marketing
- list some well-known brokerage firms in various regions

Sell-Side Organization

The sell-side firm is made up of many different business units providing various types of services to buy-side firms. Based on the size of the firm, the array of services varies from single simple services to specialized packages of services.

Chapter 5 described the various roles of a sell-side. This chapter focuses on organization structure. To review, the major roles of sell-sides include the following:

Execution broker. Trade execution services in listed and OTC markets.

Market-maker. Execute trades as a market-maker or a designated market-maker.

Clearing broker. Provide clearing and settlement services as a member of a clearinghouse

Prime broker. Provide full service to the private investment firms, such as hedge funds.

Local and global custodian. Provide custody services in local and global markets.

Securities lending and borrowing. Lend and borrow securities to serve client needs.

Fund administration. Provide full fund administration services to buy-side firms of all sizes.

Middle office outsourcing. Provide operational services allowing buy-sides to outsource various life-cycle operations such as post-trade processing, profit and loss calculations, and other reporting services

Proprietary trading. Trade and manage portfolios for profit making.

Collateral management services. Allow buy-side to outsource the collateral management process.

Portfolio valuation services. Provide reliable valuation services to firms such as hedge funds and other asset managers.

Other services including corporate finance, mergers and acquisitions, and securitization.

The sell-side firm's revenues come from various business activities such as trade execution commissions, spreads from market-making, fees from clearing services, fees from underwriting, and profits from proprietary trading. Most sell-side firms also focus on retail investors through wealth management and investment advisory services, which are beyond the scope of this book.

As mentioned earlier, sell-side firms are also known by diverse terms such as *investment bank*, *commercial bank*, *dealer*, *broker-dealer*, and *financial services firm*.

Conspicuous examples of sell-side firms include the following:

- BNP Paribas (France)
- BNY Mellon (US)
- Citigroup (US)
- Crédit Lyonnais (France, Britain)
- Crédit Suisse (Switzerland)
- Deutsche Bank (Germany)
- Goldman Sachs (US)
- HSBC Bank (UK)
- JPMorgan Chase (US)
- Morgan Stanley (US)
- Royal Bank of Scotland (UK)
- Société Générale (France)
- Swiss Bank Corporation (Switzerland)
- UBS (Switzerland)

The sell-side organization structure is usefully approached by dividing the trading organization into three major logical functional units: front office, middle office, and back office. The focus in this chapter is to review these three units' functions specifically in respect of derivative operations and processing rather than of the entire sell-side organization. The following list shows the various functional groups, each of which is discussed in turn in following sections:

- Front office
    - Sales traders
    - Trading desks
    - Research or quantitative analysis
- Middle office
    - Risk management
    - Collateral management and margining
    - Trade processing and operations
- Back office
    - Finance and accounting
    - Compliance and legal
- Information technology

Figure 7-1 illustrates the organization structure and the external entities with which a sell-side interacts.

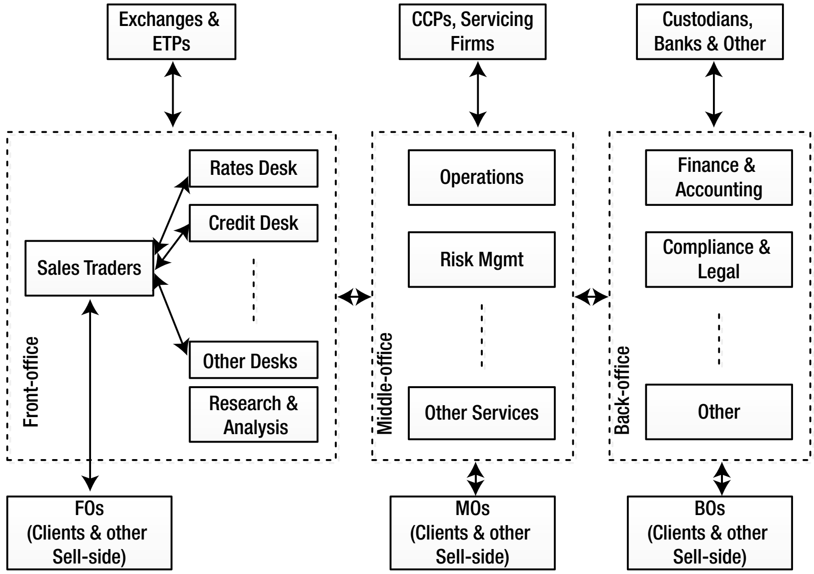

Figure 7-1. The sell-side organization

Note An *interdealer broker* (IDB) acts as a middleman between dealers. IDBs are also known as a *broker's broker.* This term is commonly used in corporate debt markets. An *interdealer market* represents transactions among dealers.

In certain situations, a broker can match and execute orders from two of its clients. This is known as *broker crossing*.

Front Office

The front office is responsible for executing orders received from clients and internal business units. The front office provides services to a broad range of clients including institutional investors, corporations, and affluent individuals. Most sell-side firms have a global footprint supporting most of the derivative classes such as credit, rates, and equity derivatives in all global markets.

The key focus of the front office is to maximize profits while minimizing risk and providing the best services to clients. Because derivatives are risky and complex products, the front office pays particular attention to risk management. In addition to executing client orders, the front office also caters to other needs of their clients, such as investment and hedging, in order to serve client needs and win new business to the firm.

Front office staff includes *sale traders, traders, research analysts,* and *support staff*. The functions of the front office can broadly be divided into three major sections: *sales, trading*, and *research*, which the following sections discuss in turn.

Sales and Client Relationship

The sales department interfaces with clients directly and develops and manages the client relationship. It is primarily responsible for attracting new clients, maintaining existing client relationships, determining what products meet clients' needs, and providing services by client request. Typically, the front office employs a large number of sales professionals with extensive derivatives market experience within the trading community. Sometimes this sales group is also known as *introducing brokers*. The sales team connects clients to the specialized derivatives desk, which is transparent to the client. For instance, rates from one trader from a buy-side may have a direct relationship with a rates trader of a sell-side.

In a traditional environment, the sales department receives client orders and then routes these orders to the appropriate trading desk. Typical responsibilities of the sales team include the following:

- Receiving orders from clients
- Splitting orders and routing to desks
- Communicating executions back to the clients
- Processing allocations
- Managing the client relationship
- Studying client needs, introducing or suggesting products, and generating new business

Trading Desks

Derivative traders work with non-derivative traders and sales teams in serving demands of clients. For instance, a sales team may work with one or several traders (desks) to serve the specific needs of a client. The fiduciary responsibility of a trader is to get the best execution for the client—that is, the execution that most closely matches the client's instructions.

At a sell-side, trading activities are typically separated into product classes and markets. Each trading unit is called a *desk*. The most common desks in derivatives are the following:

- Listed Products Desk
- Equity Derivatives Desk
- Rates Desk
- Credit Derivatives Desk
- FX Desk
- Commodities Desk

The number and organization of desks in a given firm vary with the firm's size, trading volume, and market demand.

Research and Analysis

It is critical for sell-side firms to stay on top of the market in order to provide the best possible advisory services to their clients as well as to inform their own proprietary trading and risk management. The sell-side firm employs expert analysts for research activities in various areas of the market.

In derivatives, research involves the areas such as study of market news, events and trends, study of client business needs, documentation of derivatives product structure, risks and mechanics, development of new products, and development of valuation and risk models. In addition, sell-side analysts publish their views on different aspects of the market such as interest rates, volatility, and commodity prices.

Research teams are also known as *quantitative analysts* or *analysts*, *strategy teams,* or *planning teams*.

Note A trading division is also known by several names such as *dealing room, trading floor, floor, trading desk,* or simply *front office*.

To comply with regulations that are intended to control the abuse of information and market manipulations, sell-side firms separate the trading floors and certain research teams. This separation is known as a *Chinese wall*.

Middle Office

The *middle office* is a broad conceptual division of the organization containing a multiplicity of functional units. Most operation groups fall within the middle office. In a sell-side, the middle office has to process client transactions on one side, and on the other side it has to process the transactions of exchanges, clearinghouses, and external service providers such as affirmation platforms. In addition, sell-side firms have to operate their own servicing platforms such as collateral management and other business lines. Typically, each business function operates as a quasi-independent unit.

The following are the core functions of middle office groups:

Post-trade processing and life-cycle management. Process trades after execution such as allocation, confirmation, and clearing.

Reporting. Report profit, loss, trading activities, and so on.

Documentation. Obtain all signed contracts and other legal documents from clients for all derivative transactions.

Risk management. Manage different risk types such as market risk, credit risk, and risk reporting.

Data management. Manage data such as transaction data, market data, reference data, and fixings.

Portfolio reconciliation and break resolutions. Match transactions with counterparties and resolve differences.

Collateral and margin management. Manage client accounts and the firm's account with clearinghouses.

Back Office

The *back office* of the sell-side has a similar role to that of the buy-side, but it deals with a much larger number of clients and clearinghouses. The back office of a sell-side is accordingly much larger and more global. The back office settles a large number of transactions in local and global markets. Because a sell-side involves many other types of services, the back office also deals with transactions generated from various other services.

A back office is a conceptual division and comprised of many processing units of the firm. Most transaction processing units that are not part of a middle office are typically considered as part of the back office.

The key responsibilities of back office groups are the following:

Settlement and accounting of all transactions from clients as well as clearinghouses

Settlement reconciliation

Portfolio valuation

Securities administration

Corporate actions monitoring and processing

Custody services

Reporting profit and loss and other financial reporting

Risk Management

Sell-side risk management is a complex undertaking. One reason for this is that a sell-side takes the risk that a buy-side is trying to remove. The strength and profitability of the sell-side is largely dependent upon the risk management strategies they employ. Each sell-side adopts its own risk management strategy (see Chapter 3).

In response to the pressure to increase profitability, some of the sell-side traders tend to take excessive risk. The acceptable limits of each firm and desk are set by risk management. It is the risk manager's responsibility to keep track of risk limits at different levels such as trader, desk, and division. In addition, risk is measured by risk type, duration, trader, desk, and other dimensions.

Risk measure and control activities are spread across the firm from the front office to the back office and at the enterprise level. Most groups take part in risk management at different levels—desk, division, and enterprise.

A global sell-side firm faces many different types of risks. Analyzing and controlling these risks requires advanced skill and continuous effort. Sell-sides employ critical resources for risk management. They hire the smartest of the crowd to work on their risk management teams. Team members are mostly mathematicians and financial engineers with an in-depth understanding of financial products. They continually develop and introduce new strategies and models to better manage the firm's risk. It is not uncommon, however, that sell-side firms fail to recognize and manage certain risks, and they may eventually face large losses or even collapse.

While each trader and desk monitor their risk periodically during and at the end of trading day, the firmwide risk division (enterprise risk management) is responsible for assessing, monitoring, and controlling the level of risk being taken by all business lines across all products. The risk management group acts as an independent oversight group and periodically quantifies risk taken by the business. Various risk measures are computed from different dimensions. The risk management team directly reports its observations and numbers to senior management. To ensure maximum transparency of trading activity and optimal firm-level controls, the risk management group is kept separate from the trading division, and the risk managers who work on the trading floor do not report to trading floor managers. In addition, the compensation of the risk management group is tied not to trading profits but to the overall performance of the firm.

As well as setting firmwide risk management strategies, the risk team helps in developing and analyzing new products and research.

Legal, Compliance, and Controller

In practice, legal, compliance, and controller are independent departments. Sometimes they are counted in the back office rather than the middle office. In their case, the difference in classification is nugatory.

Compliance

As the name implies, the responsibility of the compliance department is to ensure that the day-to-day activities and overall business practices comply with the relevant laws, exchange regulations, and industry best practice standards. The department's responsibility starts with training—in other words, ensuring all employees are sufficiently knowledgeable about rules and regulations, and that they are licensed when required in order to perform their job.

The next key responsibility is to monitor and control business activities and internal procedures in order to adhere to the set standards.

Sell-side firms are subject to exchange, clearinghouses, market association, and governmental rules and regulations. Failure to comply with any one of these may lead to fines, sanctions, or a loss of license to operate their business.

The compliance at the trading level includes the monitoring and control of assigned limits of notional and different risk measures, trading practices, and adherence to predefined strategies.

Legal

The legal department provides such legal services as interpreting laws and court rulings that help define the firm's governing policies and business practices.

Controller

Controllers are the independent bodies of the firm that check financial reports (P&L, accounting, and so on) for accuracy and consistency. Essentially, they cross-check all final numbers computed by the corresponding teams. They basically provide independent oversight into economics and help firms to avoid any intentional or unintentional mistakes or manipulations performed by business teams.

Information Technology

Sell-sides are involved in a variety of services in financial markets. Sell-side business operations are highly dependent on IT. These business activities require efficient and innovative systems. Innovative IT systems help a sell-side to stay competitive and provide state-of-the-art services to the market participants.

There are many IT departments comprised of sell-side IT organizations. Some of the key IT departments related to the derivative area are the following:

- Front-office derivative trading systems (typically multiple systems serving different trading desks)
- Dealer's proprietary trading platforms
- Post-trade processing systems
- Derivative life-cycle management systems, also known as *portfolio management systems*

- Collateral and margin management systems
- Derivatives accounting systems
- Derivatives exchange, connectivity systems, and others

The various systems involved in derivatives management are detailed in Chapter 18.

Global Organization

Most large sell-side firms are global. Due to local laws and regulations, each domestic branch of a firm legally operates as an independent entity. In the case of global transactions, however, business activities are shared among these entities. They allow access to foreign markets via their counterparts in different countries for their local clients. Global sell-side firms are typically known as *international banks*. An illustrative operational structure in a global setup is depicted in Figure 5-9.

Boutique Sell-Side

The sell-side firms that are small and specialized in specific areas are referred to as *boutique sell-side firms*. Most boutique firms specialize in specific areas such as rare asset classes or specific research services.

Summary

This chapter outlined the three essential units into which a sell-side organization is divided and described the key activities of each unit. While the front office interacts with clients and pursues business opportunities, the middle and back office units process transactions and enable the functioning of the overall organization.

Even though they are profit-driven, sell-sides cannot afford to neglect the establishment of and adherence to thorough risk management policies. As risk traders, sell-side firms accept the risk from clients. Sell-side firms may trade this risk with each other in order to reduce or eliminate the risk. In addition, sell-side firms employ various risk management strategies in an effort to escape risk altogether.

Another key challenge is operational risk. Sell-side firms employ internal policies and procedures to monitor and control operational risk across the board. A dedicated division under enterprise risk management is generally responsible for operational risk management.

Besides derivatives, sell-side firms provide key services in capital markets such as investment banking (underwriting), mergers, and acquisitions and research. These were not discussed in this chapter, exclusively concerned with derivatives.

Finally, the sell-side market is quite competitive. Large established firms serve most of the needs of market participants. To stay relevant and win over the competition, sell-side firms continuously innovate and introduce new products and services.

The next chapter focuses on the data that are critical to managing derivatives contracts.

CHAPTER

8

Market and Reference Data

Chapters 6 and 7 introduced the structures and operations of buy-side and sell-side organizations, respectively. This chapter examines the data these organizations use to manage their derivative portfolios.

There are two major data types: *market data* and *reference data*. Market data represent the prices or rates of instruments currently traded in financial markets. Reference data represent a broad range of items including static information such as instrument information, issuer, counterparties, currencies, and almost all other information except market data and transaction data. While market data are continuously changing throughout the trading hours, reference data are static until any changes happen to instruments or issuers, such as the introduction of new instruments, or when one entity is merged with another. Market data is critical for portfolio valuations and risk analytics. For computing accurate profit-and-loss numbers and various risk measures, firms must collect and use reliable market data.

This chapter begins with an explanation of the importance of the data and proceeds to explain the various types of market data and reference data elements. Finally, it outlines the various elements of data management strategy.

The objectives of this chapter are to

- discuss the importance of market and reference data
- list various market data items required in processing derivative contracts

- list the various reference data items required in the processing of derivative contracts
- briefly discuss various elements of data management strategy

The Importance of Data

In the derivatives area, contract valuation, portfolio analytics, and risk analytics are the most critical numbers. They are essential for effective risk management, collateral management, and reporting. The data are key to the underlying models to generate expected results, so it is necessary to collect the data in a timely manner and maintain quality.

The major uses of market data are the following:

Profit and loss analysis (P&L) and portfolio analytics. P&L numbers, P&L variance (period over period), and portfolio analytics are computed at trader, desk, and entity level.

Risk analytics. Computation of intra-day and end-of-day risk measures at the trade, desk, and portfolio levels by traders as well as risk managers.

Cash flow. Generation of future cash flow and the fair value of that cash flow, both at inception and throughout the contract term.

Collateral calculations. Exposure and margin calculations and collateral valuations.

The benefits of efficient reference data management are reduced trade failures and operational risks. Most computations rely on market data rather than reference data. However, missing or stale reference data may lead to larger operational issues (Figure 8-1).

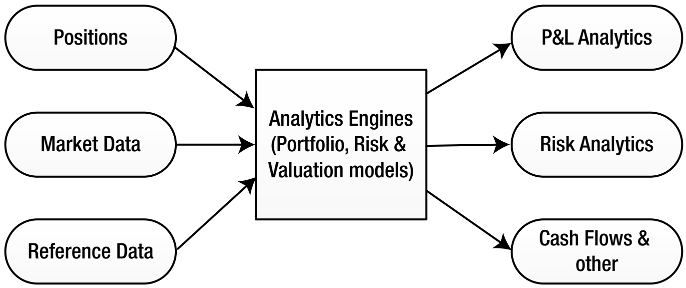

Figure 8-1. Data usage

Market Data

Derivative portfolio management depends on a variety of market data. Market data includes real-time market prices, end-of-day prices, and historical data. Live data represent quotes with a bid and ask price, and other details of instrument trading in the market at any given point of time during trading hours. Historical data represents official prices in the past.

Market data fall into two stages: *raw data*, which include actual market values, and *derived data*, which are computed by applying mathematical models to the raw data. Types of raw data items include the following:

- FX rates (currency prices)
- Interest rates
- Credit data
- Equity and equity index prices
- Bond prices
- Option and futures prices
- Commodity prices
- Credit spreads
- Swap rates

Derived data are either produced by the firm itself or obtained from an external data supplier or aggregator. For instance, interest rate curves are smoothened using mathematical techniques such as interpolation. Derived data are manipulated in the following ways:

- Logarithmic returns
- Standard deviations

- Correlations
- Volatility measures for interest rates, options, and so on
- Interest rate curves
- Index values

Note Sometimes the terms *price* and *rate* are used synonymously, even if the actual data is not the price of the referring instrument. For instance, an *index value* is also referred to as an *index price*.

The cash flow dates of contracts to be valued rarely exactly match the dates defining a data curve. *Interpolation* is used to derive additional data points. This process is also known as *curve fitting*.

FX Rates

Foreign exchange rates are retrieved from a market data vendor for all the currency pairs that the firm has any type of transaction with. Each currency is identified by an ISO code three characters wide such as USD, EUR, and JPY.

FX market data elements include the following:

Spot prices. *Current exchange rates for immediate settlement.*

Forward prices. *Exchange prices for future settlement.*

Swap points (forward points). *The difference between spot and forward rate of different maturities.*

Volatilities. *FX price volatilities, option volatilities.*

Security Prices

The securities and security derivative data most commonly used in various transactions affecting derivative portfolios include the following:

- Bond prices
- Bond future prices
- Bond option prices
- Bond spreads

- Stock prices
- Stock future prices
- Equity option prices
- Equity repo margins
- Volatilities (equity, bond, and futures)
- Dividends
- Index Values
- Credit spread curve
- Benchmark spread curve
- Bond repo margins

Note All exchanges publish live market data known as *exchange feed* to their subscribers. It is typically used by sell-side firms, ETPs, data vendors, and some large buy-side firms. Exchange feed contains live quotes of listed products trading on the publishing exchange. Buy-side firms typically get this data through the data vendor, who supplies aggregated data from multiple exchanges.

Interest Rates

In addition to interest rate derivatives, interest rates are used in the valuation of contracts, computation of cash flow, and other functions. Types of interest rates available for different maturities, currencies, and instruments include the following:

- Treasury rates
- Zero rates
- Swap spreads (swap rate)
- LIBOR and other interbank offer rates such as Euribor
- Repo rates
- Forward rates
- Interest rate volatilities
- Yield curves

Credit Data

Credit data affect interest rate derivatives. Market data in credit markets include the following:

- Single name CDS prices
- Credit index prices
- Loan CDS prices
- Recovery rates
- Default probabilities
- Credit ratings
- Credit events

Commodity Prices

A firm dealing with commodity contracts retrieves commodity prices from a market data vendor, including the following:

- Spot prices
- Futures prices
- Forward prices
- Volatilities

Data Curves

A *curve* is a time series of a specific type of data—for instance, a set of specific interest rates at different maturities. Similarly, different types of data elements across a timeline form curves. The most common curves used in derivatives processing are the following:

Yield curve. This represents the relationship between the interest rate and maturity period of a certain interest bearing instrument. For instance, the current US dollar interest rates are paid on US Treasury securities for various maturities. This is simply known as the *yield curve*.

Zero curve. Built using zero coupon rates of different instruments.

LIBOR curve. Built using LIBOR rates at different LIBOR maturities.

Treasury curve. Built using different Treasury rates at different maturities.

Swap curve. Built using swap rates across all available maturities.

Volatility curve. In the case of options, a popular type of derivative, this curve is built using implied volatilities across different strike prices.

Credit curve or credit spread curve. Built using credit spreads over a time horizon.

Credit default curve. Built using default probabilities over a time horizon.

Note *Fixed income term structure* refers to the collection of curves that describe the time value of money at a particulate point in time. It includes *spot curve, forward curve, discount curve,* and *yield curve*.

Credit Ratings

Credit ratings are another important item that affects the interest rate and credit instruments. The credit rating represents the credit worthiness of an instrument issuer such as a corporation or government.

Ratings are given by professional rating agencies. These agencies study and analyze corporations and sovereigns around the world. Ratings are updated periodically or on any change impacting the issuer's financial condition.

Popular rating agencies Standard and Poor's (S&P), Moody's, and Fitch.

Research and News

In addition to the data types mentioned above, market participants also rely on professional firms for news and research updates. Most sell-side firms have research departments that supply research data in specific areas. In addition, there are independent firms that provide research data. Typically, research data includes news, in-depth analyses of company financial and nonfinancial data, expert views, and opinions.

Financials

Financial information on various corporations includes such data as corporate dividends, corporate actions, earnings reports, and corporate filings.

Historical Data

Historical data play a critical role in analyzing portfolios using historical simulation, backtesting, and P&L analysis (see Chapter 3). Historical data are used to derive standard deviations, volatilities, and correlations that are especially valuable in relation to stress-testing of portfolios and banks during market crises.

Real-Time vs. Closing Data

During trading hours, the latest market data is available as trading proceeds throughout the day. At the end of the trade day, the final prices are collected as the closing data (official prices). Similarly, other data, such as LIBOR interest rates, are finalized by the BBA (British Bankers' Association), which prepares official rates of the day.

Live data changes continuously as the market moves. Live data snapshots at a specific time can be used to compute flash reports (intraday). Final reports (official end-of-day), P&L statements, and risk numbers are computed using closing prices.

Based on the type of data, closing prices are also known as *settlement prices, settlement rates, official prices, official rates,* and *fixing rates.*

Reference Data

Reference data represent a broad range of items, including instrument information, issuers, counterparties, currencies, and almost all other information except market data and transaction data. However, firms may not need all data from all markets. Instrument information is also referred to as *master data*. Typically, firms obtain only the data that are required. Reference data include the following:

- Securities information such as bonds and equities
- Indices information such as equity and bond indices
- Option contracts information
- Futures contract information
- Interest rate indices information
- Currency pairs
- Credit instruments such as credit indices, single names, loans, and others

- Calendars of different markets
- Market conventions
- Counterparties, sectors, countries, markets, rating agencies, and rating definitions

Identifiers

Unique identifiers identify most trading instruments. In certain areas, there are multiple identifiers in use. It is important for firms to keep this information and map it, as needed. Cleared derivative instruments are well defined in terms of identification. Firms must maintain accurate information and keep updating it as new instruments are introduced. Identifiers used in derivative markets include the following:

Symbol. Stocks symbols or tickers.

International Securities Identification Number (ISIN). Identifies bonds, commercial paper, equities, warrants, and most listed derivatives.

Committee on Uniform Securities Identification Procedures (CUSIP) Number. Identifies North American stocks and bonds.

Stock Exchange Daily Official List (SEDOL). Identifies UK securities that are not traded in the US.

Reuters Instrument Code (RIC). Used by Reuters to identify financial instruments and indices.

ISO currency code. Identifies each of the world's currencies such as USD, GPB, JPY, and EUR.

Reference Entity Database (RED) Code. Markit code used to identify trading credit products such as CDS and CDX instruments.

Bloomberg open symbology identifiers. Standard codes introduced by Bloomberg to identify various financial instruments.

Data Sources

Professional data vendors generally supply data. These corporations collect data from multiple sources such as exchanges, electronic trading platforms, and market makers. Then they normalize, cleanse, validate, and distribute the data. In addition to raw data, vendors also supply derived data computed by feeding raw data into mathematical models.

There are many data vendors in the market. Most firms use more than one data vendor for their data needs, aggregating and cleansing disparately sourced data before using it.

Some of the popular data vendors that supply both market data and reference data for derivatives are Bloomberg, Reuters, SuperDerivatives, and Markit. Figure 8-2 shows data suppliers and how data flows to market participants.

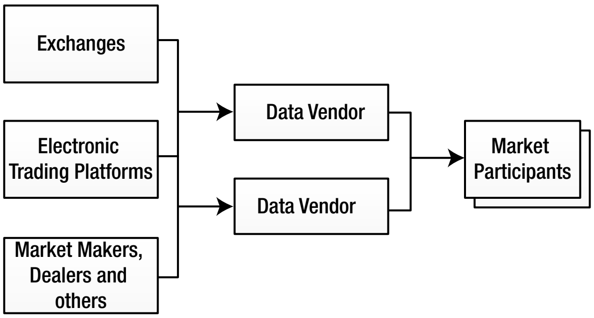

Figure 8-2. Data vendors

Data Management

To the extent that market data is a critical component, data management strategy plays an important role in the operations department. To represent current market conditions, data must be up-to-date. Traders rely on real-time daily data, whereas risk managers use end-of-day data. Collecting and transforming market data into usable data for valuation and risk analysis requires significant time, technology, and resources. Data management strategy includes the following key elements:

- Comprehensive data capture
- Quality data production
- Storage in a well-formed structure
- Efficient and quick access platforms and tools
- Historization
- Managing multiple data sets

Figure 8-3 shows the structure of the basic data management platform.

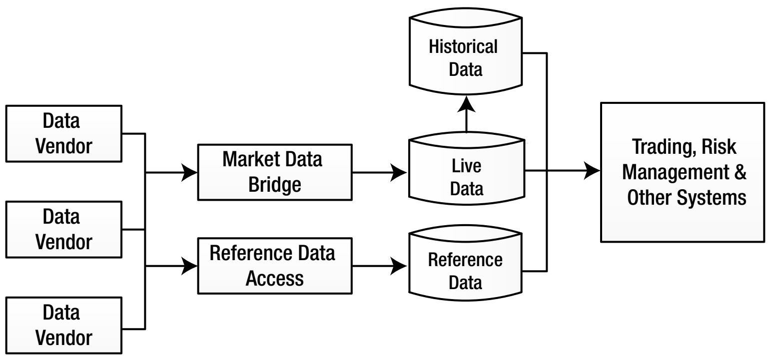

Figure 8-3. Data management platform

Data Capture and Quality

Essential to data capture is the production of clean, consistent, and complete data. The key elements of data capture are the following:

> **Collection.** Comprehensive data collection.
>
> **Cleansing.** Often data has outliers such as inconsistencies among different sources, unrealistic illiquid prices, missing data points, and human errors. These errors are resolved using different techniques to produce clean, consistent, and complete data.
>
> **Quality control.** Validate and analyze data for quality and accuracy.

Firms generally have dedicated data analysts who are responsible for procuring high-quality data from external resources and maintaining it in readiness for processing.

Data Storage and Access

Data captured from multiple resources is stored in a well-structured database, usually in a central data repository. To provide quick access, live data is typically stored in a separate faster database, while historical data is stored in a larger separate database.

Multiple systems and users throughout the trading day heavily access real-time market data storage. Historical market data is accessed on demand by a limited set of processes. At the end of each business day, the closing prices (official data) are copied to the historical database. While the live database is purged daily to maintain a smaller size and faster access, historical data is kept for years based on the firm's data management strategy. To provide faster access, better technology platforms and access tools are employed.

Reference data is mostly static, and most firms refresh this data on a daily basis. In addition, they may refresh the data on demand in case of new issues or to complete missing information.

Data Sets

Multiple departments including trading, reporting, and risk management groups use market data. Typically, firms maintain multiple sets of data, one for each of these groups—sometimes even a set for each trading desk and trader, as required. Trading departments may use their own models or standards in choosing derived data. They may even manipulate certain elements to suite their valuations, whereas the middle office may need a clean set of data for official reporting. Similarly, risk management looks for the most accurate data. All these departments use their own set of data to produce independent results. Typically, it is also a compliance requirement for risk management to use an independent set of data. Hence, firms must be capable of maintaining multiple sets of data.

Operations

The data analysts manage market and reference data. Although most operations are automated, extra care is taken to guarantee the timeliness and accuracy of data. During the business day, typically the following activities are performed:

- Schedule market data snapshots for flash reports and intra-day analysis
- Verify external data loads
- Review and validate data elements
- Resolve data issues (cleansing)
- Reset interest rates (fixing process)
- Build and verify various curves
- Load closing prices to the historical database
- Refresh reference data elements and run on-demand loads

Summary

This chapter outlined data management, including market data and reference data, which are critical in managing derivatives. Accurate and timely market data play a major role in valuating derivative portfolios. In addition, various risk measures depend upon clean and accurate market data. To reduce operational risk, firms must maintain accurate information about instruments through frequent reference data loads. Most firms use data vendors as their data suppliers. Data vendors collect data from different sources, scrub it, and derive new numbers from it as needed.

Managing data is a task that is separate from all other operations and foundational to them. All daily operations rely on that day's market data load, and successful derivatives trading relies on effective use of that data. Good understanding and a sound data management strategy must be part of the overall strategy. This chapter explained the key elements of data management strategy—data capture, quality, storage, access, historization, and dataset management. The next chapter examines the unfolding implementation and implications of the Dodd-Frank Act in the derivatives market.

CHAPTER

9

The Dodd-Frank Act and Other Reforms

In the wake of the 2007–2008 financial crisis, legislative and regulatory regimes around the world have introduced laws to reform financial markets—notably the *Dodd-Frank Act* in the United States and the *European Market Infrastructure Regulation (EMIR)* in the European Union, as well as other similar laws in many countries and regions. The joint aim has been to provide for a uniform global marketplace without regulatory gaps and disparities between regimes.

A principal objective of these laws is to reduce the systemic risk in financial markets. These laws are focused on certain perceived flaws in over-the-counter (OTC) derivatives markets that many hold responsible for exacerbating the crisis. These reforms restructure the financial regulatory system to restore public confidence and to prevent another crisis from occurring. These laws have changed the oversight and structure of the OTC derivatives market in the United States and other countries that have sizable derivatives business.

The goal of this chapter is to provide a cursory overview of the major reforms of the Dodd-Frank Act and to survey more closely the new global regulatory framework for the derivatives market. This starts with a survey of the Dodd-Frank Act and proceeds to look at how Title VII of Dodd-Frank is reforming the derivatives market structure and constraining its players by reference to each major component of the regulatory framework. Finally, this chapter summarizes how other concurrent reforms—especially the Basel II and Basel III Accords—are affecting the global derivatives market.

Note that this chapter is intended to provide only the essentials of the Dodd-Frank Act and derivatives reforms. It is far from comprehensive and is not intended to proffer any legal advice on complying with the Dodd-Frank Act.

The objectives of this chapter are to

- understand the major reforms of Dodd-Frank
- understand the derivative reforms prescribed under Title VII
- explain the new structure of the OTC derivatives market and the roles of each involved entity
- study the key elements of regulatory framework

The Dodd-Frank Act

In 2010, *the Dodd-Frank Wall Street Reform and Consumer Protection Act* (the *Dodd-Frank Act* or simply *Dodd-Frank*) became law in the United States. The Dodd-Frank Act is an extensive reform, touching most parts of financial services of the country.

A principal objective of the Dodd-Frank Act is to promote the financial stability of the United States by improving accountability and transparency throughout the financial system, controlling systemic risk, forestalling the need for government bailouts and protecting consumers from abusive market practices. The act has changed entire market practices—how financial products are traded and used by market participants.

The Dodd-Frank Act has 16 *titles* (major sections), each focusing on specific aspects of regulation. The derivatives market reform is mostly covered under Title VII of the act. This act has reshaped the oversight and structure of OTC derivatives market including market scope, structure, execution mechanics, pricing, margin, collateral requirements, and supervision.

Furthermore, other major derivative markets of the world have also introduced similar laws in order to level the playing field. The following section provides a summary of the Dodd-Frank Act followed by the derivatives reform.

Major Tenets

The Dodd-Frank Act covers broad areas of the financial system with many rules and exceptions. The principal aspects of the act are as follows:

Financial stability reform. The Dodd-Frank Act creates a core organization named the *Financial Stability Oversight Council (FSOC or simply council).* The main purpose of this organization is to identify risks to US financial system stability that may arise from ongoing activities of large, interconnected financial companies as well as from outside the financial services marketplace. It also promotes market discipline through various regulatory agencies. The council is responsible for overseeing various regulatory agencies and aligning the roles of these agencies to avoid any gaps. The act also created the *Office of Financial Research (OFR)* to assist the FSOC.

Regulatory agencies reform. In addition to the FSOC, the act creates several new regulatory agencies and enhances the role of several existing agencies in various segments of the financial system. The created agencies include the *Bureau of Consumer Financial Protection (Bureau), Office of National Insurance, and Office of Credit Rating Agencies*. The agencies with enhanced roles include the *Commodity Futures Trading Commission (CFTC), Securities Exchange Commission (SEC),* and others.

Securitization reform. The act introduces regulations on registration, disclosure, and reporting requirements for asset-backed securities and other structured finance products.

Derivatives business reform. The act introduces an extensive reform of derivatives business, imposing comprehensive rules on derivatives trading and market participants. The act empowers parallel regulatory agencies, the CFTC, and SEC, and it divides jurisdiction between them while the banking regulators (*prudential regulators*) will retain jurisdiction over certain aspects of banks' derivatives activities.

Investor protection reform. The act addresses certain custody issues and introduces rules relating to investor protection that are aimed at strengthening investor confidence.

Credit rating agency reform. The act introduces several compliance requirements on rating agencies.

Volker rule provisions. The act limits the engagement in proprietary trading by US banks and their affiliates. Furthermore, the rule also limits the owning of, sponsoring of, or investing in hedge funds or private equity funds by these entities.

Compensation and corporate governance. The act imposes certain changes to executive compensation policies and corporate governance policies.

Capital requirements. The act imposes a more stringent regulatory capital requirement standard on financial institutions. In addition, it also introduces standards on leverage limits, liquidity requirements, and concentration limits.

There are many more minor rules that address the objectives of broader reforms of the overall financial system.

Derivatives Market Reform

The derivatives business reform has been introduced through Title VII in the Dodd-Frank Act. The title is also known as *The Wall Street Transparency and Accountability Act of 2010*. It imposes comprehensive and far-reaching regulatory rules on derivatives and market participants. The major elements of Title VII are summarized below.

Regulatory framework. Primarily, the CFTC and SEC are given enhanced authority to jointly regulate the derivatives market. These agencies have enhanced governance and compliance structures of the market and participants. The key market players are subject to enhanced compliance, business conduct rules, and processing standards. However, banking regulators retain jurisdiction over certain aspects of the derivatives activities of banks, such as capital and margin requirements and prudential requirements.

Standardization. The act enforces standardization of certain derivative contracts, central clearing, organized trading platforms, categorization of market participants, and transaction reporting requirements to improve market transparency and mitigate systemic risk.

Electronic Trading. The act requires all standardized contract (eligible for central clearing) trades to execute over an organized trading platform. In addition, the dealers on execution venues are obligated to provide pre-trade price transparency.

Central clearing. The act mandates central clearing of standardized swap contracts through a central clearing organization. Market participants are required to clear their trades either through a derivatives clearing member or directly through a clearing organization.

Reporting. The act requires all transactions, including standard as well as non-standard swaps, to be reported to trade repositories by the appropriate market entities and parties involved.

Collateral and margin requirements. The act prescribes margin requirement standards for centrally cleared transactions and stringent collateral requirement standards for non-standard (bilateral) transactions to mitigate counterparty credit risk. Furthermore, it also introduces standards for increased capital requirements on major market participants.

Restrictions and limitations. The act also limits the involvement of certain entities in derivatives transactions.

Exceptions. The act includes many exceptions to the involved parties and transactions, and it includes applicable criteria for each exception.

Note The full text of the Dodd-Frank Act can be accessed at `www.sec.gov/about/laws/wallstreetreform-cpa.pdf`.

New Market Structure

As stated earlier, the Dodd-Frank Act has changed the landscape of the OTC derivatives market. According to the act, the key market players are the following:

> **Regulatory agencies.** Introduction of new and expanded supervisory agencies to regulate and oversee markets.
>
> **Product classification.** All derivative products are classified into two major groups—*standard and non-standard swaps*.
>
> **Market participants.** All swap market participants are classified into multiple categories and subject to regulations based on their category.
>
> **Trading venues.** Introduction of organized trading platforms to trade standard products that are subject to new regulations.
>
> **Clearing organizations.** Central clearing of standard swaps through CCPs that are subject to additional prudential standards.
>
> **Trade repositories.** Central databases to collect and report market transactions to regulators and provide a certain level of transparency to the public.

Figure 9-1 shows a high-level market structure with various players. The following sections explain each of these players in detail.

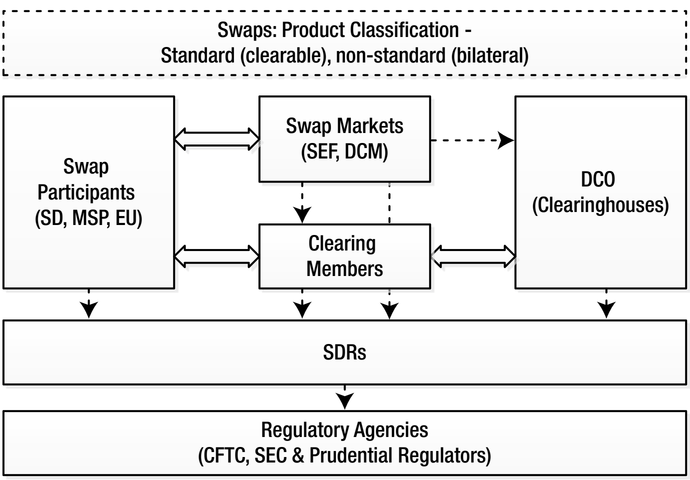

Figure 9-1. New OTC derivatives market structures

Regulatory Agencies

The act appoints the CFTC and SEC to jointly regulate the derivatives market. These organizations operate under the guidance of the FSOC. The broad derivatives jurisdiction has been clearly split between these agencies. The primary objectives of these agencies are to prescribe regulations and oversee markets.

Furthermore, the CFTC and SEC work in conjunction with prudential regulators, such as the *Federal Reserve Board (FRB)*, in respect to prescribing certain rules for banks and other entities that are regulated by these prudential regulators.

Note The key prudential regulators are the Federal Reserve Board, the Office of the Comptroller of Currency, the Federal Deposit Insurance Corporation, the Farm Credit Administration, and the Federal Housing Finance Authority.

Resources To learn more about these entities, visit the following links:

CFTC: www.cftc.gov/LawRegulation/DoddFrankAct/Dodd-FrankFinalRules/index.htm

SEC: www.sec.gov/spotlight/dodd-frank/derivatives.shtml

FSOC: www.treasury.gov/initiatives/fsoc/Pages/home.aspx

OFR: www.treasury.gov/initiatives/ofr/Pages/default.aspx

Product Classification: Swaps

The Dodd-Frank Act amends *the Commodity Exchange Act (CEA)* by adding definitions of the terms *swap, security-based swap, and non-security-based swap*.

According to Dodd-Frank, the term *swap* is broadly defined as agreements, contracts, or transactions linked to an array of underlyings such as physical commodities, rates, foreign currencies, broad-based security indices, or US government or other exempt securities (other than municipal securities), unless a predefined exclusion applies.

In general, under the Dodd-Frank Act, all OTC derivative products are simply referred to as *swaps*—not to be confused with the derivatives class *swap* (see Chapter 2). It is important to distinguish between the two terms and to recognize which one is appropriate based on the context. Throughout this chapter, the term *swap* refers to a derivatives contract under Dodd-Frank unless otherwise specified. Most OTC derivatives are some form of the *swap* class of derivatives, so *swaps* became a commonly used term to refer to all OTC derivatives.

The OTC products included in the *swaps* definition are interest rate swaps, basis swaps, currency swaps, foreign exchange swaps, total return swaps, equity and equity index swaps, debt and debt index swaps, credit default swaps, energy swaps, metal swaps, agricultural swaps, and other commodity swaps. The act mainly covers five major asset classes: interest rate, credit, equity, foreign exchange, and commodity.

Per the act, swaps (derivative products) are divided into two major categories: *security-based swaps* **and** *non-security-based swaps*. The scope of regulation and which rules apply to a given transaction are determined by the type of underlying swap instrument, whether security based or non-security based. Figure 9-2 shows this classification.

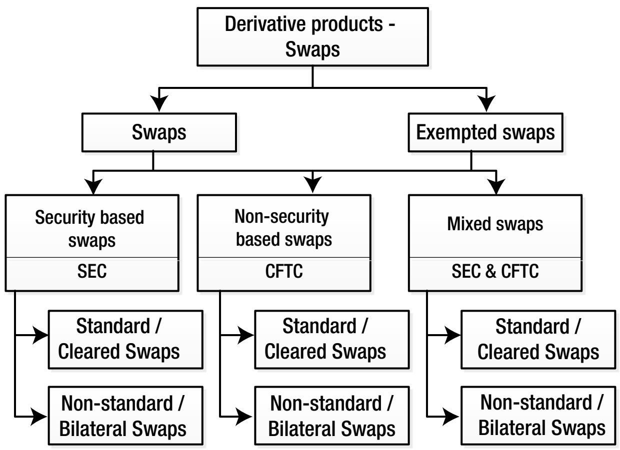

Figure 9-2. Classification of derivative products

Security-Based Swaps

Security-based swaps are swaps based on financial instruments such as *securities or loans*. Securities include all financial instruments that are covered under the *Securities Act of 1933 (Securities Act)* and *the Securities Exchange Act of 1934 (Exchange Act)*.

Security-based swaps capture most types of commonly traded OTC derivatives. They include contracts based on a single, non-exempt securities or a narrow-based security index, single-name CDS, most CDS based on narrow-based indices, and most equity swaps such as *total return swaps*.

The SEC is responsible for overseeing this category of swaps, markets, and participants.

Non-Security-Based Swaps

All swaps that are not security-based swaps fall into this category. The non-security-based swaps are referred to simply as *swaps, while security-based swaps are prefixed by the term security-based.* The most common non-security-based swaps are the following:

Interest rate swaps. Most plain vanilla interest rates swaps include fixed-to-floating swaps, floating-to-floating swaps (basis swaps), forward rate agreements, and overnight indexed swaps (OIS) in limited currencies (currently USD, EUR, GBP, and JPY are included).

FX derivatives. FX derivatives include foreign exchange options, currency swaps, and nondeliverable forwards. Note that FX swaps and FX forwards in general are exempted.

Credit indices. Credit Default Swaps (CDS) are on broad indices, other than security-based CDS.

Total return swaps. These are certain types of total return swaps that do not fall under the definition of security-based swaps.

Options on rates. All options—such as puts, calls, floors, caps, and collars—are based on a rate, such as an interest rate or a currency exchange rate.

Commodity options. All options—such as puts, calls, caps, floors, and collars—for purchase or sale, are based on the value of one or more commodities. However, options that involve the physical delivery of commodities for a business purpose are exempt, with certain conditions.

Other swaps. All other swaps that do not qualify as security-based swaps and not exempt.

The CFTC is responsible for overseeing this category of swaps, markets, and participants with input from the SEC, where appropriate.

Mixed Swaps

Mixed swaps are another category that includes security-based swaps with a commodity component. The CFTC and SEC share the regulatory authority over this type of swaps.

Excluded Swaps

The act excludes the following derivative transactions from being either security-based or non-security-based swaps:

Listed products. Include listed futures, options on listed futures, listed options on securities, and broad and narrow-based security indices, exchange-traded commodity futures, and options on exchange-traded commodity futures.

Securities products. Include unlisted options on securities or on certain indices that are subject to securities laws.

Forwards. Certain physically settled forward contracts and forwards tied to nonfinancial commodities.

FX products. Include FX swaps and FX forwards.

Central Clearing

All swaps under the Dodd-Frank Act are divided into the two following major categories based on the central clearing requirement:

Clearable swaps or standard swaps. The act prescribes that swaps be standardized into *standard swaps, also known as clearable swaps*. All standard swaps are mandated to be traded on an organized trading platform and cleared by a designated clearing organization. Regulators have the authority to enhance the list of clearable swaps, as required.

Non-clearable, non-standard, or bilateral swaps. All swaps other than standard swaps are considered *non-standard, non-clearable, or bilateral swaps*. These swaps are traded over any traditional channel and not cleared by any central clearing organization. According to the act, however, these transactions are subject to increased collateral requirements and counterparties are subject to increased capital requirements. This category is also known as *off-facility swap*.

Swap Participants

The act requires all market participants to be registered to trade. Registered participants are known as *Eligible Swap Participants (ESP) or Eligible Contract Participants (ECP)*.

Market participants are classified into three broad categories: *Swap Dealers (SDs), Major Swap Participants (MSPs*), and *End Users (EUs)*. The act prescribes the rules and requirements by these categories. The following sections explain how each participant is classified into one of these categories.

Swap Dealers

The *SD* is a financial institution that acts as a dealer or market-maker in a swap transaction. Typically, dealers take the counterparty role in derivative transactions for the benefit of their clients and other market participants, providing liquidity. The act requires all such institutions to be registered as swap dealers.

Based on the instruments they deal, swap dealers may have to register with either or both CFTC and SEC. Furthermore, institutions dealing with non-security-based swaps also have to register with the *National Futures Association (NFA)*, a market association.

Major Swap Participants

A *Major Swap Participant (MSP)* is a market participant satisfying one or more of the following conditions:

- Maintaining a substantial position in swaps
- Maintaining swap positions that create substantial counterparty exposure that could have serious adverse effects on the financial stability of the US banking system
- Being a highly leveraged financial entity that is *not* already regulated by any federal banking regulator

The size of the substantial position, exposure, and leverage are prescribed by the appropriate supervisory agency. In summary, SDs and MSPs are larger participants who are critical for market success while they are also sources of major systemic risk.

End Users

All ESPs that are not designated as either SDs or MSPs are referred to as *end users (EUs)*. The EUs are swap participants with limited assets (with asset thresholds being set by regulatory agencies). However, this category includes certain other institutions that cross the threshold such as the farm-credit association, credit unions, and rural electrical cooperatives.

EUs are further divided into two broad categories: *financial and non-financial end users*.

An EU is a *financial end user* if it is a commodity pool, private fund, employee benefit plan, or a person that is predominantly engaged in activities that are in the business of banking or that are financial in nature.

All EUs other than financial end users are referred to as *non-financial end users* or *commercial end users*.

This categorization is done to provide certain exemptions, which are discussed later.

Note The term *financial entity* generally includes SDs, MSPs, commodity pools, private funds, employee benefit plans, and persons predominantly engaged in activities that are in the business of banking or that are financial in nature.

Participant categories are another commonly used classification of derivatives market players. For the phased implementation of the Dodd-Frank Act, all participants are divided into the following three major categories: **Category 1:** Entities that include swap dealers, security-based swap dealers, major swap participants, major security-based swap participants, and active funds. **Category 2:** Entities that include commodity pools or private funds. **Category 3:** All other entities affected.

Execution Venues

All standard swaps are subject to mandatory trading on an *Organized Trading Platform* (OTP) that is electronic and licensed by appropriate regulatory agencies, unless the swap is not "*available to trade*." The act defines two types of trading platforms: *Designated Contract Markets (DCMs)* or *Swap Execution Facilities (SEFs)*.

Under the act, a DCM is a large, recognized exchange (*board of trade*) on which physical commodities and other non-security-based swaps are traded. An SEF is an electronic trading platform on which multiple participants have the ability to execute or trade swaps by accepting bids and offers made by multiple participants.

Most major conventional exchanges are likely to be classified and registered as both a DCM and an SEF. However, both DCMs and SEFs are required to register with supervisory agencies (CFTC, SEC, or both) and are subject to prescribed trading rules and other requirements.

An SEF or DCM is subject to determination of whether a swap is made "*available to trade*" or not and to submit such determinations to regulatory agencies for approval or certification. The rules also propose that, if one SEF makes a swap available to trade, all "economically equivalent" swaps would be deemed "available to trade."

Note Some of the SEFs are Tradeweb, MarketAxess, Bloomberg, and ICAP, while most major derivative exchanges are either already licensed as DCMs or are in the process of obtaining a license.

Clearing Organizations

All standard swaps are subject to mandatory clearing by *Designated Clearing Organization (DCO),* also known as *Central Clearing Counterparty (CCP) or Central Counterparty*. DCOs are subject to licensing by the appropriate regulatory agencies and must comply with margin requirement standards and other prescribed rules.

Most DCOs are existing clearinghouses that are licensed to clear standard swap contracts. Similar to a listed market, DCOs are accessible to EUs through *Clearing Members (CMs) (also known as FCMs or brokers)*. Clearing members operate under the rules of DCOs in addition to applicable market regulations.

Note Major clearinghouses that clear standard swaps are CME, ICE Clear, LCH.Clearnet, IDCG, NASDAQ OMX, Eurex Clearing and others.

Trade Repositories

One of the key requirements of the act is to collect the data on market transactions into a central repository known as a *Trade Repository (TR) or Swap Data Repository (SDR)*. The act establishes that these repositories are to collect transaction data from responsible market players.

As per the act, an SDR can be defined as a centralized record-keeping facility of swaps that collects and maintains information with respect to swap transactions, or positions held by market participants. The act also allows multiple trade repositories to exist and collect data serving different segments of the market.

These repositories serve as central databases, providing reports to regulatory authorities and making applicable data available to the public. According to the act, the requirements of the swap data repository are the following:

- Collect swap transaction data from designated reporting entities (the rules designate a specific participant as a responsible reporting entity in each transaction type)
- Verify the accuracy of the data submitted and maintain it in a uniform format
- Maintain records, data processing, and reporting systems as prescribed by the SEC and CFTC
- Report trade data to the SEC and/or CFTC, as prescribed by the act

---

Examples of SDRs

DTCC GTR: www.dtcc.com/products/derivserv/suite/us_swap_data_repository.php

CME: www.cmegroup.com/market-data/repository/

ICE TradeVault: www.theice.com/trade_vault.jhtml

Regulatory Framework

The previous section defined various key players of the market as prescribed by the Dodd-Frank Act. This section explains new framework, that is, how these players do business and key regulatory requirements imposed on each player and swap transactions. This section is divided into multiple subsections, each explaining different aspects of the new framework.

Figure 9-3 presents key building blocks of the regulatory framework. The following sections explain each of these blocks.

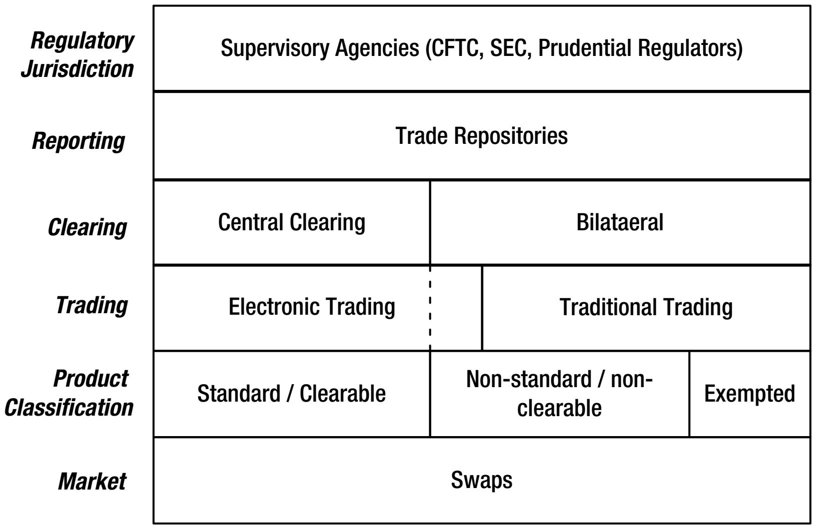

Figure 9-3. The building blocks of regulatory framework

Jurisdiction

As we discussed earlier, the Dodd-Frank Act creates a key regulatory entity, the *Financial Stability Oversight Council* (FSOC). The FSOC is an independent rule-making agency focused on identifying, monitoring, and addressing systemic risk. It is chaired by the treasury secretary and consists of the federal financial regulators as members.

Under the new law, the CFTC and SEC have been given new authority to enforce required rules and to regulate the OTC derivative markets, products, and market participants. Both of these agencies are members of the FSOC and take significant responsibility toward achieving the goals of the FSOC.

The SEC is given jurisdiction over security-based swaps and all entities dealing with security-based swaps such as ESPs, clearing agencies, trading venues, and trade repositories. The CFTC is given jurisdiction over non-security-based swaps and entities dealing with these swaps. The two regulators share jurisdiction of certain mixed swaps.

Registration and Licensing

A swap participant must register with the regulators as a swaps dealer, major swaps participant, or end user. This means that a swaps dealer, usually a broker-dealer that makes a market in swaps, must register with either the CFTC or SEC, or with both regulators if dealing with both category swaps. For instance, with large hedge funds and dealers, these are typically subject to registering with both the CFTC and SEC as they mostly deal with both types of swaps.

However, there is an exemption from registration for non-financial companies that are hedging commercial risk. For example, a heating oil company that purchases swaps to hedge its exposure to oil prices could be declared as a commercial end user. Regulations provide many exceptions and required criteria for each exception in detail as part of the rules.

Electronic Trading

As per the act, all standard swaps (designated as clearable) must be traded on DCMs or SEFs unless there is no registered venue that accepts the swap for trading (not "*available to trade*"). The act proposes non-security-based swaps that are to be traded on DCMs, non-commodity, and non-security-based swaps, such as interest rate swaps, which are to be traded as SEFs that are on smaller electronic platforms. Security-based swaps, such as single-name CDS, are to be traded on either an SEF or DCM.

These trading platforms are subject to reporting requirements on trading activity. Reporting on trading activity includes information such as the trading swap, presence of buyers and sellers, frequency or size of transactions, trading volume, bid-ask spread, and indicative bids and offers.

A block trade in swaps can be negotiated over the phone and entered into an electronic system after the fact, for reporting purposes. Non-standard swaps can also be traded on these electronic platforms, even if they are not cleared by DCO.

Central Clearing

All standard swaps that are designated as clearable must be centrally cleared through a *Designated Clearing Organization* (DCO). As discussed earlier, central clearing virtually eliminates the counterparty credit risk that existed in earlier OTC transactions (see Chapter 5). The act also prescribes new margin management standards to all DCOs, which are discussed in later sections.

Both sides of the standard swap contract clear the trade either through a derivatives *Clearing Member (CM)* or directly (if the party is itself a member of the DCO), rather than establishing a bilateral contract with each other. Typically the relationship between an end user and a *Futures Commission Merchant* (FCM) is established through the *give-up agreement* (see Chapter 5). The CM is also known as the *clearing broker, FCM,* or simply *broker*.

Furthermore, the act states that the counterparty to a swap transaction that is not an SD or MSP has the sole right to select the DCO to clear standard contracts. The two counterparties of the contract are not required to but may use the same CM. In practice, swap pricing may be affected by the selected DCO, so the DCO is chosen before the execution. EUs clear their trades through CM, while SDs clear their trades directly through a DCO.

Swap transactions initiated before the Dodd-Frank Act became effective are exempted from the clearing requirement. They may, however, be subject to other requirements such as data reporting and record-keeping.

Per the act, CM accounts at DCO are segregated and portable, which allow EUs to switch to a different CM in case of CM defaults (see Chapter 5).

Another important note is that the EUs may also choose to clear non-standard swap transactions if the transaction is acceptable by any DCO for clearing.

FCM vs. Broker In a futures market, a clearing member is known as *FCM*, whereas in a securities market, a clearing broker is primarily referred to as a *broker-dealer* or simply as a *broker*. After new regulations, the *FCM* term is being widely used.

Collateral Management and Capital Requirements

The strength and safety of a financial system depends on the strength and risk management practices of its participants. To promote stronger risk management practices among participants, the regulatory agencies prescribe the margin requirement standards for *designated clearing organizations* (DCOs), and collateral management standards for non-clearable swaps among SDs, MSPs, and EUs.

Margin rules of clearable transactions are prescribed and implemented by regulators in consultation with DCOs. Since DCOs have a major role in providing financial security, stringent margin requirement standards are enforced upon them. It is critical for DCOs to maintain sufficient financial resources that will enable them to withstand any adverse event.

All cleared swaps are subject to margin requirements as established by the DCO. These include daily *variation margin* (VM) (or mark-to-market variation) and an upfront *initial margin* (IM) (posting of cash or securities) to cover the DCO's (and FCM's) potential future exposure from the default of a contract holder (or FCM).

In case of uncleared swaps (OTC bilateral), regulators prescribe collateral standards such as the subjected swaps, documentation requirements, rules related to *Independent Amount* (IA) requirements, collateral eligibility and restrictions, timing of posting collateral, calculation methodology, and collateral custody. Collateral requirements for these swaps are generally higher than the margin required for cleared swaps. Swaps initiated before the act are not specifically exempt from the margin requirements. Chapter 11 explains the derivatives collateral management in detail.

In case of non-dealer transactions (end user to end user), a clearing member must be involved for all clearing activities. The end users that are subject to collateral requirements follow the rules enforced by a clearing member.

In addition to margin and collateral requirements, both SDs and MSPs are subject to new minimum capital requirement standards in order to mitigate the systemic risk to the overall financial system. These new capital requirement standards are comparable to those applicable to banks, such as *Basel II or Basel III,* providing harmonization across jurisdictions and regulators.

While the CFTC and SEC set capital and margin requirements for DCOs and most other participants, federal banking regulators (prudential regulators) set these standards for the SDs and MSPs that are banks.

Furthermore, the act also prescribes rules for collateral custody. These rules include the separation of client and clearing member collateral and third-party custody, in certain cases.

Note Prudential regulators further divide financial end users into two categories for the purpose of collateral rules enforcement. They are *High-Risk Financial End Users (HRFE) and Low-Risk Financial End Users (LRFE).*

Data Reporting

The act requires reporting of transactions, both clearable and bilateral transactions, to registered *Swaps Data Repositories (SDRs).* Reporting information details vary by transaction and market. The reporting information typically includes details on new transactions and changes to current positions such as unwind, novation, amendment, revision, and valuation throughout the life of the contract until termination. The rules designate one or more entities as *data reporting entities* responsible for reporting, based on the type of the transaction, execution, and clearing method used.

Furthermore, designated data reporting entities are responsible to report data electronically and in real time as soon as *technologically practicable*. Generally, reporting is expected to occur immediately after execution or confirmation.

Transactions executed on DCM or SEF are supposed to be reported by execution venues. Uncleared swap transactions or transactions that are not executed on SEF or DCM must also be reported to a registered SDR. The designated reporting party would typically be an SD or an MSP, based upon a hierarchy. The hierarchy includes SD before MSP, and MSP before the EU. In cases where neither party is an SD or an MSP (end-user to end-user transaction), one of the counterparties would be designated as the reporting party to report transaction data to the appropriate SDR.

In addition to reporting, in the case of uncleared (bilateral) swaps, both parties of the swap must maintain detailed records of the swap data, which must be made available to the applicable regulators as required (as part of the *record-keeping requirements under the act*).

Block transactions or large notional swaps are exempted from some real-time reporting requirements, but they are still required to be disclosed after a certain period of time. By the rules, block trade size thresholds and reporting delays differ depending on the asset class (or sub-asset class swap category) method of execution and the status of the parties.

Under the act, the CFTC and SEC issue annual and semi-annual reports on market data for major swap categories including rate, credit, equity, and commodity swaps. In addition, SDRs makes limited data available to the public in real time. This data includes basic elements, such as swap prices and volumes.

Regulatory agencies require only a limited amount of transaction information to be reported, including terms most common to all standardized products. The CFTC and SEC publish data fields required to be reported and have the authority to enhance the scope.

To collect and track transaction data into a central repository, regulatory agencies have introduced three main unique key fields: *Unique Counterparty Identifier (UCI) or Legal Entity Identifier (LEI), Unique Swap Identifier (USI) or Unique Trade Identifier (UTI), and Unique Product Identifier (UPI)*. While the UCI is used to uniquely identify each market participant, the USI and UPI are used to identify each market transaction and the underlying product, respectively.

The USI is a two-part, alpha-numeric code that identifies a registered entity and swap transaction that facilitates tracking of positions and/or activity of traders across business units of single as well as multiple firms.

Note To learn more about these identifiers, visit the following online resources: www.ciciutility.org, www.sifma.org/issues/operations-and-technology/legal-entity-identifier/overview/, www2.isda.org/identifiers-and-otc-taxonomies/.

Trading Limits and Controls

Both the CFTC and SEC are given the authority to limit swap positions held by participants in their jurisdictions. These agencies impose *aggregate position limits* at participant levels, or at a level of a specific class of trades.

Furthermore, these agencies can also prohibit market participants to be involved in a swap transaction in a foreign country that may undermine the stability of the US financial system.

Counterparty details and position limits are regularly reported by DCOs, DCMs, and SEFs.

End-User Exception

According to the Dodd-Frank Act, certain EUs are exempted from mandatory clearing and reporting requirements under the following conditions:

- That an end user is not a financial end user
- An end user is using the swap to hedge or mitigate commercial risk (as defined by the act)
- An end user is notifying the appropriate regulatory agencies as to how it meets its financial obligations associated with entering into non-cleared swaps

However, to avoid the abuse of this exemption, the act also mandates that the exempted party is to be identified in reports to the corresponding SDR by the designated transaction reporting entity. In addition, some other rules, such as required annual filings, might be applicable for such exemptions.

In general, exempted end users are known as *commercial end users*. They include non-financial firms such as pension funds, institutions managing public debt, and commercial and manufacturing companies that use swaps to hedge or mitigate their business risks.

In addition to this exception, the act also grants many other exclusive exceptions and appropriate eligibility criteria to address specific needs of the market participants.

Non-ESP Participation

All persons or entities that are *not* ESPs per the act are known as *non-ESPs*. These entities can enter into swaps only via an exchange (using exchange-traded products).

Business Conduct and Compliance

As a result of central clearing, risk is concentrated at the DCOs. In order to avoid this potential risk, regulators have introduced stringent risk management standards governing the operations, the conduct of business, and organizational and prudential requirements, so that DCOs manage their risk properly and avoid any financial system-wide crisis.

In addition to DCOs, all other major participants, such as SDs and MSPs, are also subject to rules governing business conduct, ethics, operations, and risk management practices. The act also introduces rules to mitigate conflicts of interest at DCOs, clearing members, exchanges, and SEFs.

All participants are required to monitor their own trading activity operations and risk management practices in order to ensure compliance.

Recordkeeping

The rules of the act require SDs and MSPs to maintain daily trading records of swaps. These daily records include recorded communications, such as electronic mail, instant messages, and recordings of telephone calls, daily trading records for each customer or counterparty, and a complete audit trail for conducting comprehensive and accurate trade reconstructions.

All EUs are required to keep full, complete, and systematic records, together with all pertinent data and memoranda, throughout the life of each swap and for five years following the termination or expiration of the swap.

The records can be kept in either paper or electronic form, as long as the records are retrievable upon request by the regulators within the prescribed timeline.

Enforcements

Both the CFTC and SEC are responsible to police the compliance with regulations in their jurisdictions. Both of these agencies have created or enhanced their enforcement groups or squads that are focused on their own respective areas. The primary objective of these groups is to monitor activities and investigate and prosecute any alleged violation.

Push-Out Rule

The Dodd-Frank Act (under Section 716) also introduces the *push-out rule* or *Lincoln rule*. According to this rule, banking entities such as banks and other bank holding entities with access to federal government assistance (such as access to the Federal Reserve's discount window or FDIC deposit insurance) are prohibited from engaging in many derivatives trading activities, with certain exemptions.

Volcker Rule

The Dodd-Frank Act (under Title VI) introduces the *Volcker Rule*, which prohibits and limits the ability of banking entities from engaging in certain derivatives activities. The Volcker Rule prohibits these entities from engaging in proprietary trading, and it limits their involvement in sponsoring and investing in private equity funds and hedge funds. However, the act provides certain exceptions to this rule.

Proprietary trading means trading for the firm's own account. The ban on proprietary trading includes derivatives and other financial instruments that are identified by the CFTC, SEC, and appropriate federal banking agencies.

However, *systemically significant non-banking financial entities* are not prohibited from engaging in proprietary trading. Nonetheless, these companies are subject to additional capital requirements and quantitative limits enforced by the regulators.

Note The act designates and names certain non-banks as *Systemically Important Financial Institutions (SIFI)* based on the level of risk they pose to the financial system.

Applicability: US and Non-US Entities

In general, the Dodd-Frank Act is applicable to all US citizens and entities related to US persons who participate in financial markets. In case of cross-border transactions and non-US entities, the act prescribes detailed criteria on the applicability of the law. In general, the law is applicable to all non-US citizens or entities that deal with a US citizen or that operate in a US swap market with certain threshold of swap activity.

The act provides detailed definitions of US citizens, non-US citizens, and the thresholds of swap activity and all other details.

Dodd-Frank and Global Reforms

As a consequence of the 2007 financial crises, G20 countries are committed to implementing regulatory reforms that are in line with the Dodd-Frank Act to promote the stability of the global financial system and to ensure no regulatory arbitrage.

The *Financial Stability Board (FSB), an international body working to promote financial stability,* is taking the lead to coordinate the world's major markets in order to bring their national level regulatory frameworks into line with each other. The FSB's *OTC Derivatives Working Group* is responsible for providing recommendations and monitoring implementations.

The core principles agreed by these G20 countries are *to improve transparency in the derivatives markets, mitigate systemic risk, protect against market abuse, standardize certain OTC derivatives, mandate trading on exchanges or electronic trading platforms where appropriate, mandate the central clearing of standard products, and transaction reporting to trade repositories*. Furthermore, G20 countries have agreed on enforcing *higher capital requirements for non-centrally cleared contracts*.

In addition, agreements included that trade repositories should be subject to robust and consistently applied supervision, oversight, and regulatory standards that, at a minimum, meet evolving international standards developed jointly by *the Committee on Payment and Settlement Systems (CPSS)* and *the International Organization of Securities Commissions (IOSCO)*.

Next to Dodd-Frank, the major market reform regulations are EMIR and MiFID II in the European Union. Although EMIR is already effective, MiFID II is only going to be effective from sometime in 2015.

Global firms trading derivatives in multiple jurisdictions must understand regulatory requirements in both regions they operate out of separately and comply with any regulations that may apply. Although the overall objectives of these reforms are similar, the detailed requirements and implementations are not the same. For instance, the reporting requirements detailed under the EMIR are not same as under Dodd-Frank. It follows that the firms must comply with each jurisdiction separately.

Note *The Group of Twenty (G20)* is the premier forum for international cooperation on the most critical issues of the global economic and financial agenda. The G20 brings together finance ministers and central bank governors from 19 countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States of America, and the European Union, which is represented by the president of the European Council and by the head of the European Central Bank. For more details visit www.g20.org/.

FSB: To learn more about FSB, visit www.financialstabilityboard.org/about/history.htm.

CPSS: CPSS is a standard setting body for payment, clearing, and securities settlement systems. To learn more about CPSS, visit http://www.bis.org/cpss/index.htm.

IOSCO: IOSCO is a recognized global standards setting body for the securities sector. It is working intensively with the G20 and FSB on the global regulatory reform agenda. To learn more, visit www.iosco.com.

EMIR

The European Market Infrastructure Regulation (EMIR) is the European Union (EU) regulation that is similar to its Dodd-Frank US counterpart. The European Union (EU) has introduced OTC derivatives market reforms through the EMIR and MiFID II (*explained in the next section)*.

In addition to EU swap market participants, the EMIR also applies to any entity established in the EU that has entered into (or is a legal counterparty to) a derivatives contract, and applies indirectly to non-EU counterparties that are trading with EU parties.

Similar to Dodd-Frank, EMIR's focus remains on the central clearing of certain OTC derivatives, stringent risk mitigation techniques for non-centrally cleared OTC derivatives, reporting to trade repositories, application of organization, conduct of business and prudential requirements for DCOs, and application of requirements for trade repositories—including the duty to make certain data available to the public and the relevant authorities. However, the implementation details of EMIR are different from Dodd-Frank.

Note To learn more about EMIR, visit www.esma.europa.eu/page/European-Market-Infrastructure-Regulation-EMIR.

MiFID II

In October 2011, the European Commission (EC) released its proposal to amend and extend the current *Markets in Financial Instrument Directive (MiFID)*; it is referred to as *MiFID II*. This is expected to be effective beginning sometime in 2015.

In addition to revising the initial MiFID, MiFID II introduces a range of measures that seek to address issues raised by the financial crisis. These measures include improving investor protection as well as the commitments made by the G20 to improve the transparency and regulation of the more opaque markets, such as derivatives.

This reform covers broader financial markets, including derivatives. In respect to derivatives reform, MiFID II introduces derivatives execution requirements, reporting requirements, market structure rules, and other requirements. In summary, MiFID II is expected to fill the gaps between EMIR and Dodd-Frank, eventually leading a well-regulated financial system across the EU and in line with global reforms.

Basel II and Basel III

The Basel II accord was introduced in 2004 by the *Basel Committee on Banking Supervision (BCBS)*. It recommends rules for enhancing credit risk measures, extending the scope of capital requirements to operational risk, providing various enhancements to the earlier accord (Basel I), and detailing the supervision and market discipline. The Basel II is essentially composed of three pillars: *minimum capital requirements, supervisory review process, and market discipline*.

The Basel III is the latest version, revising Basel II, introduced by the BCBS. After the 2008 financial crisis, the accord was drastically revised in respect to the various risk management aspects of the banking sector. In 2012, Basel III officially replaced Basel II.

Basel III is a comprehensive set of reform measures introduced to strengthen the regulation, supervision, and risk management of the banking sector. The key aspects of Basel III are increased quality, consistency, and transparency of the capital base, framework to promote more resilient banks with countercyclical capital buffers, enhanced risk-based framework with leverage ratio, and a new global liquidity standard.

Note The initial accord (Basel I) was defined by a group of regulators in Basel at the Bank for International Settlements (BIS), Switzerland, hence the name *Basel Accord*. To learn more about Basel III, visit `www.bis.org/bcbs/basel3.htm`.

Summary

The Dodd-Frank Act is the most substantive reform of the US financial system. It introduces many rules touching various parts of the financial system. This chapter provided a summary of overall reforms and thoroughly discussed the reform of derivatives business, which was covered under Title VII. In general, the Dodd-Frank Act imposes more stringent regulatory requirements on the larger financial institutions and critical market players, such as central clearing agencies, to reduce systemic risk.

The major areas related to derivatives impacted by the act are derivative product classification, trade execution via SEFs, central clearing mandate of standard swaps, MSP regulations (capital, liquidity, and leverage standards), and transaction reporting to swap data repositories.

Finally, this chapter briefly discussed global market reforms such as EMIR, MiFID II, and Basel III.

This chapter concludes Part II of this book, concerned with market structure. Part III drills down into the contract life cycle.

PART

III

Contract Life Cycle

CHAPTER

10

The Derivatives Contract Life Cycle

For any organization involved in derivatives, managing derivative contracts is the most important operational task. You have seen how important the effective management of a contract is to avoiding operational failures that may cause serious financial and reputation damages to the firm. To manage the contract successfully, a thorough understanding of the contract life cycle and underlying processes and procedures is essential.

Part I of the book briefly introduced the derivatives contract and the life cycles of the three major types of contracts. Part II and this opening chapter in particular provide thorough descriptions of the general and type-specific derivatives contract life cycles.

This chapter divides derivative contracts into three major categories from the lifecycle perspective: listed, OTC cleared, and OTC bilateral. It divides the contract life cycle into five major phases and explains each phase in general terms. Finally, it explains the settlement process of a derivatives transaction and related concepts. This chapter is the foundation for the following chapters of Part II, each of which treats the life cycle of a different type of derivatives contract. These topics are essential for gaining an understanding of the management of derivative contracts.

The objectives of this chapter are to

- understand the market-wide contract workflow from origination to settlement
- explain the contract workflow of listed, OTC cleared, and OTC bilateral contracts
- discuss each phase of the life of a derivatives contract in detail
- understand the settlement process of derivative transactions
- understand various operations and events that impact contracts

The Contract Life Cycle

Part I introduced the big picture of derivatives market including the basics of the derivatives contract and life cycle. It briefly explained characteristics of a contract and various phases in the contract life in general terms. This chapter will take you deeper into the contract life cycle. The following sections explain various phases of contract and activities involved in each phase.

Phases

The life of a derivative contract can be broadly divided into five major phases. Figure 10-1 shows different phases and various activities in each phase.

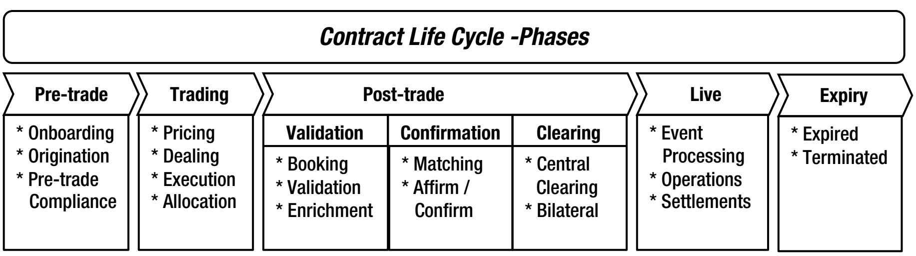

Figure 10-1. The phases of the contract life cycle

Chapter 4 defined each phase and related terms. The following sections further explain the different phases of the derivatives contract life cycle.

Onboarding

Onboarding is the process of establishing a legal relationship between trading counterparties and other institutions that support derivatives business. Buy-side firms most often use broker–dealer (sell-side) firms for trade execution, clearing, and other services in both listed and OTC markets. Large firms may trade directly on exchanges.

Before trading, a buy-side firm establishes an account with a sell-side firm and, in turn, with an exchange and a clearinghouse. An account is established by executing various standard agreements. Buy-side firms also enter into similar agreements with other servicing firms. Buy-side firms commonly use multiple sell-side firms for the same or different services. In such cases, they establish an appropriate legal relationship with each sell-side firm they work with.

The sell-side firms are required to obtain licenses and sign legal agreements with exchanges, clearinghouses, and regulatory agencies that govern the business services they provide. In addition, they also execute legal agreements with various service providers.

The onboarding process is also known as *account setup* or *documentation*. Normally, legal and compliance departments are responsible for the onboarding process.

As discussed earlier, the derivatives market is divided into two major submarkets—listed and OTC. The legal framework of these markets is explained below.

Listed Markets

In listed markets, legal procedures are defined and maintained by industry associations with the help of an exchange clearinghouse and regulatory bodies. Through a *give-up agreement*, a buy-side firm legally appoints the broker-dealer to trade and perform other activities (such as clearing) on its behalf. The give-up agreement, with other standard agreements, establishes the complete trading relationship. Some of the key roles defined through these agreements are the following:

Customer/client. Buy-side firm that is trading.

Trader. Sell-side firm representing the customer.

Clearing broker (CB) / clearing member (CM) / futures commission merchant (FCM). Sell-side or specialized firm that is a member of clearinghouse and provides the clearing services to its customers.

Executing broker (EB). Sell-side firm that executes trades in the marketplace for its customers either on an exchange or in the OTC market.

Carrying broker. An institution (broker) that maintains the customer's account but is not a member of a clearinghouse. A carrying broker is distinct from a clearing broker in that a carrying broker eventually uses a clearing broker to clear trades with a clearinghouse.

Although these services are sometimes provided by different sell-side firms, usually a single sell-side firm plays multiple roles providing full service to its customers. The give-up agreement essentially defines the order acceptance, trade routing, and compensation protocols between the executing broker, client, and carrying broker.

Every client executes an *Exchange User License Agreement* (EULA) in order to register with an exchange.

In the case of a direct account with an exchange, clients execute agreements with an exchange and clearinghouse directly. There are no brokers involved in such cases.

Each exchange defines and maintains rules and procedures on membership, trading, clearing, delivery, and all other topics. The exchange's rule book works as master reference for details on all procedures and processes including clearing process. This can be a great resource for understanding the market and procedures. Most exchanges provide online access to this document. Table 10-1 provides links to the rule books of some popular derivative exchanges.

Table 10-1. Links to the Rule Books of Some Popular Exchanges and/or Clearinghouses

Exchange	Rule Book Link
CME	www.cmegroup.com/rulebook/CME/
ICE Futures US—Listed Products	www.theice.com/Rulebook.shtml?futuresUSRulebook=
ICE Clear Europe	www.theice.com/Rulebook.shtml
LCH Clearnet	http://www.lchclearnet.com/rules_and_regulations/ltd/

OTC Markets

In OTC markets, an ISDA Master Agreement fulfills most of the legal requirements. *International Swaps and Derivatives Association* (ISDA) is a trade association for participants in the OTC market. ISDA provides a standardized Master Agreement to establish the uniform trading environment. The Master

Agreement contains general terms, conditions, and overall parameters of trading activity that apply to all OTC transactions. Various provisions in this agreement cover matters such as payment netting, tax withholding rules, tax representations, basic covenants, events of default, and termination terms. Another important document used by participants is the *Credit Support Annex* (CSA), which establishes counterparty credit lines, trading limits, and collateral management rules.

All OTC market participants sign these agreements with their counterparties before executing a trade. During onboarding, other local legal regulatory procedures, such as *Know Your Client* (KYC), *Anti-Money Laundering* (AML), and *Markets in Financial Instruments Directive* (MiFID), are followed.

However, cleared product trading requires different sets of legal agreements with clearing member firms and clearinghouses. In some cases, they could be merged with listed market agreements. In addition, market reforms (Dodd-Frank, EMIR, and other) require all OTC market participants to register with regulatory agencies. More details on this topic are available in Chapter 9.

Contract Documentation Management

Although many operations are electronic, legal documents such as trading agreements, other signed contracts, certain trade confirmations, and collateral certificates are all maintained and transferred between entities in paper form. These documents are stored and managed by custodians or by the trading partners themselves.

Order Origination

As discussed earlier, derivatives are traded either for hedging or for profit making. A portfolio or asset management group, which is responsible for managing a firm's portfolios, usually makes trading decisions. After the derivatives trading decision is made, an order is created and sent to the front office (buy-side trader) to execute the trade. Usually, mid- to large-size firms maintain an order book (order management system) to track orders. Orders are usually required to pass control and compliance checks, and they must be approved before sent for execution. Risk and compliance departments typically govern the overall order approval process. Internal controls may vary by firm, based on the nature and size of each firm's business and applicable regulatory laws.

Pre-Trade Compliance

Pre-trade compliance is the process of monitoring and enforcing rules that are intended to protect the firm from any internal and regulatory violations before an order is executed. These rules may include internal checks and balances established to manage operations risk, regulatory rules, trading limits, credit limits, and other such controls. These checks may be separate or combined with checks performed during the order origination process.

Similarly, the executing broker and trading venues may check trading limits before executing a client's orders. In addition, executing brokers, exchanges, and electronic trading platforms must comply with regulations enforced by market regulators.

Pricing

Pricing is the process of finding a fair price for a derivatives contract. Listed products are more liquid, and their market prices are readily available from exchanges, which are usually considered a fair price. The price of listed derivatives is driven primarily by market demand and supply. Market quotes are published by all trading venues. The market quote includes current trading details such as the bid, ask, and last trading price.

Liquid OTC product prices behave very similarly to listed products. In the non-liquid OTC market (exotics, customized deals), however, the negotiation process takes place by telephone, emails, and/or electronic trading platforms. During this process, traders compare quotes from several counterparties (dealers) including the prices derived using their own pricing models (mathematical models).

Erroneous models and/or inputs (parameter values) to these models may lead to misleading prices, and trading based on such prices may lead to financial losses. The underlying models and data, therefore, play a major role in OTC markets. Potential risk from such models is known as *model risk*.

Mark-to-model valuing derivative contracts using a theoretical model.

Dealing and Trade Execution

Execution is the process of two parties agreeing to enter into a contract. In the case of electronic execution, this process involves matching the orders of a buyer and seller and generating the execution agreement. Orders are automatically matched and executed by systems employed by execution service (exchanges and other platforms). However, the manual trading involves two steps:

1. **Dealing or negotiation.** This finds the best price at which two parties are willing to execute a trade.
2. **Execution.** This generates an initial agreement (also known as *execution agreement*, *execution*, or *fill*) between two parties to enter into contract.

Dealing

During *dealing*, each party's objective is to find the best possible price. Traders may check different venues or negotiate with dealers to obtain the best price. In the listed market, prices are streamed through market data sources. Traders participate in bidding or execute the trade at the best price available on the market.

On exchanges, most trades are executed by electronic matching systems. However, some exchanges still operate trading floors with an Open-Outcry model. This involves traders from member firms executing orders through an organized auction process. In the OTC bilateral market, traders from both sides negotiate directly and execute the trade. In OTC markets, however, prices for popular instruments are available through electronic trading platforms. For other OTC products, traders negotiate with multiple dealers using various communication channels such as telephone, fax, and email to obtain the best prices.

Derivatives market participants use various trading platforms to execute trades. The following is a list of some common platforms:

- Exchanges
- Traditional channels using telephone, fax, and email
- Single dealer electronic platform
- Multi-dealer electronic platform
- Swap execution facility
- Dealer-to-dealer networks

Request for quote (RFQ): a request made by a client to a dealer for a quote in order to trade a specific instrument

Indicative prices: quotes published by dealers through certain channels that are subject to approval. These prices are not final.

Indication of interest (IOI): a statement of interest submitted by the client in order to trade a certain instrument

Liquidity pool: another name for an electronic trading platform

---

Entities on Contract

Each contract has two trading partners but may involve other entities. The other entities that may be involved are the following:

Client. Owner of the contract and the first trading partner.

Counterparty. The other trading partner. In case of centrally cleared trades, the counterparty of the client is a CCP or clearing broker. In case of bilateral trades, the counterparty may be a broker-dealer firm or another end client.

Executing broker. The firm that executed the trade in the case of broker-arranged trades.

Clearing member. In the case of listed and cleared trades, a member firm that mediates between the end-client and the clearinghouse. The clearing member is also known as the *Futures Commission Merchant* (FCM), *Designated Clearing Member* (DCM), *Clearing Broker* (CB), or *Clearing Firm* (CF).

Clearinghouse. In the case of listed and cleared trades, the clearinghouse is the central counterparty (CCP) that clears the contract.

Execution Models

The derivatives market is complex and several players are involved in trade execution in different capacities. Derivative trades are executed in several different ways. Various execution models are listed below:

Exchange-traded. Execution of listed derivatives through an executing broker (anonymous markets).

Bilateral OTC-cleared derivatives (non-exchange). Maintains anonymity between the clearing member and the executing counterparty.

Trilateral OTC-cleared derivatives. No anonymity for any party. The clearing member sets the execution limits of executing counterparty. Cleared derivative trade executions involve trading platforms, swap execution facilities (SEF), organized trading facilities (OTF), and manual negotiation and submission for clearing.

OTC bilateral (non-cleared). These trades are negotiated directly between counterparties. Usually, broker-dealer firms act as the counterparty to clients. Negotiation may take place directly between two counterparties through traditional channels or by using an electronic trading platform.

Prime broker execution. The derivatives prime broker acts as the principal intermediary but not as a clearing member. There is no anonymity, and the prime broker sets the executing limits of executing counterparty.

Exchange products traded off-exchange. Some listed products are traded on electronic networks in addition to exchanges to provide additional liquidity.

Direct market access (DMA). End clients execute their orders on a wide range of exchanges and ECNs through a single DMA platform. DMA platform provides a single interface to its clients.

The following sections explain each of these models in detail.

Exchange Trading

Only exchange members are allowed to trade on an exchange. Major participants on an exchange are executing brokers (dealers) who represent their clients. Some large clients also have exchange memberships and trade directly on an exchange. Most buy-side firms use dealers to trade listed products.

Exchange products are cleared through a designated clearinghouse. Listed and OTC cleared contracts are cleared through a member of a clearinghouse. As explained earlier, these members are known as *clearing members* or Futures Commission Merchants (FCMs). Clients clear their contracts through their clearing member.

In this model, counterparties of a trade remain unknown to each other. At the end of the clearing, both parties contract with the clearinghouse through a clearing member instead of with each other—in other words, they both "face" the clearinghouse as counterparties. Figure 10-2 shows the market structure and general flow of exchange trading. There might be some variations in certain situations. For instance, dealers may directly execute proprietary trades on their own accounts on exchanges and clear with a clearinghouse.

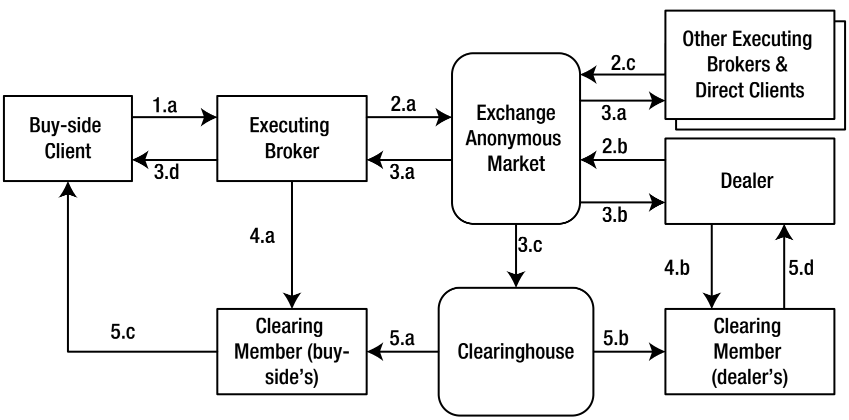

Figure 10-2. Exchange trading model

The following steps are involved in exchange trading:

1. Buy-side firms send orders to their executing brokers.
2. All exchange participants send their orders to an exchange.

3. Matched (executed orders) trades (referred to as *trades* instead of *orders* from this point on) are sent to both counterparties and to the clearinghouse by the exchange. Counterparty information is not disclosed. Only the execution confirmation is sent, and the exchange guarantees the trade.
4. Through a give-up agreement, clearing members will become representatives of the trade in the clearinghouse.
5. Once all parties agree and trade details are matched, the trade will be cleared and the status will be sent to clearing members and, in turn, to end-clients.

Bilateral (Direct) OTC-Cleared (Anonymous)

Clearable OTC derivatives are typically executed on electronic trading platforms such as SEF. In cleared trades, counterparties of the trade could both be end-clients, both be dealers, or one of them be an end-client and the other be a dealer. Figure 10-3 shows their market structure and flow.

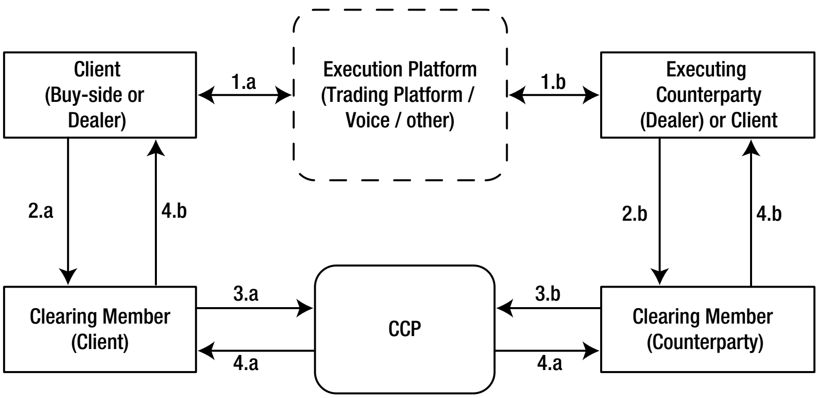

Figure 10-3. OTC cleared trading execution model

The following steps are involved in a bilateral OTC-cleared trading model:

1. The trade is executed between a client and another market participant (usually the dealer) over an electronic trading platform or by voice brokering.
2. Both parties on the execution platform submit the trade to their corresponding clearing members.

3. Upon approval of the clearing member, the trade is submitted to the CCP for the clearing.

4. Upon approval of the CCP, the trade is cleared and the status is sent back to all parties.

In this model, the executing counterparty and client "face" each other until the trade is cleared by CCP. The trade may not be accepted by their corresponding clearing members or may not be cleared by the CCP. There is no prior limit check unless both participants perform checks on their own (hence anonymously). If the clearing fails, trade validity depends on their prior agreement. As a result,, there is a counterparty risk in this model.

Trilateral OTC-Cleared (Non-Anonymous)

This model is similar to a bilateral OTC-cleared trading. In this model, the clearing member assigns the trading limits to each executing counterparty (usually a dealer). The trade is executed only if the executing counterparty is within its trading limits. In this circumstance, both trade counterparties are known, and there is no anonymity.

Clearable OTC derivatives can be executed on electronic trading platforms such as SEF and OTF. Figure 10-4 shows their market structure and flow.

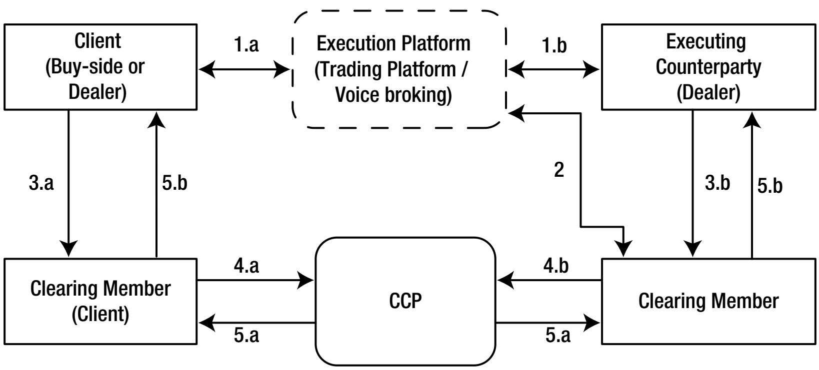

Figure 10-4. Cleared trilateral execution model

The following steps are involved in a trilateral OTC-cleared trade:

1. Client order is submitted to electronic trading platform.

2. Typically electronic trading platform validates the trading limits of executing counterparty (dealer) before trade is executed.

3. Both parties submit the trade to their corresponding clearing members.
4. The client's clearing member verifies the trading limits of the executing counterparty, if it has not already been done.
5. If within limits, the clearing member submits the trade to the CCP for clearing.
6. Upon approval of the CCP, the trade is cleared and the status is sent to all parties.

OTC Bilateral

In traditional OTC markets, trade execution takes place directly between two parties (client and dealer, or dealer and dealer) or through an execution broker (aptly named an *execution-only broker*). They may use traditional voice brokering (telephones, email, or fax) or an electronic trading platform to execute the trade. If an execution broker arranges execution, one or both parties may be charged a commission. Ultimately, the executing broker will exit, and both counterparties "face" each other.

Figure 10-5 illustrates the execution model with an execution broker.

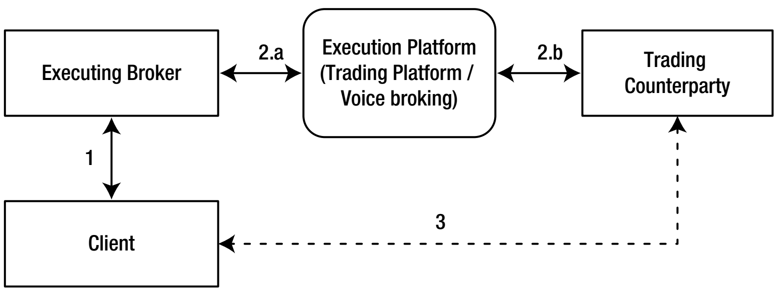

Figure 10-5. OTC bilateral with an executing broker model

The following steps are involved:

1. The client sends the order to the executing broker.
2. The executing broker executes the trade at the best price either on a trading venue or by manually matching with another order from another client.
3. Eventually, contract will be between client and trading counterparty both facing each other.

Figure 10-6 illustrates the execution model without an execution broker.

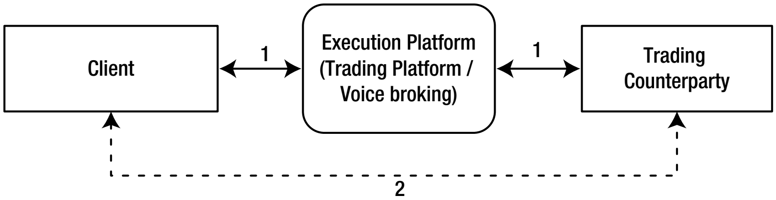

Figure 10-6. OTC bilateral unbrokered model

If no broker is involved in the trade, it is only a one-step execution.

1. The client sends the Request for Quote (RFQ) to multiple dealers. The trade is executed with one of the selected dealers or with the counterparty (market maker) at published prices. Eventually, the contract will be between the client and the trading counterparty.

Prime-Brokered Trading

A prime broker in the OTC market provides various services to its clients. More on the prime broker role can be found in the Chapter 5. A prime broker maintains a legal relationship with multiple dealers and acts as a central service agent to its clients. After an initial trade agreement (execution), the client and the executing counterparty both notify the prime broker.

The prime broker may accept or reject a trade. The prime broker may check executing counterparty limits and trade details before accepting a trade. If the prime broker accepts the trade, the execution is completed. In this case, both parties face the prime broker instead of each other. Consequently, the prime broker assumes counterparty risk from both parties, and both parties assume the prime broker's counterparty risk. The prime broker does not, however, act as a CCP, but rather as an entity providing a service. The prime broker remains between two counterparties, with the hope of avoiding most of the risk through back-to-back trades. Because the prime broker enters into back-to-back trades simultaneously, market risk is avoided; however, counterparty risk remains for both parties.

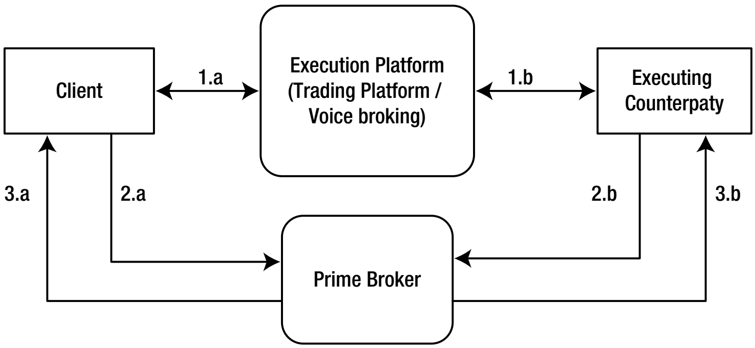

Figure 10-7. Prime-brokered trading model

1. Both counterparties (client and executing counterparty/dealer) execute the trade.
2. Both parties transfer execution details to prime broker.
3. Prime broker accepts the trade and establishes two trades, one with each party.

The process of transferring the trade to prime broker is known as *give-up*, and the trades involving the prime broker are known as *back-to-back trades*. If the prime broker rejects the trade, the trade may become invalid, based on the prior agreement between trading partners. These and other details are usually covered in the master agreement established between the counterparties.

Direct Market Access

Many execution brokers (sell-side) provide electronic platforms to their clients to access wide range of exchanges and ECN markets. Over *direct market access* (DMA) platform, end-clients can submit their orders and execute them without a sell-side trader intervention. In addition, DMA network provides access to a large number of execution venues giving the choice to clients.

Broker Crossing and Market Making

In high-volume trading, an executing brokerage firm may have sufficient order flow from its clients to match and execute without sending orders to an exchange. This is known as *broker crossing* or *agency execution*.

In the case of listed product execution, the executing broker reports the execution to the relevant exchange and clearinghouse for clearing.

Another form of such execution is *market making*. Certain brokers may execute trades for their own account and may, as a consequence, become the counterparty for a client's trade. Relatively quickly they enter into an offsetting trade with another market participant. These trades offset each other, leaving the margin to the execution broker. Such brokers are known as *market makers*. This type of execution is also known as an *internal matched-principal execution*. As explained in Chapter 5, market makers constantly provide quotes to improve the liquidity.

In both cases, the broker must have legal permission from market authorities to engage in this form of trading. There are different laws in different markets governing these trading models. Both models (broker crossing and market making) are quite common in listed and OTC markets.

OTC Negotiation Channels

Traditionally, OTC trade negotiation has been conducted over telephone, email, and fax. These methods may continue to be used, but the introduction of electronic trading platforms is growing and they now provide features that accommodate flexible negotiation models and trade execution features. For example, traders may combine the use of telephone and electronic platforms in order to negotiate a deal, or they may use RFQ features that replicate a typical telephone conversation model. The execution can be recorded over an electronic platform to accommodate *straight through processing* (STP). This increases efficiency and adds value to the whole process.

The trading platform also provides streaming quotes from dealers on liquid products. Clients can use electronic platforms to view quotes from multiple dealers and choose the dealer to execute the trade. This model, which has the benefit of efficient, electronic transmission of information, is widely used in credit and FX derivative markets and is spreading across other markets.

Figure 10-8 shows the workflow between client and executing counterparty via execution platform, either traditional or electronic.

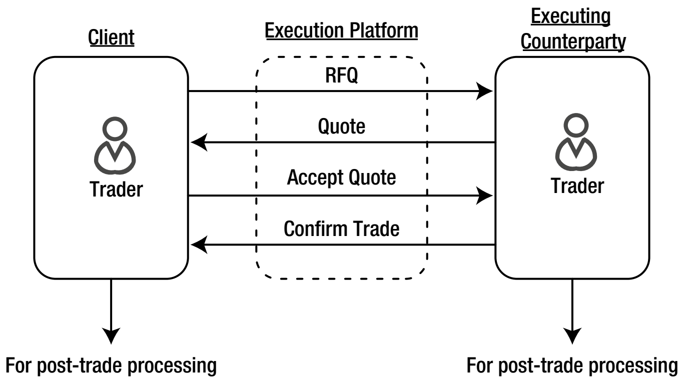

Figure 10-8. OTC trade negotiation model

Allocation and Block Trades

Allocation is the process of assigning a trade to a legal entity or to a sub-account of a legal entity. Allocation is necessary before the confirmation process can begin. In the case of single legal entity firms, trades are allocated to the entity by default in a potentially seamless manner.

There are two points at which allocation can take place: pre-trade and post-trade. In pre-trade allocation, entities (sub-accounts) and allocated quantity information are sent to an executing counterparty along with the quote request. In the case of post-trade allocation, allocation information is sent after the trade is executed. In either case, allocation is a mandatory prerequisite for confirmation. In the case of electronic trading, allocation information is sent by an electronic channel to enable faster STP.

It is common for mid- to large-size organizations to trade on behalf of multiple legal entities. Trades that cover multiple trading entities (or sub-accounts) or of large size are known as *block trades*. Normally, a block trade is a privately negotiated transaction. The buyer and seller agree upon the price and quantity of the trade, either bilaterally or over an electronic trading platform other than an exchange.

The allocation process is sometimes considered to be part of post-trade processing. Regardless, in the derivatives world, allocation is usually conducted at the time of execution, and confirmation does not begin until allocation is complete. In addition, some OTC instrument pricing depends on the legal entity requesting the quote. In such cases, pre-trade allocation becomes essential.

Another point to note is that with allocation being the initial step of post-trade processing, it is done at the earliest possible time, if not actually prior to the execution.

Execution brokers combine multiple client orders with proprietary orders and send to the exchange for execution. In such case, regulations stipulate certain rules for allocation to promote fair practices. These rules vary by market. For instance, the *National Futures Association* (NFA) regulates listed market product allocation processes.

Trade Booking and Trade Capture

Trade booking is the process of entering trade details into a trade management system or trade processing system, immediately after execution. This process is also known as *trade capture, deal capture, trade booking,* or simply *booking*.

In the case of a traditional execution platform, trades are manually entered into the system. This is usually done by trading assistants or operations personnel. Traders may forward the trade information in electronic (email) or paper form (fax or any other form that is used during the negotiation phase). Trade entry personnel enter the trade into a system used by the organization to process trade and manage contracts. Trade entry is the first step in post-trade processing.

In electronic markets, it is possible that *order management systems* (OMSs) are directly linked to an execution platform or the executing broker's systems, and the execution information may flow into the organization's trade management system electronically. This eliminates the need for manual entry and may in turn avoid any potential errors as well as enabling STP.

After trade capture, each trade is given a unique number known as a *ticket number* or *trade number*, which may be used to refer to the trade throughout post-trade processing.

A trade is usually captured only once and then flows electronically into the firm's other data systems, including the *accounting, risk management*, and *collateral management systems*.

Trade Validation and Enrichment

After execution details are captured, these details must be validated and the trade must pass internal checks and balances. The validation process includes trade economic data, dates, counterparty information, and the cash-flow schedule. The validated trade is enriched with additional information based on needs of the organization. These details usually include accounting classification, program name or strategy, and portfolio information. Some of this additional information is necessary; other details help to achieve STP. The trade's adherence to compliance rules may also be verified.

Other terms used to refer this process are *economic affirmation* and *trade verification*.

Confirmation and Affirmation Platforms

Confirmation entails both parties' official agreement to the trade terms. Once confirmed, the contract is legally binding between both parties.

Confirmation is a two-step process. The first step is trade matching, and the second step is the legal confirmation. During the matching process, both contracts are compared to guarantee that there are no differences in the two parties' contract terms. Contract terms include financial details, dates, cash flow, and other nonfinancial details. This step corrects any errors occurred in the trade capture. Legal confirmation is the notification of the final trade agreement.

Confirmation is a critical step in post-trade processing. It enables the trade to become a live contract. There have been significant changes in this process in the last decade, such as the introduction of *electronic affirmation platforms* and *Same-Day Affirmation* (SDA).

In exchange trading, both parties submit their trades to an exchange (central matching confirmation system) and receive confirmation if the trade is matched. In OTC trading, confirmation is arranged either bilaterally or over an affirmation platform. In a bilateral process, both parties communicate directly and confirm the trade. Alternatively, an affirmation platform provides an electronic interface through which trading partners can submit trade details and complete the confirmation.

Electronic systems such as affirmation platforms help to reduce risks and save processing costs and time. In addition, they enable STP by directly sending confirmed trades to clearinghouses, custodians, and regulatory agencies as required.

Any inconsistencies are resolved manually. Exchanges and affirmation platforms provide online systems to accommodate the whole process and resolve any issues. Some affirmation platforms currently used in the derivatives market are *Markit/SERV* (www.markit.com/product/markitserv) and *Omgeo* (www.omgeo.com). Today, most electronic trading systems provide links to these systems to transfer trade details directly after execution.

If any paper documents are involved in the confirmation process, they are transferred between counterparties and preserved on both sides.

The following sections explain various models used by electronic systems to confirm trades.

Central Matching and Confirmation

In the *central matching and confirmation* (or simply, *confirmation*) method, each party submits trade details to an electronic matching system (known as an affirmation or confirmation platform). The matching system compares trade details electronically. If all details are consistent, the system sends the confirmation to both parties. This completes the confirmation process. Figure 10-9 shows the central matching and confirmation process.

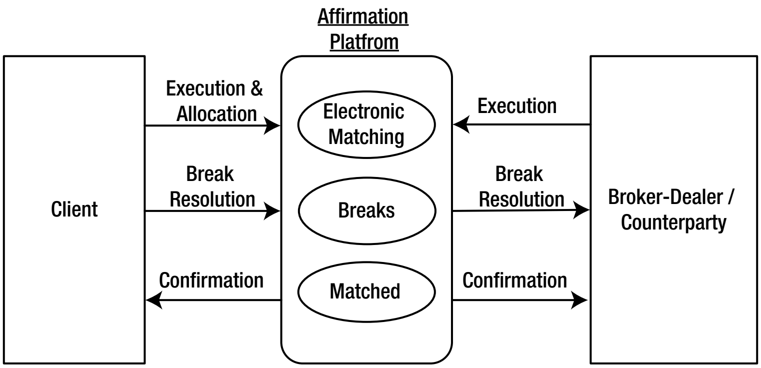

Figure 10-9. Central matching and confirmation

Confirmation through Affirmation

In this model, trade details are loaded onto or sent directly to an affirmation platform by one party, while the other party then views the details to match and affirm. This serves as the final trade confirmation. In most cases, dealers load the execution details, and buy-side clients verify and affirm their trades through the system provided by affirmation platforms, which is mostly a web-based system. Often this process is also referred to by the terms *tie-out* or *alleging trade*. Figure 10-10 illustrates this process.

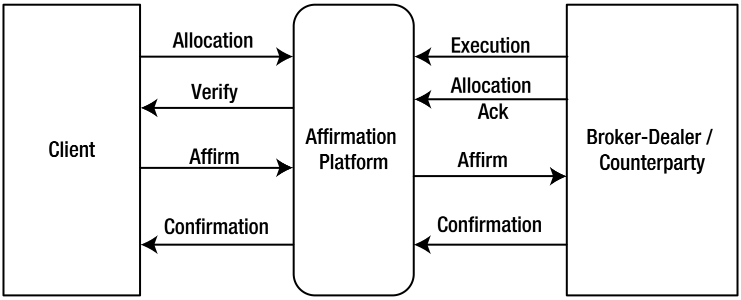

Figure 10-10. Confirmation through affirmation

Traditionally, the affirmation process for OTC bilateral trades has been paper-based. However, the introduction of electronic affirmation platforms is changing this practice, and most OTC trades are now being confirmed on these electronic platforms.

Manual Confirmation Process

In the case of certain bilateral trades, confirmation is still completed manually. This is similar to the affirmation process, but both counterparties communicate directly by fax or email. One party sends the trade details to the other party, who matches the trade details and confirms the trade. These emails or fax messages (signed contracts) are saved as confirmations. Figure 10-11 illustrates the manual confirmation process.

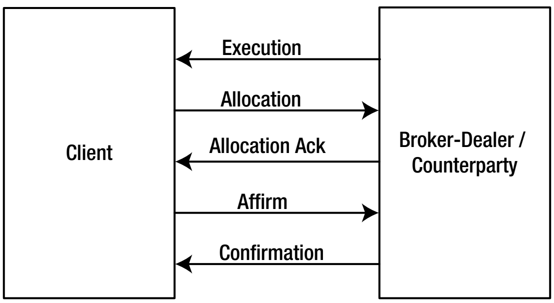

Figure 10-11. Manual confirmation

Clearing

In general, *clearing* is the process of recording the transaction and establishing the legal binding between parties involved in the contract. The clearing process confirms the obligations of each party toward the other. After clearing, the trade becomes a live contract. There are two types of clearing: *central clearing* and *bilateral clearing*. Typically, the *clearing* term is used to refer to *central clearing*.

In central clearing, the agreement between both initial trading partners is transferred to a central counterparty (CCP). The CCP assumes the role of legal counterparty for both original trading partners. Through this arrangement, each party is protected from default by the other party, with the clearinghouse functioning as both the buyer and seller of the contract. That is, the trading parties "face" the clearinghouse instead of each other. The initial relationship between trading partners is discarded after clearing. Figure 10-12 illustrates the clearing process.

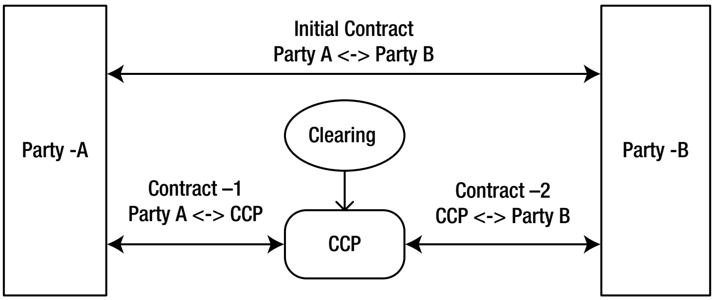

Figure 10-12. Clearing relationships

In the listed derivatives market, an exchange designates the clearinghouse that clears all trades executed on that exchange. Clients use clearing brokers (clearing members) who are members of a clearinghouse to clear their trades with a CCP. Thus, the terms *clearinghouse* and *CCP* are used synonymously.

Clearinghouses and clearing members manage their risk by maintaining the margin collected from contract holders. The margin process will be discussed in detail in Chapter 11.

In bilateral clearing, the initial trading partners face each other. If the trade is not centrally cleared, it is bilateral by default and may not involve a separate step of clearing.

In OTC markets, only limited contracts (instruments) are cleared. These contracts are known as *clearable OTC derivatives* or simply *cleared contracts or cleared swaps*. The clearing service is provided by certain clearinghouses for selected derivative contracts. As a result of recent regulations, the number of clearable OTC contracts is growing and is expected to continue to grow. Further details are available in Chapter 9.

Clearing is also known as *novation* in the context of post-trade processing. In OTC markets, novation is used to refer to the process of transferring an existing bilateral contract to another party. Another term for the same process is *assignment*. You can learn more about these processes in later chapters.

In addition, the term clearing is also used to collectively refer to all post-trade activities.

Cross-Border Clearing

If the trade is cleared by a CCP located in a foreign country, it is known as *cross-border clearing*. Cross-border clearing is normally arranged by a global clearing firm that holds membership in a foreign clearinghouse through a local counterpart.

Live Contract Management

Unlike securities transactions, a derivatives contract is not an asset; rather it is a contractual obligation that is in effect (*live*) for a certain period of time. Trading a derivatives contract is only the beginning of a cycle of obligations. The contract holder is under contractual obligations until the contract expires or is terminated. The contract is a position in a portfolio and carries market value, risk, and reward. After post-trade processing, the contract is live, and the contract-related obligations and risk must be managed.

A live contract creates an open position in a portfolio. Hence, live contracts are also known as *open contracts*. Managing derivative positions is different from managing other financial assets. Managing the contract involves many different tasks, including the following:

- Contract operations
- Amendment or restructure of a contract
- Termination of a contract (partial or full termination)
- Exercise of option contracts
- Assignment or novation (partial or full assignment)
- Event management (processing credit events, corporate actions, and so on)
- Cash-flow processing (processing obligations, both payables and receivables)
- Position and portfolio valuation (mark-to-market, mark-to-model, and so on)
- Margin and collateral management
- Risk management (VaR and other risk factor analysis, scenario testing, stress testing, and so forth)
- Reporting (profit and loss calculations, enterprise risk reporting, market risk, credit risk, regulatory reporting, and so on)
- Portfolio reconciliations (reconciliation of positions with counterparties)

Contract Operations

Live contracts are subject to various operations such as amendment and early termination. The following sections describe these operations.

Amendment or Restructure

Amendment, or *restructuring*, is the process of changing a contract's terms, which may impact the economics of the contract. Amendments are initiated by the mutual agreement of both parties. Listed and cleared products, which are more standardized, cannot be subject to amendment or restructuring operations. However, OTC bilateral contracts are amended from time to time.

Amendment and restructuring send a trade back to the processing stage. After any changes are made to the contract terms, the contract will be validated and returned to the confirmation process (post-trade process) in order to go through the full cycle as if it were a new trade.

Unwind, Close-Out, and Offset

Offset and *unwind* operations will terminate a contract. To terminate a live contract, the client must either make an offset trade (in the case of listed and cleared products) or unwind the position with the original counterparty. This may be permitted based on the terms of the original agreement. Clients are normally required to pay a termination fee to unwind a contract. This is also known as *early termination* or *close-out*. The characteristic of terminating an open contract with another contract is also known as the *fungibility* of contract. For instance, all futures contracts are fungible because an offset trade can terminate them. The termination fee is also known as *close-out payment*.

Partial Unwind

A *partial unwind* operation reduces the notional of a contract. The client can partially unwind a contract with agreement from the counterparty. This operation returns the contract to post-trade processing. Partial unwind can be performed only if permitted by the original contract terms. Listed contracts do not permit the partial unwind of contracts. However, clients can make offsetting trades with a required notional to achieve the effect of a partial unwind after netting. Partial unwinds are common in the bilateral market.

Assignment or Novation

Assignment is the process of one party transferring a contract and its obligations to another party. All future obligations of the contract are transferred from the current contract holder (transferor) to the new party (transferee) entering into the contract. This process is also known as *novation*, *step-out* (from the perspective of the transferor), or *step-in* (from the perspective of the transferee).

Listed contracts do not permit assignment. However, contract holders can close out a position in order to achieve the same effect as assignment. OTC bilateral contracts can be either terminated (unwound) or transferred to another market participant. It is also possible to use assignment to transfer a contract to another counterparty or dealer. In OTC markets, this process is defined by *ISDA novation agreements*. A fundamental requirement for assignment is the agreement of the remaining party. The remaining party may reject the transfer for any number of reasons, including the credit condition of the new party and other terms of the contract.

Note that the term *novation* is also used in clearing. During the clearing stage, it refers to the process of replacing the original contract (execution) between initial trading partners by two separate contracts: first, between the first party and the CCP and second, between the second party and the CCP. *Novation* in this context is not, however, widely used. The term *novation* most commonly refers to the transfer of an OTC contract one party to another.

Exercise

Unlike other types of contracts, an option contract may become eligible for *exercise* at any point in its life or on certain dates based on the option type. The option holder may be required to send notice to exercise an option. Option exercise triggers the settlement of an underlying asset (or obligation).

Valuation

Valuation refers to the determination of a contract's current market value. Each position is *marked-to-market* (MTM) to determine its market value. The market value of liquid instruments is generally obtained from trading venues such as exchanges and trading platforms. However, the fair market value of nonliquid instruments, such as complex OTC instruments, is computed using mathematical models and required market parameters, known as *mark-to-model*. Valuation is also performed at the portfolio level to determine the total market value of a portfolio.

Valuation is a critical task that is necessary in order for investment managers to make any further investment, hedging, or trading decisions.

There are two basic types of valuation based on the time it is performed: *mid-day valuation* and *end-of-day valuation*. If the valuation is performed during business hours using current market prices, it is known as *mid-day valuation, intra-day valuation*, or *snapshot*. If the valuation is performed at the end of the day using official closing prices, it is known as *end-of-day valuation*. End-of-day valuation is final and used for all formal bookkeeping and reporting purposes.

For instance, the value of the simple asset-based contract (future) is the difference between the agreed contract price of the underlying asset and the prevailing price (market price) of the underlying asset.

Cash-Flow Processing

Some derivative contracts have periodic obligations that generate cash flow—for example, coupon payment of IRS and CDS contracts. Typically, at the end of each business day, cash flows due are computed for the following days based on the official market data (interest rates, closing prices, and so on). The resulting flows create settlement instructions, which are sent to back office for further processing. Normally, the generated cash flow undergoes validation and approval before being released to a custodian for final processing.

In general, cash flows are computed in advance to allow sufficient time for the validation process. In addition, all cash flows of each contract are regularly computed for valuation, reporting, and other purposes.

Event Management

There are various events that may affect a contract during its life cycle, such as a credit event of a company, which may impact the contracts on that entity. All such events must be captured and processed to reflect changes in contract positions. These events, including their impact and the affected derivative contract types, are addressed in a later chapter.

Corporate Actions

Corporate actions, such as stock splits, mergers, dividends, and coupons, impact all derivatives linked to those assets. All affected contracts are modified to reflect any changes resulting from such corporate actions.

Reporting

Reporting is another key task to apprise traders, operations teams, middle and senior management, and regulatory departments and agencies of trading activity and position details. Some common reports include the following:

> **Daily trading/transaction report.** Transactions of a given business day by desk, trader, portfolio, and so on.
>
> **Position report.** Complete information about positions, hedges, and so on, that is generated daily.
>
> **Cash-flow report.** Current and upcoming cash flow and details.
>
> **Risk reports.** Various risk factors by different criteria.
>
> **Hedge effectiveness report.** Predicted effectiveness of a hedge if the contract were to be hedged.

All or any of the above reports can also be generated any time during business hours for unofficial review using current marker data. These mid-day reports are known as *flash* or *unofficial* reports.

Risk Management

Although derivatives are used to manage risk, holding a derivatives contract also exposes a firm to various types of risk. Risk management teams periodically assess and monitor these risks. There are two key objectives of risk management in this context: first, to hedge the benefit of holding the contract; second, to monitor and manage risk generated by the contract itself (see Chapter 3).

Firms compute various risk factors during business hours and at the close of the day. Furthermore, the operations risk is managed through certain frameworks.

Margin and Collateral Management

The collateral management function is an integral part of the risk management process. For a buy-side firm, it involves maintaining margin accounts with a clearing member and collateral with counterparties. The clearing member firm maintains clients' and its own collateral at the clearinghouse. Typically, collateral consists of cash and securities that are posted to a margin account or maintained with a custodian.

Collateral management is thoroughly discussed in Chapter 11. At buy-side firms, margin management involves the validating and processing of margin requests from clearing members. Similarly, at clearing member firms, it involves processing margin requests from clearinghouse and generating margin requests to send to end-clients. However, in OTC market, collateral management is a two-way process. It involves managing the counterparties' collateral held by the firm and the firm's collateral held by other counterparties. Basic activities include monitoring counterparty exposure, processing margin calls, generating margin calls, settling collateral funds, and facilitating reconciliation.

Post-Trade Compliance

Post-trade compliance includes checking the compliance with internal investment guidelines, regulatory reporting, and other rules and regulations.

Expiry or End-of-Life

Each derivative contract designates a start date and end date that determine the life span of the contract. Unless a contract is terminated before the stated end date, it expires on its end date, after which the contract is no longer valid and all obligations are terminated.

The trade is reflected in P&L from the start date until the day the contract expires. It is not included in P&L, risk, and other analytics computations from the day after the expiration. The trade is also not included in any of the margin calculations beginning the day after expiration. If there is any initial margin, it is returned to margin account or to the owner directly. The actual day of settlement varies according to contract terms.

For some instruments, expiration may trigger the final settlement. If a final settlement is required, final payments are calculated as of the maturity date and settled per the settlement terms.

The end date is also known as the *maturity date, expiry date,* and *termination date*, depending on the context.

Table 10-2 lists different contract types and how they reach their end-of-life (expiry).

Table 10-2. End-of-Life Processes by Product Type

Type	End-of-Life Processes
Futures	Futures expire on their maturity date. Futures are settled every day in cash. Settlement on the maturity day is final. The client's margin account is credited or debited with settlement amount. If delivery is involved, the delivery process begins on maturity. (See Chapter 12 for more details.)
Options	Options can be exercised at various points of time based on its type, such as anytime during the contract (American), on maturity (European) or at specific dates (Bermudan). If the option is *in-the-money*, the holder can choose whether or not to exercise it. If exercised, the delivery process begins. If it is cash settled, the client's margin account is credited with settlement (See Chapter 13 for more details.)
Forwards	Forwards are custom contracts similar to futures. Cash-settled contracts are settled upon expiration. Any collateral involved is also adjusted. For delivery contracts, the delivery process starts on maturity. (See Chapter 12 for more details.)
Swaps	All flows between parties end upon maturity. If swap is terminated before the stated maturity date, it may involve a termination fee. The terms of some exotic products allow contract termination at certain intervals or in certain conditions, such as predefined credit events. (See Chapters 14 and 15 for more details.)
Credit Products	Upon maturity, credit protection and premiums flow ends. If an eligible credit event occurs before maturity, the contract is settled. If an instrument is associated with a single event (entity), the contract terminates after the credit event. If it is an index instrument, the contract is modified after the initial credit settlement and continues to exist until its original stated end date. Actual details vary by the structure of the product. (See Chapter 16 for more details.)
Other Instruments	For all other instruments, termination rules are defined in the contract terms.

Termination Events

Apart from the scheduled end of life (maturity), contracts are terminated as a result of the following events or operations:

- **Assignment or novation.** Transfer of a contract to another party.
- **Early termination (close-out/unwind).** Any contract with an early termination option can be terminated according to the terms defined in the contract. This usually results in termination fees for one of the contract holders based on the contract value at the time of termination.
- **Offset.** To close a position, the holder can enter into an opposite trade (trade with opposite economic terms) with the intention of offset. This results into a close-out of the open position. For example, in the case of futures, the party that is short can close a position by trading a long position with the same contract terms (expiration date, underlying asset, and so on).
- **Compression.** In compression, opposite trades are eliminated before they actually mature to reduce the overall notional or credit exposure.

Settlement Process

Settlement is the process of fulfilling obligations between parties designated in the contract. It involves the exchange of cash or other types of assets, as dictated by the contract terms. During the life of a derivatives contract, there may be multiple obligations to be fulfilled. Various types of obligations are raised from derivative positions such as principal transfer, periodic obligations, margin call postings, fee payments, and fee. For example, in the case of an interest rate swap, there are a series of interest payment exchanges between both parties until the contract expires.

Contract holders review their portfolios and generate lists of payables and receivables on a daily basis. Each of these items is known as a *settlement instruction* (SI) or *standard settlement instruction* (SSI), discussed in the following section. These settlement instructions are sent to a custodian, who is responsible for processing the actual transfer of assets. The custodian releases the deliverable to the custodian of the counterparty (beneficiary). Asset transfers through SIs are irreversible. This is a critical task and may impact the firm's liquidity. In addition, firms may face fines and reputation damage in case of settlement failures. Accordingly, organizations adopt multi-level verification and approval steps and reconcile settlements on a daily basis.

Common items that generate cash flow and in turn settlements include the following:

- Transactions resulting from daily trading activity, such as premium, principal, and accrual payments, fees from the initiation of a new contract, termination fees, accrual payments, and fees for amending or unwinding live contracts
- Obligations from existing live contracts, such as periodic interest payments and premium payments
- Collateral and margin (both cash and securities) postings in response to margin calls
- Various fee payments such as execution broker fees, clearing fees, and other fees from service providers
- Final settlements in the case of exercise of any options
- Asset delivery resulting from maturing futures and forwards
- Settlements resulting from credit derivatives in case of credit events

Most derivative obligations are settled in cash. However, the physical delivery of securities (stocks and bonds) and commodities are also common assets exchanged between market participants.

Figure 10-13 depicts the relationships and communications among institutions involved in listed and cleared contracts; Figure 10-14 depicts the relationships and communications among institutions involved in bilateral contract transactions. Both figures depict common practice; in certain cases, the relationships and settlement processes may diverge from those shown.

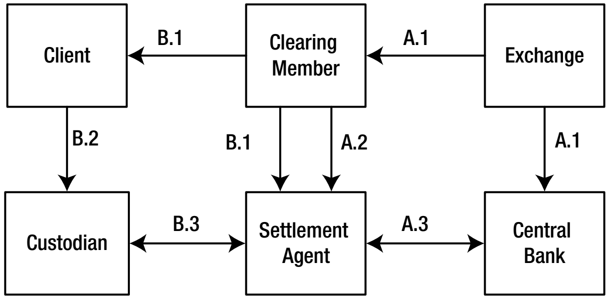

Figure 10-13. Institutional relationships in listed and cleared contract transactions

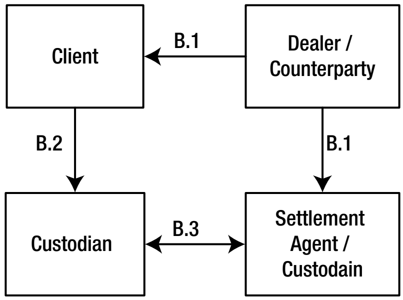

Figure 10-14. Institutional relationships in bilateral contract transactions

In the general case (noting that SI submission deadlines and settlement timing may vary), the settlement process in the listed and cleared market involves the following steps:

> *Step A-1:* Settlement instructions are sent to a clearing member and central bank from the clearinghouse.
>
> *Step A-2:* The clearing member sends approved SIs to the settlement agent to transfer assets to the clearing-house account.
>
> *Step A-3:* The settlement agent transfers assets to the clearinghouse account in a central bank. In the case of receivables, assets are transferred from a clearing-house account to a settlement agent account.
>
> *Step B-1:* The clearing member sends SIs to its clients.
>
> *Step B-2:* Client validates SIs from clearing member and sends the approved SIs to the custodian.
>
> *Step B-3:* The custodian transfers assets to the settlement agent of a dealer. In the case of receivables, assets are transferred from the settlement agent to a custodian.

Another important task in the settlement process is dispute resolution. Each settlement instruction is validated from both parties, transactions are reconciled, and any disputes are resolved manually.

Settlement Instructions

A *settlement instruction* is a notice generated by a firm to its custodian to advise the custodian to transfer assets (securities) or funds to a trading partner.

Typically, settlement instructions are generated by the middle office and sent to the back office for further processing. Normally, all transactions go through multiple levels of approval before they are released for final processing by custodian.

The settlement instructions are transmitted electronically using the SWIFT messaging platform, detailed in Chapter 18. Typical instructions include information such as the originator and recipient's account details, delivery asset or cash, and other delivery details.

There are two types of settlement instructions: *Delivery versus Payment* (DvP) and *Free of Payment* (FoP) or *Delivery versus Free* (DvF). In the case of DvP, the exchange of assets between two parties happens simultaneously. For instance, cash payment is made only after delivery of securities. In the case of FoP, deliverables are sent to the counterparty irrespective of any receivable.

Settlements of exchange-monitored and OTC transactions are irrevocable. These transactions are usually one of the following types:

- A one-way cash payment, made electronically or physically (check, for example)
- A payment of one currency for the receipt of another currency
- A delivery versus payment or the simultaneous exchange of cash for a security

Settlement Price

The settlement is the official price used for purposes such as the valuation of contracts for settlement, margin calculations, and all official reports. In a listed market, for instance, the settlement price is typically an average of the last few trades of the day. The actual procedure of determining the settlement price varies by exchange and is available to the public. Every day, the clearinghouse publishes the settlement price after the market close.

Reconciliation and Breaks

The actual delivery takes place after the reconciliation of settlement instructions from both parties. Settlement may fail due to various reasons, including non-matching settlement instructions and insufficient funds or assets in the account. Such failures will generate breaks (mismatches). These breaks are resolved manually before reprocessing.

Netting

Transactions between two parties may be netted to reduce the overall amount of the transfer. For example, a clearinghouse nets all client accounts held by a clearing member and generates a single SI.

Multilateral netting allows two parties with numerous transactions between them to settle through a single payment that is net of amounts parties owe to each other.

Netting rules are predefined, and market participants execute *netting agreements* as part of the onboarding process.

Custodian

A *custodian* is usually a bank that holds cash and/or securities on behalf of a trading entity. Custodians deliver and receive assets from other client accounts or custodians on behalf of their client. Custodian services are usually provided by commercial or central banks, as explained in Chapter 5.

In the case of a clearinghouse, central banks generally assume the custodian role. All clearing members initiate payment through their banks. All these banks use a central bank's clearinghouse account to process transactions. Dealers use a settlement agent for custodian services, which is explained in the following section.

Settlement Agent

A *settlement agent* is a servicing institution that provides total settlement services, such as generating settlement instructions from client positions and processing and monitoring the exchange of deliverables.

In the case of dealers, settlement agents usually manage the entire settlement process including determining settlement positions and monitoring the exchange of securities and payments. Settlement agents use private or central banks for fund management.

Global Settlement and Global Custodian

Settlement may also take place between two global entities operating from different countries and using different currencies. Such transactions are processed by a global custodian. A global custodian is usually a financial institution with franchises in different countries.

Products and Settlements

Table 10-3 provides an overview of the settlements generally involved with various product types. The actual settlements may vary by instrument, as there is a variety of payment structures associated with the many instruments.

Table 10-3. Products and Settlements for Various Product Types

Product	Settlements
Futures	On contract initiation, futures require initial margin to be deposited into margin account.
	Futures are settled every day in cash. Settlement on the maturity day is final. The client margin account is credited or debited. If delivery is involved, the underlying is delivered on maturity.
Options	On contract initiation, buyer settles premium payment and option seller deposits required margin.
	Upon maturity, if the option is in-the-money, the holder can choose whether or not to exercise.
	If option is exercised, the delivery process begins. If it is cash settled, the option seller settles the difference with buyer. If it is a delivery, underlying is settled between buyer and seller.
Forwards	Forwards contracts may require independent amount on initiation.
	Cash-settled contracts are settled upon maturity.
	Periodic collateral payments are settled between counterparties.
	For delivery contracts, the underlying is settled between counterparties on maturity.
Swaps	On contract initiation, swaps may require the settlement of independent amount, principal, and any accrual amounts.
	Periodic contractual obligations are settled between counterparties.
	In case of early termination, termination fee is settled.
Credit	On contract initiation, initial premium and any accrual payments are settled.
	Periodic premium is settled.
	In case of credit event, notional is settled as per the contract terms.
Other Settlements	In addition to standard obligation settlements, derivative transactions involve various types of fee, interest payments, collateral exchange, and other settlements.

Life Cycle Comparison

Table 10-4 provides a brief comparison and summary of various aspects of the three major contract categories.

Table 10-4. Comparison and Summary of Various Aspects

	Listed	OTC Cleared	OTC Bilateral
Onboarding Entities Involved	Client, clearing member, clearinghouse, exchange, executing broker, custodian	Client, SEF, clearing member, clearinghouse, servicing firms, custodian	Client, dealers, prime brokers, servicing platforms, custodian
Legal Framework	Regulatory bodies, market associations (for example, CFTC), exchange, clearinghouse driven agreements	Regulatory bodies, market associations (for example, CFTC), exchange, clearinghouse and ISDA driven agreements	Entity registration and mostly ISDA agreements
Negotiation	Mostly electronic platforms connected to exchanges	Authorized swap trading platforms and hybrid form	Voice broking, trading platforms, and hybrid
Execution	Exchange and exchange-designated venues (market makers, electronic trading platform, broker crossing)	Electronic trading platforms	Bilateral voice brokered and trading platforms
Trading Model	Mostly through executing broker	Mostly through executing dealer	Mostly client–broker bilateral or through execution-only broker
Confirmation	Exchange	Affirmation platform	Bilateral and affirmation platform
Clearing	CCP	CCP	Bilateral (no CCP)
Settlement	Daily	Daily (as per product definition)	Periodic settlement as per contract terms
Regulatory Reporting	Yes	Yes	Yes (limited)
Counterparty Risk	Margin account	Margin account	Collateral management
Systemic Risk	Low due to strong clearinghouse risk management policies	Low due to strong clearinghouse risk management policies	High
Termination	Maturity and through offset trade	Maturity and through offset trade	Maturity, early termination, and assignment

Summary

This chapter detailed the derivatives contract life cycle, dividing it into five major phases. This knowledge is essential for anyone directly involved in the derivatives business or supporting derivative businesses.

Various differences among listed and OTC cleared and bilateral contracts were also discussed. Finally, this chapter explained the various deliverables involved in derivatives and settlement process.

This chapter and the next chapter on collateral management serve as the foundation for the remaining chapters of Part II, which delve into specific contract types such as futures, listed options, and OTC cleared and bilateral contracts.

CHAPTER

11

Collateral Management

The collateral management function is an important function in the derivatives business. Collateralization is an essential tool used in counterparty credit risk management. It is used in a number of business areas including derivatives transactions, repurchase agreements, and securities lending.

After the Dodd-Frank Act and similar laws were passed in major derivative markets around the world, new and more stringent collateral management standards have been introduced. According to new regulations, all *central counterparty* (CCP) organizations (clearinghouses) are required to adapt to robust collateral management models to maintain economically strong clearing organizations. The laws also enforce higher collateral requirement standards and other rules for all non-cleared derivative transactions between market participants to protect and promote the safety of all market participants.

This chapter starts with an introduction to the overall collateral management process in the derivatives market. It goes on to explain both the margin management model that is used for listed and cleared products and the counterparty collateral management model used for bilateral transactions, together with the collateral custody model implicit in both those models. Finally, it briefly explains the different aspects of enterprise collateral management—an emerging trend in financial and nonfinancial firms.

This chapter explains the essential principles of collateral management. Following chapters on the life cycles of various product groups provide further details in relation to the different product groups (futures, listed options, OTC cleared, and OTC bilateral).

The objectives of this chapter are to

- understand the use of collateral as a risk management tool in derivative transactions
- discuss new collateral management standards introduced through the Dodd-Frank Act and other similar reforms
- explain the margin model used in listed and cleared derivative transactions
- explain the counterparty collateral management model used in OTC bilateral derivative transactions
- describe the collateral custody model in listed, cleared, and bilateral transactions
- identify the importance and various aspects of enterprise collateral management

Derivatives Collateral Management

Counterparty credit risk is one of the major risk factors in derivatives transactions. Collateralization is a significant credit risk mitigation tool as it provides protection in the event of a default on the transaction. The regulatory reforms including the Dodd-Frank Act and similar reforms around the world introduced the stringent collateral management rules in OTC markets and changed the overall collateral management practices. After reforms, financial institutions and corporations are required to manage their collateral assets better than ever. Especially in the derivatives business, the collateral management function plays a critical role inasmuch as derivative contracts may carry large credit risk (Chapter 3).

The following sections briefly explain some general aspects of collateral management.

Collateral

Collateral describes an asset used to secure some kind of transaction between two parties. In general, the collateral could be any asset—such as cash, securities, or guarantees—that is acceptable by the parties involved in the transaction. In the event of one of the parties' failure to honor obligations, the other party has the right to liquidate the collateral to recover those obligations.

In a financial derivatives transaction, cash and government and high-grade corporate securities are commonly used as collateral assets. ***For simplicity, this chapter treats only cash and securities as collateral.***

The party that pays the collateral is referred to as the *collateral giver, collateral provider, or pledging party*. The party that receives the collateral is referred to as the *collateral holder or collateral taker*. As a result of the current value of the contract, the collateral provider or transferor is obligated by contractual terms to provide sufficient collateral. In such a case, the collateral taker, or transferee, collects the collateral from a counterparty to secure the contract that exists between them.

Credit Exposure

As discussed in Chapter 3, *counterparty exposure* is generally defined as the amount lost in the event of a counterparty defaulting or failing to fulfill obligations. The exposure amount may include components such as the contract replacement cost and potential future exposure. The actual definition of an exposure may include some other parameters and may vary by product type, market, and local law. The assets held as collateral may reduce or cover the total counterparty exposure.

As discussed earlier, derivative contracts can be divided into two major categories based on the exposure: *centrally cleared* and *bilateral*. The major difference between these two categories is the counterparty exposure to the contract holder.

In a centrally cleared contract (*listed and OTC cleared*), the counterparty exposure is concentrated at CCP because all contract holders face a CCP. CCPs employ best collateral management policies that make them strong and sustain severe defaults. The counterparty risk that clients face from a CCP is considerably negligible because of the firm counterpart risk management policies adapted by a CCP.

In a bilateral contract, each party is exposed to the credit risk from the other party of the contract. To mitigate this risk, parties directly collect the collateral from each other.

Actual calculations of exposure and other details are beyond the scope of this book.

Collateral Management Models

In derivatives markets, there are two major *collateral management models* in use. They are the *margin account model,* or simply *margin model*, and the *counterparty collateral management,* or simply *collateral management* model. They are briefly explained below and are thoroughly discussed in later sections.

Margin Management

The margin model is used by CCPs (or clearinghouses) for listed and cleared transactions. This is a one-way model in which collateral is posted only by clients. End-clients post their collateral to clearing members and, in turn, to the CCP.

The margin model in a listed market is old but efficient. By contrast, the margin model for cleared contracts is relatively new and quite similar to a listed market model. The underlying contract valuation models, collateral custody, and other rules are prescribed by the respective regulatory agencies.

Collateral Management

Although the term *collateral management* covers a broader subject, it is commonly used in an OTC bilateral market. In this model, the counterparty with a positive contract value (the party with credit exposure) holds the collateral from the other counterparty. The contract is valuated using method specified in agreement.

This is typically a two-way collateral exchange between counterparties. The collateral management in bilateral markets has been reformed as part of the Dodd-Frank Act, as well as related reforms in global OTC markets. The collateral management in bilateral markets is a two-way direct collateral exchange between counterparties. Moreover, new regulations prescribe various rules to protect the collateral posted by counterparties in bilateral transactions. This model and other regulatory details are discussed in later sections of this chapter.

Note The term *margin* has a different meaning in securities trading than in derivatives trading. In the securities market, *margin* is a borrowed fund (loan) to purchase stock or bond. In the margin account, an account holder can purchase new securities with the loan proceeds using the securities held in that account as collateral. Conversely, in a derivatives market, *margin* is analogous to a performance bond or a security deposit to enter into contract.

Margin Call

A *margin call* is a demand notice from one party to another requesting funds to fulfill the collateral requirement, as per the legal agreement between parties. According to collateral agreement terms, contracts are valuated and margin calls are issued at regular intervals, such as daily or weekly. However, in case of large movements in the contract value due to a volatile market or any other event, a margin call may occur intraday or more frequently than normal. This is referred to as an *intraday margin call*. The date and time at which a contract is valuated and the collateral calculation performed is known as a *valuation date* and *valuation time*.

In derivatives transactions, typically, one margin call per contract is issued with the netted collateral amounts of all transactions. It may even include fees, interest, and other payments.

Regulatory Reforms

Most global listed markets continue to use an existing margin model that is proven to be safe. However, Dodd-Frank and similar regulations have reformed the collateral management practice in OTC cleared and bilateral transactions. Cleared transactions use a standard margin model framework with mechanics that comply with new regulatory requirements.

For bilateral transactions, regulatory rules prescribe collateral eligibility, custody, and the timing of posting and other rules. These reforms mostly focus on swap dealers and major swap participants as they play a major role in the OTC bilateral market.

Collateral Transfer

In general, collateral assets (securities) are transferred in either of two forms: *ownership transfer* or *pledge*. When the collateral is transferred in full ownership from *Party A* to *Party B*, at the time of the return, *Party B* is required to return the same quantity of the same security.

In the other form of transfers, *pledge,* the delivered securities remain the property of the original owner although they are held with the other party. The owner may replace them with a same value asset, as needed. The collateral holding party has the right to dispose of this collateral, but only in case the owner fails to fulfill contractual obligations.

In the case of cash, it is simply transferred from one party to other.

The reinvestment (re-use) rules of the collateral by the collateral receiver—*Party B* in this case—are dictated by applicable regulatory rules.

Margin Model

As explained earlier, after clearing each trade will create two contracts, each between the CCP and original party, simultaneously. These contracts are opposite in nature and are created at the same time. Hence, the market risk from these contracts is virtually eliminated because the change in market value of one contract will be offset by an opposite contract. However, the counterparty risk at CCP remains.

All CCPs (clearinghouses) use the *margin account model,* or simply the *margin model,* for listed and cleared contracts. In this model, the CCP manages counterparty risk mainly by collecting deposit (*initial margin*) for open contracts and daily settlements of the change in the contract value, resulting from market movement (*variation margin*). Thus, at any given point, the exposure from market movements (*market risk*) for the CCP is limited to the contract value change from the last settlement (previous business day). This exposure is expected to be covered from the initial collateral collected from a contract holder in the case of a default.

This is a one-way model where collateral (generally referred to as *margin*) is posted only by clients (*end-clients*). Clients post their collateral to a clearing member and, in turn, the clearing member posts it to the CCP. In cases in which a clearing member owns positions (house accounts), the clearing member becomes the client and is required to post the collateral to the CCP like any other client.

The margin model is defined by the CCPs. The clearinghouse defines the margin requirements, acceptable collateral, and all other rules for each type of a contract that it clears. In listed and cleared markets, the clearing member is known as a *Futures Commission Merchant* (FCM), as explained in Chapter 5.

Minor details of the margin management process vary by each clearinghouse. However, the overall model remains uniform across all clearinghouses. The following sections describe the overall process and essential concepts.

Figure 11-1 shows the key elements and flows of the margin model.

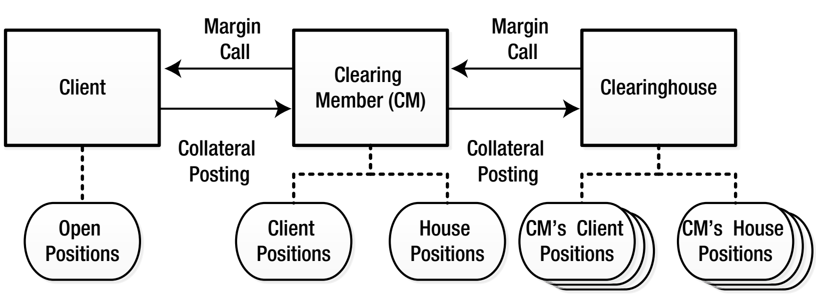

Figure 11-1. Margin model that is used by a clearinghouse

Margining Process

The overall margin process consists of the following steps, detailed in subsequent sections. At the end of each business day, the following steps are performed at a clearinghouse for each clearing member account and similarly at the clearing member firm for each end-client account:

1. **Update positions.** At the end of each business day, each account is updated to reflect new and closed positions and collateral postings.
2. **Valuation (positions and collateral).** All positions and current collateral are evaluated to determine their current market value.
3. **Calculate initial margin.** Required collateral is calculated using a predetermined model.
4. **Calculate variation margin.** The change in market value from the last settlement is calculated for each contract. The result is a *profit or loss (return)* on a contract.
5. **Update margin account.** A margin account is updated to reflect initial margin, variation margin, and other fees to determine the *net account value*.
6. **Margin call.** If the net account value is lower than the required margin, the margin call is issued for an additionally required amount.
7. **Publish market data.** The clearinghouse publishes market data used for valuation and is published to a clearing member and the public.
8. **Reporting.** The clearinghouse and clearing members send margin reports to their clients.

Margin Calls

As explained above, the clearinghouse computes the margin requirements at the end of each business day and sends *margin calls* to its members. Similarly, each clearing member computes the margin requirements for all its clients and sends margin calls. The margin amounts are settled as per the settlement terms. In most cases, they are settled T+0 (same day) or T+1 (next day).

Alternatively, if there is an excess amount in the clearing member's account or in the client accounts, daily reports will reflect those amounts. The account owner is free to withdraw the excess assets.

Intraday Margin Calls

In addition to the daily margin call issued at the end of the day, the clearinghouse (or clearing member) may also send an *intraday margin call* if any account value drops below the threshold due to drastic market changes or other reasons.

Margin Account

A *margin account* is the centerpiece of this model. The clearinghouse maintains the margin account that holds the collateral and daily settlements for positions of a clearing member. For each clearing member, the clearinghouse separates end-client positions and the clearing member's proprietary position into different accounts. This is done to avoid a client collateral leverage by the clearing member.

Similarly, the clearing member (CM) maintains a margin account for each client to manage the collateral and settlements for all positions of that client. Furthermore, non-clearing member firms access a clearinghouse through a clearing member to manage the margin of their clients.

Figure 11-2 shows the overall account structure of a margin model.

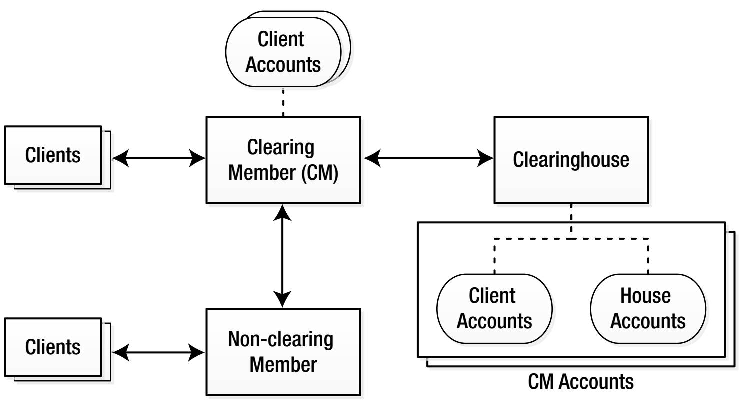

Figure 11-2. Margin account structure

A clearing member can combine all positions of the client into a single account or maintain multiple accounts segregating contracts based on some criteria, such as one account for all those that are listed and another account for cleared contracts. However, this is done in accordance to the applicable regulatory rules.

In general, daily transaction activity that impacts account value includes new positions added to the account and the closing of existing positions, the transaction fee, changes in an open position value, change in collateral value, and new collateral that is posted.

Contract and Collateral Valuation

In a margin model, all open positions are valued using official closing prices determined by a clearinghouse every day. Also, collateral securities are valued using closing prices.

The clearinghouse publishes all official market data such as *closing prices*, *interest rate curves*, and any other parameter used to valuate positions and collateral. This data is used by clearing members and end-clients to value positions and collateral on their end.

Margin Types

There are various components involved in margin flows. Two major components are the *initial deposit*, which is known as the *initial margin*, and returns (profit or loss), which are known as *variation margin*, from the market movements. The following sections explain these margin types and margin account thresholds.

Initial Margin

Listed and cleared contracts require an initial deposit, known as an *initial margin* (IM), from contract participants during the inception of a new contract. This deposit is returned upon maturity or the termination of the contract. The actual deposit amount is specified by a contract or is determined by the clearinghouse rules. Sometimes it is also known as a *good faith deposit,* since it is returnable, or a *performance bond*.

As discussed earlier, the primary objective of IM is to cover change in contract value from the last settlement (the previous business day). So, it is typically a small portion of the contract value. In practice, IM is computed at an aggregate level such as a portfolio of all open positions.

Since the IM is a deposit, the depositor legally owns it. If this deposit is cash, it usually earns a nominal interest. But the clearing member has the right to take possession at any time if the client positions require collateral. Consequently, the clearinghouse has the right to take possession of the clearing member's deposit.

Note that the initial margin set by a clearing member might be more or the same amount as a clearinghouse. This is left up to the clearing member's discretion. However, the clearing member must maintain minimum levels as advised by the clearinghouse.

Variation Margin

At the end of each business day, an open position is marked-to-market and the resulting change in value (profit or loss) is either credited to or debited from the margin account. This change in the value of the contract is known *as the variation margin (VM)*, or variously *variation, settlement variation, or mark-to-market amount.*

Maintenance Margin

The *maintenance margin* is the minimum amount (or threshold) that needs to be maintained in a margin account by the account owner. When the account balance falls below the maintenance margin, the account holder is required to post the collateral to restore the account to the levels of required (initial) margin amount. The amount required to be deposited is also known as the *daily variation margin (DVM)* or simply as the *account variation margin (in the context of an account)*. For instance, assume that the initial margin is $1,000 and the maintenance margin is $600 of the account. If the net account value falls to $500, then the account holder is required to deposit $500 to bring the account balance back up to $1,000.

The minimum amount (maintenance margin) is a certain percentage of the current market value of positions. When a client fails to maintain this level, the holding entity (clearinghouse or clearing member) may immediately liquidate some or all of the client's positions.

Additional Margin

In addition to the regularly required margin (initial margin and variation margin), from time to time a clearinghouse may request additional margin from certain members. This is not common except in certain situations such as stress losses that are larger than the expected thresholds.

Margin Calculation

Each clearinghouse may have different *margin calculation* methods that are explained by the rule book of a clearinghouse. The clearinghouse calculates the value of a position and margin for all its direct members (clearing members). Clearing members use the same market prices to compute client position values and may use a similar margining model used by the clearinghouse. However, overall margining requirements by a clearing member may be higher in certain cases for extra protection.

In the case of listed futures and options, many clearinghouses use the *Standard Portfolio Analysis* (SPAN) method, developed by the Chicago Mercantile Exchange (CME). Essentially, it is a portfolio margining method that computes the margin requirement using the portfolio level risk instead by each contract.

Span To learn more about SPAN, visit www.cmegroup.com/clearing/span-methodology.html.

Reconciliation and Reporting

Daily activity and margin reports are distributed by the clearinghouse to clearing members and the clearing member to end-clients. At the end of each business day, end-clients reconcile their transactions with clearing member reports. Similarly, clearing members reconcile their transactions with the clearinghouse.

Default Handling

Chapter 5 discussed the market players, the CCP role, and *default handling*. The details of the default handling process vary by CCP and applicable regulatory and local laws. The end-client, the clearing member, or both might default. In such situations, the CCP uses funds from liquidating the defaulting client's open positions, collateral being held, funds from the CCP guarantee fund, a credit insurer if any, and equity capital of the CCP until the losses are covered. These resources together will make it easy to cover any potential losses from even reasonably larger defaults. The details of default handling are generally explained in the rule book of each clearinghouse.

Agreements and Documentation

In a listed market, the clearinghouse essentially drives all legal documentation. A clearinghouse provides the license to its members to clear end-client contracts. In addition, the clearinghouse governs the overall margining process of its members. Each end-client enters into an agreement with the clearing member. Furthermore, a clearinghouse may hold details of each end-client for monitoring and other purposes.

In a cleared market, as regulatory requirements vary, CCPs may or may not use the agreement used for the listed market. However, overall legal documentation framework remains the same with rules satisfying regulatory requirements.

Cleared Contracts and Margin Model

Most clearinghouses that clear OTC contracts also clear listed transactions. The margin model used for cleared transactions is similar to the model used for listed transactions. Similar to listed contracts, cleared contracts require an initial margin with the variation margin settled daily. The initial margin for cleared contracts varies by the contract type and the clearinghouse. Moreover, the details of the margin model for OTC cleared contracts are prescribed under the Dodd-Frank Act and similar reforms around the world.

Collateral Management Model

Although collateral management is broadly used to refer to the overall process, it is quite commonly used in the OTC bilateral market. As discussed in the chapter, the Dodd-Frank Act and major global derivative markets have introduced new margin requirements for OTC bilateral contracts. These new standards are more stringent than those that were previously in force on OTC markets.

As opposed to the margin model, the counterparty that is exposed to risk obtains the collateral from the other counterparty. However, in US markets, the requirements of collateral (*independent amount: see the "Collateral Types" section below*) are prescribed by the appropriate regulators. Furthermore, regulations prescribe the eligibility criteria of collateral that can be used by market participants. Typically, cash and highly rated securities are eligible collateral.

The commitments of both parties in a bilateral contract are frequently reciprocal so that each party is exposed to a default of the other. Hence, it is mostly a two-way model. Figure 11-3 shows the general collateral management model structure with the flow of margin calls and collateral.

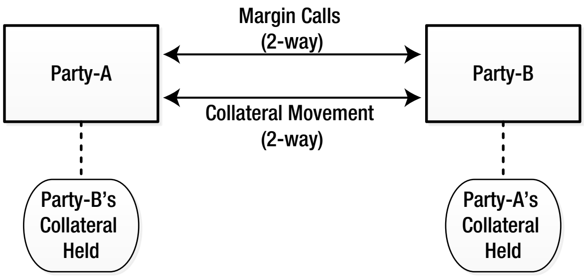

Figure 11-3. A margin call and collateral movement

Process

The following list briefly explains the steps in the collateral management process between two counterparties. Later sections describe each of these steps in detail.

At specified intervals such as daily, weekly, bi-weekly, or monthly (known as *collateral cycle*), the following steps are performed by each party.

1. **Update positions.** At the end of each collateral cycle, portfolios are updated to reflect any new and closed positions, and collateral postings.
2. **Exposure calculation.** Contracts under each agreement are subject to collateral and are valuated (marked-to-market). Exposure is calculated using predetermined methods and current market values.
3. **Collateral valuation.** Currently held collateral is valuated using current market value.
4. **Variation margin.** All open positions are marked-to-market (mark-to-model in case of illiquid contracts), and the change in contract value from previous collateral cycle is determined. The variation margin is settled between counterparties, and it is mostly netted with other collateral requirements.
5. **Independent amount.** Based on new exposure and the current value of collateral held, determine if additional collateral is required.

6. **Margin call.** If additional collateral is required after netting all the different amounts, send a margin call to the counterparty.
7. **Collateral return.** If excess collateral is being held, return the excess portion.
8. **Collateral posting and disputes.** The counterparty posts the requested collateral if it agrees with the valuation. If it disagrees with the value, a dispute is generated and is resolved bilaterally.
9. **Reconciliation.** Each party regularly reconciles margin calls and collateral positions (posted and held).

With time, the collateral requirement between two parties continues to change due to several factors including trading activity (new, termination, maturing contracts), change in the value of existing open positions from market movements, and the change in the value of collateral being held.

The following sections explain different aspects of the collateral management process.

Valuation and Exposure

Liquid OTC bilateral contracts are valuated using available market data from predetermined sources. However, exotic or bespoke bilateral contracts are valuated using complex models. In most cases, underlying valuation models, data sources, and all other required resources for valuation and exposure calculation are specified in agreement or through market practices.

For an OTC bilateral contract, exposure is a complex measure. However, for the sake of simplicity, counterparty credit exposure is a measure of the amount that would be lost in the event that a counterparty defaults or fails to fulfill the obligation. In general, exposure at any point in time is the replacement cost, which is the greater of the fair market value of the contract and zero. This is commonly used to measure credit exposure.

Furthermore, it may swing to any side as the market variables change. The commitments of both parties in a bilateral contract are frequently reciprocal so that each party is exposed to the default of the other. Hence, the counterparty risk is a risk to both parties. Consequently, all parties are involved in managing the collateral.

Another important point to consider is the netting agreement between counterparties. Netting agreements are risk mitigation tools built into most derivative contracts. This agreement enables the aggregation of contract exposure between two parties, in which the positions with positive value can be used to offset the positions with a negative value. So, from a given counterparty, only the *net* positive value represents the credit exposure at the time of default.

Furthermore, details on exposure calculation vary by contract type and are beyond the scope of this book.

Collateral Types

There are two types of collateral that are exchanged between counterparties: the *independent amount* and the *variation margin*. These are considered in the following sections.

Independent Amount

Similar to the initial margin in listed and cleared products, the *independent amount* (IA) is an initial deposit required by counterparties to enter into the contract. Like the initial margin, the key objective of an IA is to provide additional collateral to protect against changes in the market value of the contracts between collateral processing cycles.

The required IA is computed by a predetermined model for a given contract and counterparty. Typically, the IA is posted by one or both parties on or before the execution of a contract and is expressed as a fixed currency amount, a percentage of the notional principal amount, or a computation of *Value-at-Risk* (VaR) of a contract or portfolio. Moreover, preferred models, the timing of a posting, and the operational details about IA are prescribed by the respective market regulatory rules (see Chapter 9).

Variation Margin or Mark-to-Market Exposure

As for listed or cleared contracts, the *variation margin* (VM) is a change in the value of the contract from the previous collateral calculation cycle. At the end of each collateral cycle, all open positions are marked-to-market using the agreed valuation model. The difference between the previous cycle and the current cycle is the *variation margin or mark-to-market exposure*. The full variation margin amount is exchanged between counterparties.

The valuation of a bilateral contract may be a complex process due to the custom characteristics and complex structure of these contracts. The first step of the margin call process is the acceptance of the valuation and the corresponding exposure by both parties. It is possible that one may not agree with the valuation of the other party, engendering a *margin call dispute*. But this kind of dispute is resolved through direct communication. Moreover, it is critical that disputes are resolved in a timely fashion in order to avoid any counterparty credit exposure.

Collateral Asset Valuation

At the time of exposure calculations, any currently held collateral is also valuated using current market prices (official market prices) to determine the fair value of the assets that are held. In the case of non-cash assets, the market value is discounted, which is explained below.

Haircut

In the case of non-cash assets (securities), typically the market value is discounted by a predetermined percentage. This percentage is known as the *haircut, discount, or margin*. The haircut depends on the nature of the collateral asset. Cash will have a haircut of zero percent because such collateral is the safest and easiest to liquidate in the case of default. A haircut is applied to provide some level of safety margin to accommodate possible fluctuations in the value of collateral between two margin calls. For instance, a 15% haircut on a specific security with market value of $100 is valued at $85 ($100 - $15).

The haircut may also depend on the nature and credit rating of the issuer. However, a haircut by asset type is predetermined and is included in collateral agreements.

Eligible Collateral

The list of eligible asset types, applicable haircuts, and other details of collateral that is accepted are defined in a collateral agreement. In most derivative transactions, only cash and high-grade securities (highly rated securities of selected issuers) are acceptable as collateral.

Margin Call Generation

At the end of each collateral cycle, each party valuates the contract to determine the exposure and valuates the current collateral to determine its fair value.

The independent amount is computed using agreed upon models. Variation margin is the difference between the current value and the previous value (collateral cycle) of the contract. All these values are netted and a single *margin call* is raised at each agreement level. Also, the margin call includes any interest and fee payments.

If excess IA is being held and/or VM is negative, the margin call (*anticipated margin call*) is expected from the counterparty to return. The party expecting excess IA typically sends an IA return notice. Regardless of the communication protocol, IA and VMs are exchanged between counterparties as scheduled.

Typically, a margin call between two parties is for the netted single amount, intended to reduce the number of transactions. The margin call received from the counterparty is compared with an anticipated margin call before processing. In addition, anticipated margin calls provide an estimate on collateral obligations of the firm. Additional features of margin calculation are explained below.

Threshold Amounts

In the process of determining the actual collateral requirement, minimum amount thresholds are used to avoid collateral movements of small values. The threshold amount is an unsecured credit exposure that the parties are willing to accept before asking for collateral. In general, threshold amounts are set at relatively low levels in order to minimize the credit exposure.

Thresholds are usually set for independent amount and variation margin.

Minimum Transfer Amount

To prevent a small amount of net collateral transfers, a *minimum transfer amount* (MTA) is set in each agreement. Margin calls are not issued for the collateral requirements that are smaller than the MTA.

Rounding

The collateral agreement may also include rounding rules (either up or down) that will round a collateral amount to avoid uneven amounts of exchange.

Substitutions

In the case of securities deposited as collateral, either party may request the substitution of those securities. In substitution, original securities will be replaced with another asset (securities or cash) of equal value. Securities are substituted for various reasons such as securities rating falling below the acceptable limit making them ineligible as collateral or the owner would like to use them for other business purposes.

Dispute Handling and Resolution

If a counterparty does not agree with the amounts mentioned in a margin call, a dispute is created and is bilaterally resolved. In most cases, disputes are caused by the difference in exposure and collateral values calculated by both parties. These differences generally occur due to the data sources used for the valuation of a contract and/or collateral.

Reconciliation and Reporting

At the end of each business day or collateral cycle, a collateral management team generates various reports including a daily margin report, reconciliation reports, dispute reports and others for management, corporate treasury, and so on. In addition, this team reconciles contracts and collateral positions (held and pledged) of all the counterparties.

Rehypothecation

In OTC markets, it is general practice to use the collateral posted by the counterparty for pledging and re-pledging to other counterparties or any other business purpose. This is known as *rehypothecation* right. Typically, dealers reuse collateral posted by their clients for other business purposes. However, this is done with the permission of the owner of the collateral assets.

According to new regulatory rules, rehypothecation of collateral is not permitted. This rule was triggered by some of the high-profile dealer failures during the recent financial crisis.

Legal Agreements and Documentation

In a bilateral market, trading partners negotiate and execute a legal agreement before or on the initiation of the contract. Typically, ISDA's *Credit Support Annex (CSA)* is used in bilateral derivatives trading. This agreement specifies the terms for the calculating and posting of collateral by each party to cover counterparty exposure as well as all the collateral management details. ISDA's CSA has been amended to include new regulatory requirements in respective markets. The collateral agreement is also known as the *Collateral Support Document (CSD)*. All legal agreements between counterparties are subject to local jurisdictional and legal restrictions. Each participant executes the agreement with every other party that it trades with.

In addition to bilateral collateral agreements, participants may also use a *tri-party collateral agreement* that allows for a third-party custodian for the safekeeping of collateral.

Portfolio Margining and Netting

To optimize the collateral (initial margin or independent amount) required for participation in the derivatives market, markets have been using several margin calculation models that aggregate positions as a group or portfolio. The objective of the aggregation is to use appropriate levels of margin. This means determining the lowest possible amount of collateral that is sufficient to cover the counterparty risk in case the counterparty defaults. *Portfolio margining* and *risk-based margining* are popular models that are widely used by most clearinghouses.

In a risk-based model, margin requirements are set by the largest possible decline in the net value of the portfolio that could occur under predetermined market conditions. This is considered the most appropriate collateral.

Another model in use is a *strategy-based margining* in which margin requirements are set by standard strategies used in portfolios, which are based on the idea that the potential loss from some positions are offset by gains on other positions.

Likewise, clearing members also use several models to optimize the required collateral by their clients. For instance, the common models used by clearing members are *cross-product margining* or *cross-margining,* which combines the contracts of different product classes of a client to reduce the overall required margin. There is another practice known as *cross-business exposure netting* in which the exposures from different accounts or business lines of a single entity are combined to determine the overall exposure. This may optimize the margin requirements of the firm at a higher level.

Furthermore, portfolio margining procedures are done at a clearing member firm or on a CCP level for the positions held at these entities. If any client is using multiple clearing members and contracts are cleared by different CCPs, these optimization techniques would not be beneficial.

The portfolio margining or aggregating positions are allowed by netting agreements that are built into the derivatives contract in most cases. However, these institutions are allowed to use optimization models that are designed in accordance with the applicable regulations.

Collateral Custody

There are large amounts of initial margin and an independent amount (collectively, *collateral*) is transferred among market participants and CCPs in derivative transactions. This collateral is simply a deposit that is returnable and is held for the purpose of security. There is a risk of losing this collateral in case of any default that may also impact the overall system. Hence, over this period, regulations have improved custody rules to protect the collateral posted by market participants. Listed markets have relatively safe custody rules. In OTC markets, however, collateral custody rules have been enhanced due to some of the major failures in the last decade. Essentially, the regulatory rules enforce safe custody of collateral across the board.

Custody rules of collateral are prescribed by respective regulators. In general, listed markets are governed by different set of rules than OTC markets. Overall, regulators create rules on how customer funds are maintained by clearing members in different scenarios.

A clearing member maintains multiple accounts for each client, separated into listed contracts traded on domestic exchanges, listed contracts traded on foreign exchanges, and cleared contracts cleared by the *Designated Clearing Organization* (DCO). The separation usually follows regulatory requirements.

Listed Transactions

In the case of listed transactions, all funds deposited by customers are required to be segregated and are not allowed to be used to cover obligations of other clients or the clearing member (CM or FCM) itself. All of these funds are held in a bank account, trust company, DCO, or another clearing member. Furthermore, all customer funds may be commingled in a single account, known as an *omnibus account*, with beneficiary (customer) information properly tagged. An *omnibus account* is a special type of account that holds money and securities owned by more than one party (beneficiaries) but under one account holder, such as FCM or a broker.

Regulatory rules also prescribe custody requirements in case contracts are cleared by foreign clearing members and other related situations.

Cleared Transactions

In the case of cleared transactions, collateral deposited by customers is held in a separate account (also known as a *sequestered account*) in accordance with rules prescribed by applicable clearinghouses. Furthermore, these funds are allowed to be commingled in a single omnibus account, as explained above.

Moreover, in the United States, the Dodd-Frank Act prescribes collateral segregation rules through standards known as *Legal Segregation with Operational Commingling Model (LSOC)* on how to handle the collateral from cleared contracts.

Bilateral Transactions

In the case of bilateral transactions, recent regulations across the global markets prescribe stringent collateral management rules. In respect to the custody of collateral, rules require that an *independent amount* (collateral) must be segregated from the rest of the assets because it is more like a security deposit. In addition, if a collateral owner desires, it must be held at an independent third-party custodian. In such cases, collateral is held at an independent *third-party custodian* through a *tri-party collateral agreement*. This custodian is also referred to as a *tri-party collateral agent*. Furthermore, rehypothecation of this collateral is prohibited.

In respect to collateral posting requirements, regulations prescribe rules based on the type of the participant—SD, MSP, and EU. In general, for a transaction between SDs, between MSPs, and between an SD and an MSP, both parties must post collateral to cover IA. For transactions between SD or MSP and an end user, only end users are required to post collateral to the counterparty (SD or MSP are collateral holders).

In addition, rules also impose restrictions on the type and quality of collateral that can be pledged as well as the timing of the posting of collateral in bilateral transactions.

Audit

A designated *Self-Regulatory Organization (SRO)* conducts periodic audits of clearing members to confirm that customer funds are being held in properly designated accounts and other operational requirements. In addition, firms also employ an internal audit group that monitors compliance and regulatory requirements.

Interest Payments and Fees

As stated earlier, initial margin and independent amounts in the form of cash earns interest for the owner. Interest payment cash flows are processed and reconciled by respective parties.

CCPs charge a clearing fee to their customers and, in turn, a clearing member charges a clearing fee to its customers. In addition to a clearing fee, usually a service fee and other types of fees may be involved in collateral management.

Netting and Settlements

Typically for each account or agreement, only one margin call is raised combining all types of margin or collateral requirements—such as IM, IA, VM, fees, and interest payments. In addition, multiple payments between two entities may be netted to achieve a single transaction or the fewest possible transactions.

As explained above in the "Process" section, collateral transactions also go through the approval process (via the back office) and settlement instructions are sent for final processing.

Risk Management

Although collateralization is used for risk mitigation, the process itself introduces some risk that needs to be managed separately. Typically, those risks are the following:

Operational risk. The overall process needs to be managed efficiently, including valuation, exposure calculation, collateral calculation, margin call processing, and reconciliation. Any operational failure or incorrect calculation may introduce a shortfall in protection or capital management issues.

Residual credit risk. Residual credit risk may arise from the falling value of collateral securities in case of default or other such events.

Concentration risk. Risk from collateral assets that are concentrated such as on the same security, issuer, type of asset, or country.

Legal risk. Collateral and default governing laws vary by jurisdiction. The collateral agreements spreading across different jurisdictions introduce legal risk.

Liquidity risk. Quick market downturns or other such events may introduce liquidity issues of collateral assets.

Enterprise Collateral Management

After the Dodd-Frank Act and other similar global reforms, the demand for collateral has increased to greater levels across the board. Regulations also enforce stricter eligibility criteria, which further increases the demand for higher quality collateral. There has been a lot of attention for financial institutions and corporations to optimize the collateral usage at the enterprise level.

In addition to a derivatives business, typically firms use collateral in other business lines such as lending, borrowing, repo trading (repurchase agreements), and securities trading and lending. As a result, it is crucial to manage the inventory efficiently and to use the best optimization program to manage the firm's capital efficiently.

Optimization is the process of identifying and using the most cost-efficient asset to pledge as collateral. If this is done at an enterprise level across multiple business lines that require collateral, it is referred to as *Enterprise Collateral Management (ECM)*. ECM requires firms to manage their available pool of assets efficiently in order to achieve better enterprise-wide view of their collateral along with an enterprise-wide view of *liquidity* and *counterparty credit risk*.

In each business line, collateral, risk, and trading teams must work together to identify the right asset to use or receive as collateral for each trade. Additionally, an ECM function will need greater integration of treasury and risk functions with the front offices of all business lines. Figure 11-4 shows the various aspects of enterprise collateral management.

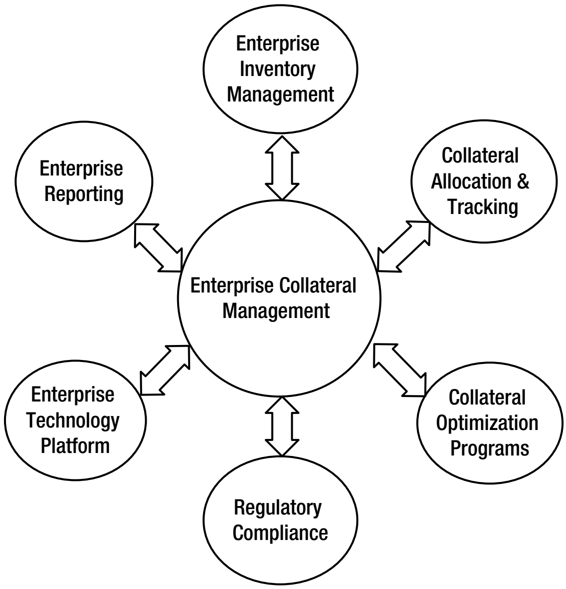

Figure 11-4. Key components of enterprise collateral management

Essential components of the ECM are the following:

> **Enterprise-wide inventory management.** Comprehensive firm-wide, real-time inventory management can use a central database of collateral available to pledge as well as the collateral that is posted and received.
>
> **Enterprise collateral management.** An efficient allocation and tracking of collateral at an enterprise level. It includes managing inventory across multiple business units, counterparties, and clearinghouses.
>
> **Enterprise technology platform.** An integrated technology platform that supports end-to-end collateral management functions to run the processes, including valuation, margin calculations, document management, workflow management, and settlement management, to reduce the operational risk and to meet enterprise level objectives.

Collateral optimization. Efficient optimization algorithms that identify eligible and cost-effective collateral to pledge and maximize return on assets while monitoring risks such as a concentration risk.

Compliance. Enterprise collateral management platforms need to support local and global compliance rules, such as Dodd-Frank and EMIR, and easily adapt to changing regulatory demands.

Integrated platform. Tight integration of collateral management components of other business lines, treasury, and risk management systems are needed to provide holistic management of enterprise collateral.

In summary, ECM is a complex task and requires a state-of-the-art technological platform that incorporates the above-mentioned features, enabling efficient inventory management and collateral optimization.

Summary

Collateralization is an essential tool for promoting safer derivative markets. Collateral management has assumed an important function at the derivatives business level as well as at the enterprise level for most financial and non-financial institutions. In recent years, derivatives markets—especially OTC markets—have gone through major reforms.

Derivative transactions are broadly divided into two categories: centrally cleared and bilateral. In a cleared market, CCPs play a major role in promoting a safer market through an efficient collateralization process. In OTC markets, recently imposed regulatory regimes (Dodd-Frank and similar) promote safety through the introduction of additional collateral requirements, collateral protection rules, and other rules to mitigate the exposures that intensified the recent market crisis.

This chapter described the collateral management function in centrally cleared markets and bilateral markets. Finally, it introduced enterprise collateral management and essential elements contributing to this emerging initiative.

Each of the remaining chapters in the third part of this book focuses on a specific product group. Together they flesh out the derivatives contract life cycle with product-specific collateral management functions.

CHAPTER

12

Futures Life Cycle

Chapter 2 introduced the futures products and various contract types. Chapter 10 explained the derivatives life cycle (DLC) of listed contracts and associated standard procedures. This chapter focuses on futures contracts and explains specifics peculiar to futures. This chapter serves as an extension of the Chapter 10, which introduced all the terminology and procedures deployed in this chapter.

Recall that a futures derivative is a contract to buy or sell some asset (underlying) on a future date for a specified price. The underlying assets include commodities, metals, and financial instruments such as eurodollar deposits, foreign exchange, stock, and other indices.

Futures are traded on exchanges and cleared by clearinghouses, virtually eliminating any counterparty risk. All attributes of a contract are clearly defined by the exchange and are documented in contract specifications. Some of the key characteristics of a futures contract include the underlying asset size, the quantity of each contract, the asset price (contract price), the contract term, the settlement type (cash or physical), and delivery details by month, day, location, asset type, and asset quality.

This chapter starts with an account of each phase of the futures contract life cycle starting from pre-trade to expiry. It goes on to examine milestone dates in the time line and margining process. Finally, it provides a summary of the end-of-day activity of each player involved.

The objectives of this chapter are to

- explain the futures trading model
- discuss the life cycle of a futures contract
- understand the time line of a futures contract and various milestone days
- examine the margining process of a futures contract
- describe the process of terminating (offsetting) a futures contract
- discuss the delivery and settlement process
- summarize the end-of-day operations of each player

Futures Workflow

Futures are widely traded instruments in listed markets. The key players in a listed market are end-clients (institutions, retail customers), *Futures Commission Merchants* (FCMs, also known as *brokers*), exchanges, and clearinghouses. The role of the FCM is explained in detail in Chapter 5. In futures trading, the FCM acts as both execution broker and clearing member. Figure 12-1 depicts the high-level workflow of futures trading.

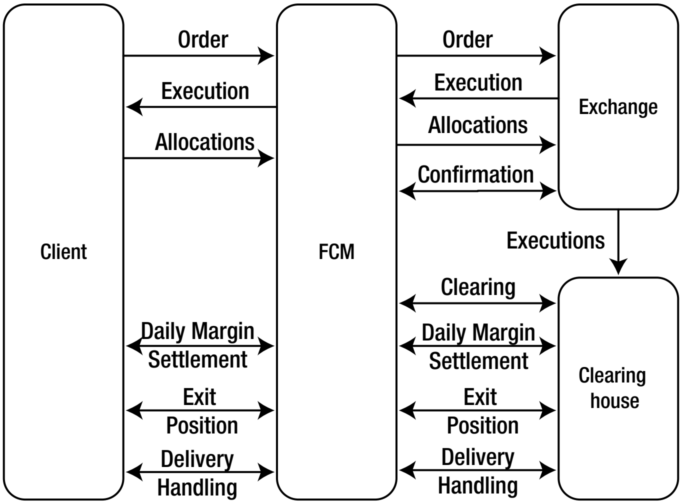

Figure 12-1. Futures trading workflow

Key steps in the futures trading workflow include the following:

- Clients (trading parties) submit their orders to their respective brokers (FCMs).
- The FCM identifies the trading venue (exchange, market-making platform, or other; see Chapter 10) and sends the client order for execution. The order is executed (filled) on the execution venue.
- Execution information is sent to the FCM and in turn to the client.
- The FCM confirms the trade and then clears it with the clearinghouse. The clearinghouse clears (novation) the trade and updates both FCM margin accounts (an initial margin is required for the new trade).
- The FCM updates the client's margin account.
- At the end of day, the clearinghouse prepares a position report and margin requirements if any (margin call) and sends it to all FCMs.
- The FCM reconciles and updates its own books with the clearinghouse. It also deposits additional margin with the clearinghouse, if required.
- The FCM then generates a position and margin report and sends it to its clients. The client will then reconcile and deposit additional margin with FCM, if required.
- Margin management continues every day until there are no open positions. Every day, each open position requires a minimum margin to be maintained and for the profit or loss of the day to be settled. The client may exit the position by offset trade. The position will be closed after the settlement of final profit or loss.
- If it is a delivery contract and the position is not closed before the delivery period, it may result in a delivery. The clearinghouse issues a delivery notice to the FCM and to the client. The client then processes the delivery of the underlying contract.

Each of these steps is discussed in the following sections.

Contract Life Cycle

Chapter 10 discussed each step of the contract life cycle for each category—listed, cleared, and bilateral products. The following sections presume knowledge of the information in Chapter 10 and highlight only information that is specific to the phases of the futures contract life cycle.

Figure 12-2 shows the key points that are specific to futures. The following section will discuss each of these points.

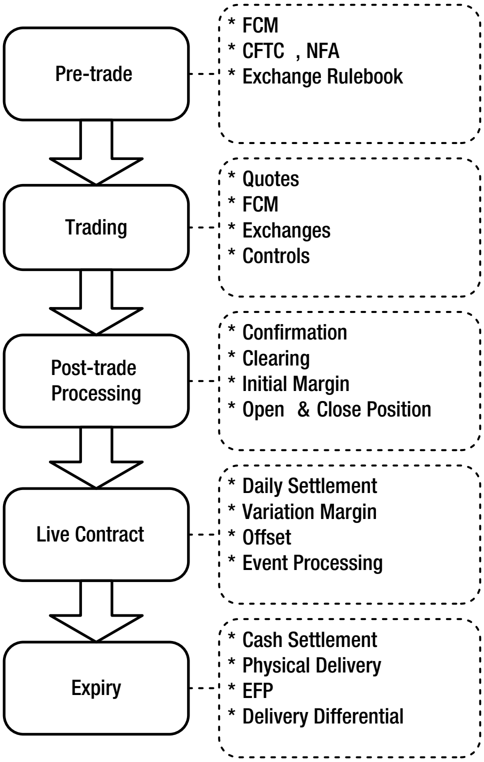

Figure 12-2. Futures contract life cycle key points

Pre-Trade

Pre-trade involves the setup of a legal relationship among all market players. For futures trading, clients follow the listed market onboarding procedure explained in Chapter 10, whose essential points are discussed below.

Onboarding and Compliance

Because futures are listed products and traded on exchanges, there are no significant differences between the onboarding process for futures and the process described in Chapter 10. Clients establish the legal relationship with FCMs using standardized agreements. FCMs obtain and maintain membership on clearinghouses and exchanges, as explained in Part I of this book. Exchange markets are regulated by governmental agencies (for instance, CFTC in the United States) and market associations (for instance, NFA in the United States).

FCM and Clearing Member

An FCM acts as a broker for all its clients to execute futures trades on exchange and maintain margin accounts. In the futures market, FCMs provide both execution and clearing services to their clients. As noted earlier, they are also known as simply *brokers*. An exchange rule book is the best resource for understanding the full details of registration and all other procedures.

Trading

Futures are traded on derivative exchanges around the world. Because futures are among the oldest form of derivatives, contracts are available on a large number of asset types, including various financial indices. Each contract is specific to the exchange, and contract terms are set by the listing exchange. Exchanges generally employ an electronic trading model, but there is still some pit trading (see Chapter 10).

Futures trading follows an anonymous exchange trading model in which buy and sell orders from two different parties are matched anonymously and then cleared by the clearinghouse. After the trade is cleared, each contract holder's counterparty (faces) the clearinghouse instead of the initial trading partner (see Chapter 10).

Institutional clients trade futures through either of the two following channels:

- Through an FCM (broker)—executed on the exchange pit or an electronic system
- Direct with exchange—electronic platform

A futures trade requires the following key information:

- Contract Identifier—Each contract has a unique identifier.
- Quantity—The number of contracts. Each futures contract represents a predetermined quantity (standardized) of underlying. For instance, one corn futures contract may represent 5,000 bushels of a specific type and quality of corn.
- Buy or sell—Representing whether to buy or sell the underlying
- Other information such as order type (market order, limit order) and opening or closing a position

---

Futures Instrument Identifier Because a large number of futures instruments are traded on each exchange, each instrument is assigned a unique identifier. Each exchange uses a specific symbology to assign identifiers. For instance, the following link shows the symbology of CBOE instruments:

http://cfe.cboe.com/DelayedQuote/CFEFuturesSymbology.aspx

Futures Trading Tutorial There are many resources to learn futures trading. The following links point to some simple learning resources:

www.nfa.futures.org/Futures_Training/main.html

www.cmegroup.com/education/files/a-traders-guide-to-futures.pdf

---

Futures Quotes

A futures contract price is the price of the underlying to trade on a future date specified in the contract. By contrast, a spot price is the price to trade the underlying right away. Key elements of futures quotes are the *best bid* (highest price), *best ask* (lowest price), and *last trade price* and *quantities*. Detailed quotes include other details such as *last sale time, change, and open interest.*

Exchanges stream quotes and execution prices throughout the trading day. At the end of the trading day, they publish closing and settlement prices of each contract. Futures are settled using a settlement price, as explained below.

Closing Price versus Settlement Price

A *settlement price* is the official price determined by the exchange at the closing of trading. It is used for the purpose of valuating a contract to calculate gains, losses, and margin amounts. Each exchange specifies a clearly defined formula that they use to determine the settlement price. Generally, the settlement price is an average of a few transaction prices immediately before closing or the average of indicative quotes obtained from traders at the closing. Sometimes *settlement price* is also referred to as *official quotation* or *simply market price*.

The *closing price* of a contract is simply the last trading price of that business day. The next business day, trading starts at the closing price of the previous business day.

Exchange Trading and Controls

Because the futures market is filled with speculators and professional day traders, exchanges place some controls such as price limits on trading to avoid extreme price movements. These controls safeguard investors from the substantial losses that may result from major events affecting the market's sentiment or from manipulation, abuse, or technical glitches.

Every contract has a *price limit* set as part of its specification. The price limit of a futures contract is the maximum amount the price can move in one day. Price limits are usually set in absolute dollar amounts. For instance, if the price limit is $5 of a specific contract, this means the price of the contract cannot increase or decrease by more than $5 in a single day.

When the trading price reaches this limit, exchanges take certain actions such as halting the trading or freezing the price. The actual practice varies by rules set by the exchange.

Post-Trade Processing

After the execution, trades must be confirmed and cleared before they become live. In the futures market, post-trade processing is done electronically. Since the trade is executed on exchange (mostly over electronic systems), trades are processed much quicker and with the least number of errors. Exchanges and clearinghouses provide direct access to their systems to submit trades, enabling STP across the board.

Allocations

If the order is not is allocated before the execution (pre-trade allocation), the client must allocate the order after the execution (post-trade allocation).

Confirmation and Clearing

After execution trades are submitted to the exchange for confirmation, they go to a clearinghouse (Chapter 10). After clearing, both parties are legally obligated to the contract.

Live Contract

A futures contract becomes effective (*live*) after clearing. Futures are standardized contracts and their provisions may not change during the terms of the contracts. Because futures contracts are traded on the open market, their prices are driven by demand, supply, and other market factors. The exchange is responsible for administering the contract, and the clearinghouse is responsible for margining through its members. An open position can only be closed (offset) when client wants to exit, and it cannot be altered during its term. A position can be held until the end of the term (to maturity), as explained in the following section. One contract is the minimum quantity that can be traded, and it represents a specific amount of underlying. Clients can open and close any number of contracts as required.

Initial Deposit

When a position is opened, an initial margin amount must be deposited (withdrawn from margin account) and it will be refunded when the position is closed.

Daily Settlement or Marking-to-Market

Futures are margined products, such that contract values are not exchanged. Instead, each open position is marked-to-market and settled daily at the clearinghouse or FCM. At the end of each business day, the gain or loss is calculated against the settlement price. At an FCM, the calculated gain or loss is added to or deducted from a client's margin account. Similarly, at a clearinghouse, each FCM's account is updated with gain or loss. This is also known as the *marking-to-market* of futures. Thus, the change in value of each open futures contract is settled daily. This is equivalent to terminating a contract at the end of each day and reopening the next day at the previous day's settlement price. This unique characteristic of futures contracts confers these products with great flexibility and liquidity.

Corporate Actions

If any corporate action such as a stock split or merger affects the underlying asset of the futures contract, the futures contract will be affected. The operations team, with the advice of the FCM and clearinghouse, will adjust futures positions to reflect such changes.

For example, suppose that a futures contract for 100 shares of ABC stock is priced at $50 and that the stock splits 2 for 1. The clearinghouse thereupon adjusts the size of the contract to 200 shares and the price to $25. Other contract characteristics impacted are similarly adjusted to reflect the stock split. Such adjustments apply to all open contracts. The clearinghouse then issues notice with details to all parties. However, on the exchange, the new contracts are issued at the standard size of 100 shares, which trade at the new price of underlying.

Expiry

Futures positions are closed or terminated either through an offset trade or by settlement on maturity, as explained below.

Offset or Close-Out

A futures contract position can be closed before its maturity or it will terminate upon maturity resulting in a delivery, if it is a delivery contract. Any open position can be closed by trading a contract and quantity in the opposite direction.

For instance, assume there is an open position such that one contract is expiring in September to deliver (sell) corn. In other words, this position was opened in the past by selling one contract of corn with September delivery (known as a *short position*). To close this position, a holder must trade one contract expiring in September in order to receive (buy) at a prevailing price. In other words, now he must buy one contract of corn with a September delivery (*long position*). This trade is called an *offset* or *reversing trade*.

An offset trade is purchased at a certain price during the day and will still result in a profit or loss on that day. This profit or loss will be determined by the difference between the previous day's settlement price and the price of an offset trade. Suppose that the opening price (the previous day's closing price) was $50 and at the time of offset trade execution it was $48. The difference of $2 is settled at the end of that day regardless of the closing of that day. In this case, a long position holder loses $2, and a short position holder gains $2. (See Table 12-1 for a detailed example.)

Settlement on Maturity

Futures are settled daily, meaning that a contract on any given day has an obligation from just that day's price change (the difference between closing price of previous day and current day). If the contract is terminated on a specific day, the settlement at the end of that day fulfills its obligation (the profit or loss is settled). In the case of a cash-settled contract, it is simply terminated or dead after the final settlement.

In the case of a physical delivery contract, upon maturity (assignment) the physical delivery process will start. The major distinction between cash-settled and physical-delivery contracts lies in the final stage known as the *delivery month*, discussed later in this chapter.

Futures Rolling

All futures contracts expire on a predefined date. If contract holders elect to continue to hold their positions, they have to offset their current position and buy a new contract before the current contract expires. These two trades are typically done in one step, known as a *roll trade*.

Most futures contracts have a specific *rollover day*. The day after the rollover day, old contract trading stops and new contract trading starts. The rollover day is typically a few days prior to the actual expiry day of the contract. The exchange sets the rollover day for each contract.

An expiring contract is referred to as the *outgoing contract*, whereas a new contract superseding it is referred to as the *incoming contract*.

Contract Timeline

The timeline is important to understanding the life cycle of a futures contract. The following are the two main stages in a futures contract's life:

Trading period. A period of time during which market participants can enter the contract and close out the open contracts.

Delivery month. A period of time during which the assignment, delivery of underlying, or settlement of a contract takes place.

Typically, major parts of the futures contract positions are closed using offset trades before maturity without resulting in delivery. Figure 12-3 shows the total time line of a live contract with various milestone days.

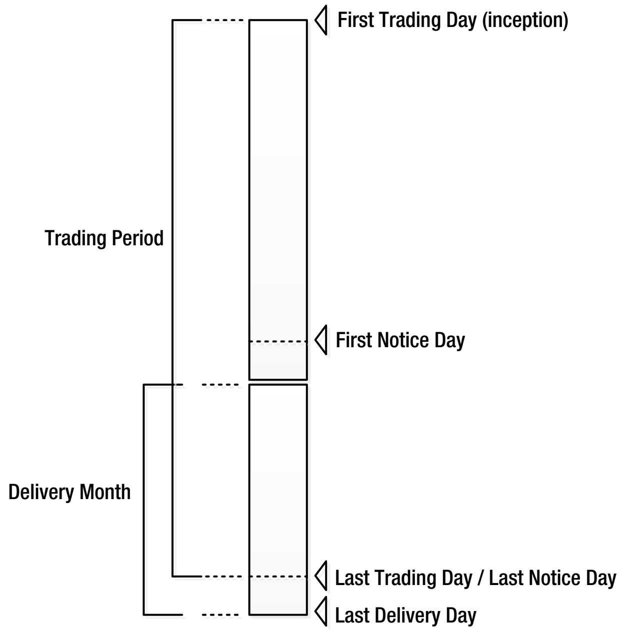

Figure 12-3. Futures contract timeline

Each of the milestone days is explained below. The actual dates and details of each milestone are defined by the exchange for each contract they trade.

Inception date. Trading of the contract starts from the inception day.

Expiration date. The contract expires on this day resulting in a final settlement of either cash or delivery based on definition, if it is held until expiration date.

Trading period. The contract can be traded through the trading period.

Delivery month or contract month. The month in which delivery of the underlying is supposed to happen. Some futures contracts define a delivery month and the underlying can be delivered during any day of the delivery month.

Delivery day. A specific day in the delivery month on which underlying must be delivered, if the contract is not closed before that. Some futures contracts define a specific delivery day of the delivery month instead of the whole month.

First notice day. A party with a short position issues a notice of delivery, usually a few business days prior to delivery (based on the settlement terms). Delivery day can vary between the first business days of the month to the last delivery day in the delivery month. But, notice has to be given on or before the last notice day.

Last notice day. This is usually a few days prior to the last trading day or the last trading day itself. In case it is defined as the last trading day, the actual delivery happens after the last trading day. It may simply vary by contract.

Delivery notice period. The period between first notice day and last notice day.

Last trading day. The final day as per the contract terms that a futures contract may trade or be closed out before delivery of the underlying asset or cash settlement must occur. By the end of the last trading day, if the position is not closed, the contract holder must be prepared to settle through the delivery using delivery terms.

Delivery and Settlement

When a futures contract matures, the trade has to be executed or settled as the transfer of the underlying between two parties according to the terms of the contract. That means the holder of the short position must deliver the underlying to the long position holder. This is known as a *futures delivery*. *Futures delivery* is defined to be as either cash-settled or a physical delivery. Delivery starts with the assignment, as explained below.

Assignment

A short position holder may offset with long trade any day until the last trading day. However, if a short position holder decides to deliver, they must issue the delivery notice during the delivery notice period. The notice period starts a few days before the beginning of the delivery month and ends just a few days before the end of the delivery month to allow the clearinghouse to process the delivery notice. The clearinghouse then assigns delivery to one of the long position holders. As it receives notices from short position holders, the assignment process continues throughout the delivery period. In addition, on the last notice day, all open long positions are matched with open short positions and delivery is assigned. Thus, all open contracts are settled by the end of their term. The clearinghouse issues the assignment to an FCM, who conveys it to one of its end-clients. The actual assignment methodology is defined by an exchange for each product.

Note that a long position holder may be assigned the delivery any time during the delivery month or at the end, if the position is still open. Figure 12-4 shows the assignment process and the flow of notices.

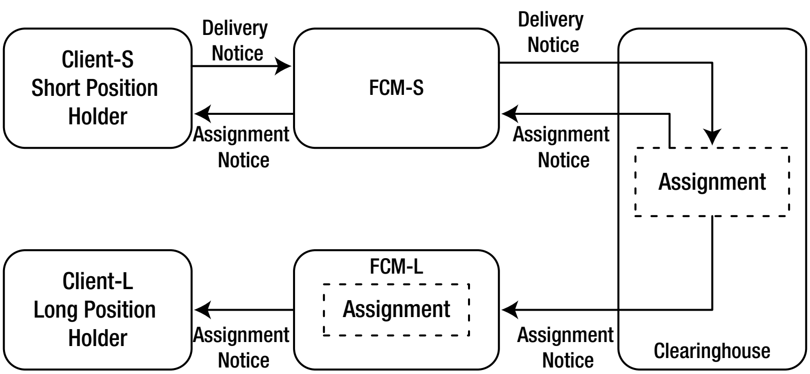

Figure 12-4. Futures assignment

Cash Settlement

To repeat, futures contracts are margined, meaning that the profit or loss is settled daily although the contract stays open (live) until offset or matured. This settlement continues until the last day of the contract. Cash-settled futures contracts can be traded until the last day of the contract on the last trading day. On the last trading day, the settlement price is set to equal the cash price of the underlying asset. Based on this settlement price, a final margin payment is settled and then the contract expires.

Physical Delivery

There are futures contracts on a variety of underlying assets such as financial securities (stocks, bonds), commodities (gold, silver, soft cocoa, and so on), currencies, and interest rates. While most are cash-settled, some require delivery of the underlying. The following steps summarize the various stages in the delivery process:

Delivery notice. A short position holder issues a delivery notice to its broker during the delivery notice period. The broker then sends the notice to the clearinghouse.

Assignment. Upon receiving the notice, the clearinghouse selects one of the long position holders and assigns the delivery. Long position holders are chosen by the exchange using specific criteria that varies by exchange.

Asset delivery. As per the terms specified in the contract, the delivery process takes place. If the last notice day falls on the last trading day, then delivery happens after the last trading day. The contract specifies delivery details such as the delivery month, delivery day, acceptable delivery location, acceptable asset quality details, and all other conditions of delivery.

Delivery period. Some contracts define the delivery month while others define the specific day of delivery in the delivery month. In the case of delivery month, delivery can happen on any day of the month. In the case of delivery day, contracts are settled (delivery must happen) on that specific day.

Trading period. Trading continues until the last trading day, as defined. If the position is not closed or not assigned a delivery by then, at the end of the last trading day all open contracts will end up in delivery. That means all long positions are assigned to short positions. Then the delivery process takes place.

Last trading day. Typically, the last trading day falls in the delivery month toward the end of the month or on the last day of the month as specified in the contract. For instance, the last trading day of the CME futures contracts is two business days prior to the third Wednesday of the delivery month. Final settlement happens on the third Wednesday (as per T+2) settlement.

Some exchanges also have alternative delivery options known as *exchange for physicals*, explained in the next section.

Exchange for Physicals

Exchange for physicals (EFP) is an alternative option to a physical delivery process. The contract defines characteristics of the asset to deliver including the location. As an alternative to the defined underlying, a short party may get into an agreement with a long party for an EFP option. In this process, both parties privately negotiate delivery details and inform the exchange to close their positions. An EFP option may not be available on all exchanges and when available, actual details may vary by exchange.

Delivery Differentials

Sometimes the quantity and quality of the delivery asset may not exactly match the quantity and quality as specified in the contract. In such cases, short parties are given an option to deliver nonstandard assets at nonstandard delivery points. However, they may have to pay a surcharge known as a *delivery differential*. This surcharge reflects the differences in the quality of the delivering asset and location of delivery, and its imposition is common practice in commodity futures.

Margining Process

The margin process was discussed in detail in the Chapter 11 (Collateral Management). As noted there, a client maintains a margin accounts with an FCM, while an FCM account is maintained with a clearinghouse.

Each trade's opening position requires an initial margin equal to the amount specified in the contract. This amount is deducted from a margin account. Similarly, a closing position will initiate the refund of the initial margin.

At the end of each business day, a position is marked-to-market and the resulting profit or loss is added (credited) to or deducted (debited) from a margin account. The value change (gain or loss) is known as a *variation margin, variation, settlement variation*, or *mark-to-market amount*.

The impact of a new trade on accounts (variation margin) could be as follows:

- If a client buys (long position) a futures contract and the price of the underlying goes up, the client's gain will be the amount of the price increase times the contract size.
- If a client buys and the price goes down, the client's loss will be the amount equal to the price decrease multiplied by the contract size.

- If the client sells (short position) a futures contract and the price goes down, the client's gain will be the amount of the price decrease multiplied by the size of the contract.
- If the client sells a futures contract and the price goes up, the client's loss will be the amount of the price increase multiplied by the size of the contract.

Thus, the values of all open positions and initial margin adjustments from the day's trading activity are processed to identify the margin account balance. If the balance is below the minimum required amount, a *margin call* is issued.

When the position is offset on any given day after that day's margin (profit or loss) settlement, the contract is terminated. Some simple calculation formulas follow:

Contract value or notional = contract size X current price

Value of contract at inception = contract size X price at purchase

Value of contract at the end of day = contract size X settlement price

Profit or loss at end of first day =>

Variation Margin = contract size X (today's settlement price—transaction price)

Profit or loss from second day to the last day =>

Variation Margin = contract size X (today's settlement price—last business day's settlement price)

Table 12-1 shows a sample account calculation for a single contract from inception to offset under the following assumptions:

An account holds one contract

50% initial margin requirement

30% minimum margin requirement

Table 12-1. Sample Margin Calculation

	Settlement Price	Contract Value	Margin (Profit/Loss)	Account Balance
Inception	10.00	10.00		5.00 (Initial Deposit)
Day 1	9.60	9.60	–0.40	4.60
Day 2	9.00	9.00	–0.60	4.00
Day 3	7.90	7.90	–1.10	2.90 (less than Minimum Margin)
			Deposit	**5.00** (**+2.1** deposited to restore account level to initial margin - 5.00)
Day 4	7.80	7.80	–0.10	4.90
Day 5	8.0	8.0	0.20	5.10
Day 6 (Offset trade)	8.3 (current market - trade price)	8.3	0.30	5.40

SPAN *Standard Portfolio Analysis of Risk (SPAN)* is a margining method introduced by CME and used by many clearinghouses today. This method computes the initial margin requirements for a whole derivative portfolio based on price and volatility changes.

Intraday Margin On high-volatility days and for certain products, some clearinghouses use intraday margining. Instead of at the end-of-day, a clearinghouse computes the margin during the day and issues margin calls to reduce its exposure. In a high-volatility situation, they may even increase initial margin levels above normal, requesting additional deposits from clients. It is also possible that an additional margin is requested only from one side (long or short) based on the price movement.

End-of-Day Activity

The following sections summarize the end-of-day activities of each key player.

Clearinghouse

The clearinghouse maintains the FCM accounts and is responsible for processing all transaction. The key end-of-day activities are the following:

- Publishing closing and settlement prices
- Updating margin accounts of each FCM
    - Applying initial margin for new and closed positions
    - Applying gains and losses after valuing (mark-to-market) of all positions
- Closing all offset and expired positions
- Sending margin account details to all FCMs
- Issuing margin calls to FCMs as required
- Processing all delivery notices and issue assignment notices
- Reconciling due collateral from the past (typically from the previous day)

FCM

- Updating closing and settlement prices for all futures contracts
- Updating margin accounts of all clients' and house accounts by
    - applying initial margin for new and closed positions
    - mark-to-market all positions and apply gains and losses
- Closing all offset and expired positions
- Clearinghouse accounts—reconciling accounts and margin calls with clearinghouses
- Client accounts—sending account updates (reports) to all clients
- Issuing margin calls to clients, as required

- Processing delivery notices and issuing assignment notices
- Posting due collateral to clearinghouses
- Reconciling due collateral from clients

Buy-Side (End Client)

- Updating the closing and settlement prices of futures contracts for all their positions
- Mark-to-market all open positions
- Closing all offset and expired positions
- Reconciling positions and margin accounts with FCMs
- Posting collateral to FCMs (process margin calls)
- Processing delivery and assignment notices

Summary

Most financial institutions and other market players trade futures both for hedging purposes and as investment instruments (see Chapters 2 and 3). Futures contracts are standardized and market operations are highly automated. Exchanges and clearinghouses define and perform most of the critical activities. The trading and processing of futures is almost as easy as that of securities. Thanks to their simplicity and flexibility, futures are popular and trade in large volumes.

This chapter explained the futures contract life cycle and related operations, including daily margining, delivery, settlement, and physical delivery. The next chapter examines listed options.

CHAPTER

13

Listed Options Life Cycle

Chapter 2 introduced the listed option products and various contract types, and Chapter 10 explained the *derivatives life cycle* of listed contracts and associated standard procedures. The present chapter focuses on the specifics of the listed option contract life cycle that are peculiar to listed options. This chapter serves as an extension of Chapter 10, which introduced all the terminology and procedures deployed in this chapter. Because this chapter refers exclusively to listed options, the terms *option* and *listed option* are used synonymously in it, unless stated otherwise.

Recall that an option derivatives contract is an agreement giving the buyer a right to execute the transaction with a seller on a future date as per specified terms. The transaction may include the purchase or sale of some underlying such as a financial instrument, commodity, or foreign currency. The party obtaining the right (buyer) pays the premium (option price) at the start in return. The issuing party (option writer) receives that premium.

Listed options are traded on an exchange and cleared by the clearinghouse, virtually eliminating any counterparty risk. All attributes of a contract are clearly defined by the listing exchange. Some of the key characteristics of option contracts are the underlying asset size or quantity of each contract, the option type, the exercise price, the contract term, the settlement type (cash or physical), and the delivery details including month, day, location, asset type, and asset quality.

This chapter starts with an account of each phase of the options contract life cycle from pre-trade to expiry. It goes on to examine milestone dates in the timeline and margining process. Finally, it provides a summary of the end-of-day activity of each player involved.

It is not surprising that many procedures and processes of listed options and futures are quite similar, for they trade side by side on exchanges.

The objectives of this chapter are to

- explain the trading model of listed options
- discuss the life cycle of listed option contracts
- examine the margining process of listed options
- understand termination, exercise, assignment, delivery, and settlement procedures

Option Trading Workflow

Options are widely traded instruments in listed markets. The key players in a listed market are end clients (institutions, retail customers), FCMs (Futures Commission Merchants or simply *brokers*), exchanges, and clearinghouses. Figure 13-1 shows the high-level workflow of options trading.

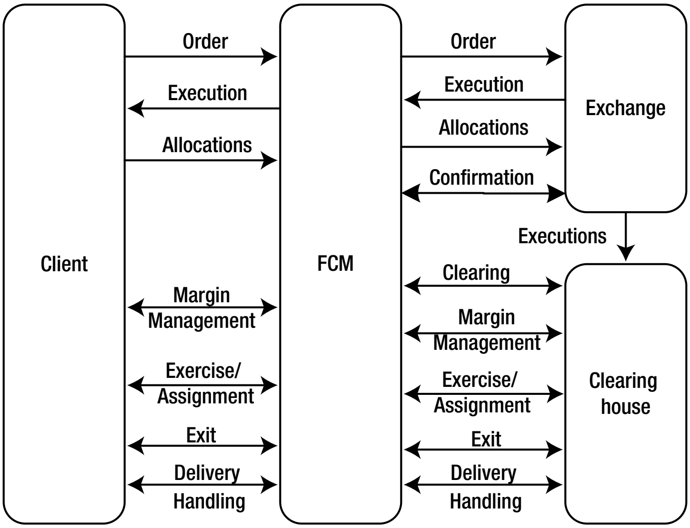

Figure 13-1. Option trading workflow

Recapitulating Chapter 10, the key steps in the options trading workflow are the following:

- Clients submit their orders to their respective FCMs.
- The FCMs identify the trading venue (exchange, market-making platform, or other) and send client orders for execution.
- Orders are executed (filled) such that two orders in opposite directions are matched at a specific price point.
- Execution information is sent to both FCMs and in turn to clients.
- The FCMs confirm the trade and then clear it with the clearinghouse. The clearinghouse clears (novates) the trade and updates both FCM margin accounts (premium and initial margin as required for the new trade by the buyer and seller).
- The FCMs update margin accounts of clients.
- At the end of day, the clearinghouse prepares a position report and margin requirements if there are any (margin call) and sends it to all FCMs.
- The FCMs update and reconcile their own books with the clearinghouse. They deposit additional margin with the clearinghouse as required.
- The FCMs generate a position report and margin report and send them to their clients.
- Clients reconcile and deposit additional margin with their FCMs as required.
- Margin management continues every day until there are no open positions. Every day, margin requirements are computed and margin calls are issued as required. The client may exit the open position by an offset trade. The position will be closed after the settlement of offset trade payments.
- If an option holder (long position) issues an exercise notice during the exercise period, the clearinghouse assigns the delivery to one of the option writers (a short position holder) and sends the assignment notice to the FCM and in turn to the client.
- Both clients execute the transaction per the contract terms.

These steps are further discussed throughout the chapter.

Options Contract Life Cycle

Chapter 10 discussed each step of the life cycles of *listed, cleared, and bilateral contracts*. The following sections examine the various phases of the contract life cycle and highlight only specific information related to listed options. For all general contract life cycle topics, Chapter 10 serves as the master reference.

Figure 13-2 shows the key topics that are specific to options, as discussed in the following sections.

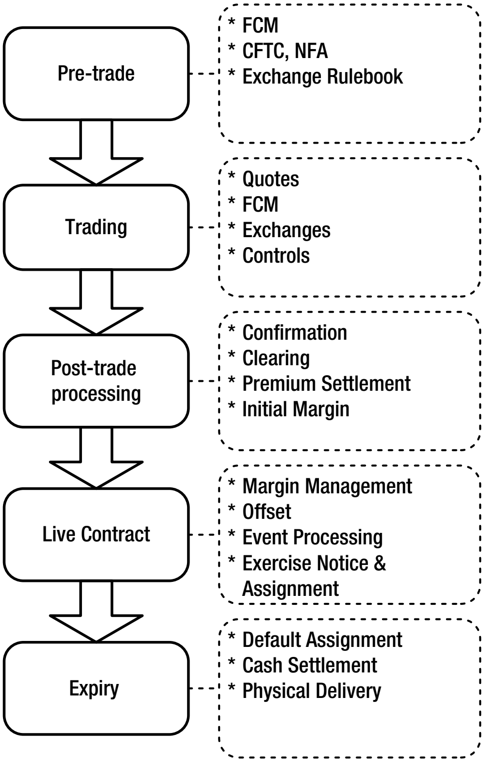

Figure 13-2. Options contract life cycle

Pre-Trade

Pre-trade involves the setting up of legal relationships among all market players. In a listed options market, clients follow the market onboarding procedures explained in Chapter 10 under listed market section and applied specifically to options in the following sections.

Onboarding and Compliance

Because options are traded on exchanges, there are no significant differences between options processes and those discussed in Chapter 10. Clients establish legal relationships using standard agreements. Exchange markets are regulated by governmental agencies (for instance, CFTC in the United States) and market associations (for instance, NFA in the United States).

FCM and Clearing Member

FCMs act as executing brokers as well as clearing brokers. FCMs execute option trades on exchanges and provide clearing services. FCMs are typically members on both exchange and clearinghouse. FCMs maintain the margin accounts of their clients in their capacity as clearing brokers.

Rulebook

Each exchange maintains its own rulebook. The exchange rulebook is the best resource for the registration process and all other procedures related to option contracts and other products traded on exchange. The rulebook includes clearing procedures as well. Online links to selected exchange rulebooks were provided in the Chapter 10.

Trading

Options are traded on exchanges around the world and option contracts are available on a large number of asset types including commodities, various financial instruments, indices, and other derivative instruments such as futures (options on futures). Each contract is specific to the exchange, and contract terms are defined by the listing exchange. Each exchange lists the variety of contracts based on various underlying asset classes, different strike prices, and with multiple expiration dates. Option contract types are known as a *series (*Chapter 2).

The options trading model follows an anonymous exchange trading model in which buy and sell orders are matched anonymously and then cleared by a clearinghouse. Each contract holder's counterparty will be the clearinghouse instead of other trading partner. Institutional clients trade options mostly through FCMs or directly on an exchange.

An option contract trade contains information such as the contract identifier representing series, number of contracts (quantity), buy or sell, type (put or call), price (premium), opening or closing position, and order type (market or limit).

Because listed contracts are standardized, each option contract represents the predetermined quantity (round lot) of the underlying. It is also known as *contract multiplier*. For instance, one corn option contract may represent 5,000 bushels of a specific type and quality of corn to be delivered when exercised. For another instance, one equity option contract might represent the exercise right for 100 shares.

Options Instrument Identifier Multiple options on the same underlying with different maturity dates and different strike prices are traded simultaneously. US markets have adopted a new option symbology that uniquely identifies all options. For more information, visit http://education.optionseducation.org/course/view.php?id=3.

The Options Industry Council (OIC) The OIC provides education on options to all types of market participants. OIC has free online resources in addition to seminars and educational materials on equity options. You can access their online courses at http://education.optionseducation.org/course/.

Option Quotes

The price of an option contract is the premium paid to a seller to own the right to trade an underlying at strike price. So, key elements of option quote are the *best bid (highest premium), best ask (lowest premium), last trade premium, change, and volume*. A detailed quote includes other details such as the *last sale time* and *open interest*. Price is typically quoted per unit of underlying. The contract price is equal to the unit price and multiplied by the contract size (contract multiplier). For instance, if a single stock option price is quoted at 15 cents, then the one contract price is $15 (=100 * 15 cents), assuming that contract size is 100 shares.

Exchanges stream quotes and execution prices throughout the trading day. At the end of the trading day they publish *closing prices* of each series.

Order Types

Each new trade either opens or closes a position, as explained below:

> **Opening a position.** The two ways of opening a new position are to *buy to open* (buy an option that is going *long*) and to *sell to open* is (sell an option that is going *short*).
>
> **Closing a position.** The two ways of closing a position are to *sell to close* (close the long position in the same option contract) and to *buy to close* (close a short position in the same option contract).

Closing Price versus Settlement Price

The *closing price* of the contract is simply the *last trading price* of that business day. The next business day trading starts at the closing price of the previous business day.

The *settlement price* is an official price determined by the exchange at the close of trading. It may not be the same as the closing price. It is used to settle contracts and calculate margin requirements of open contracts. The settlement price calculation method varies by exchange and clearinghouse. Usually it is an average of market prices just before the closing of trading. The closing price is not used for settlement because it can easily be manipulated. The settlement price is separately calculated to prevent any such manipulation.

Post-Trade Processing

In a listed market, post-trade processing is done electronically. FCMs, exchanges, clearinghouses, and most institutional clients are electronically connected, enabling end-to-end STP.

Allocations

If an order is not allocated before execution (pre-trade allocation), the client must allocate it after execution.

Confirmation and Clearing

After execution, trades are submitted to exchange for confirmation and then to the clearinghouse for clearing (Chapter 10). After clearing, both parties are legally obligated to perform the contract. For all further activity, clients deal with their FCMs and in turn the clearinghouse.

Live Contract

An option contract becomes effective after clearing. Options are standardized contracts and terms may not change during its life, except in the event of the corporate actions explained below. Since options are traded in the open market, their price is essentially driven by demand and supply and other market factors such as option strike price, expiry date, market price, and price volatility of the underlying.

Although the exchange is responsible for administering the contract, the clearinghouse is responsible for managing margin, exercising assignments, delivery, and settlement through its members.

Unlike in a futures contract, only the option writer is obligated in an option contract. Only the option writers are exposed to risk, and they tend to use various risk management strategies. Short option positions carry various types of risks, which are measured using well-known factors such as *delta, gamma,* and *vega (the Greeks)*, whereas an option buyer is exposed to the limited risk of losing only the premium that has been paid.

Premium and Initial Margin

In an option transaction, the option buyer pays the premium and the option seller receives the premium. In addition, the seller deposits the required margin (initial margin).

Option transactions may involve fees such as the execution broker fee, clearing broker fee, exchange fee, clearinghouse fee, and taxes. All these transaction fees are amounts that are settled between related market players.

Corporate Actions

If a corporate action such as a stock split or merger affects the underlying of an option, the option contract may be affected. The operations team adjusts the option positions to reflect the changes after advisement by the exchange and FCM. Certain actions may affect only the market price, while others may affect both the price and the contract size.

Expiry

The option contract ends either when it is matured or exercised. The option holders have the following choices:

Long Position Holder:

- allow it to expire without exercising
- exercise the option

Short Position Holder:

- close the position through offset trade
- allow it to expire without exercising
- assign an exercise (execute the transaction with a long position holder by trading the underlying per contract terms)

Contract expiry and the exercise processes are discussed in the next section. Most listed option contracts specify a certain week day as the *expiration day* and *last trading day*, rather than a certain calendar day of the month. For instance, most equity and index options in US markets expire on the Saturday immediately following the third Friday of the expiration month. The last trading day will be the last Friday of the expiry month—that is, the day before the expiry day. In most cases, exercise notice can be given until the last trading day, before cutoff time. If the last Friday is a holiday, then the last trading will be done on the previous business day.

The actual trading period, exercise period, and expiry day of each option series are defined by the exchange. They generally vary by asset class. In some cases, the expiry day and last trading day are the same. American-style options can be exercised at any time during the trading period (or exercise period), whereas European-style options can be exercised only on a designated exercise day. This principle holds true regardless of the exchange.

The Options Clearing Corporation (OCC) The OCC is the world's largest equity derivatives clearing organization operating in US markets. Many standards and procedures in use at OCC are adapted by many other clearing organizations across the globe. To learn more about OCC and their procedures, visit `www.optionsclearing.com`.

Contract Termination and Offset

An option contract expires after its term (expiration date). An option contract for the long position holder (buyer) is just a right but not an obligation (Chapter 2). Accordingly, long positions are either exercised or left open until expiration. A short position holder, on the other hand, may be assigned an exercise before the expiry if the position is not closed. Accordingly, if the short position holder does not want to be involved in trading the underlying, he or she must close the position.

An open position can be terminated through an offset trade (either a *buy to close* or *sell to close*) before it is assigned exercise or upon its maturity. An offset trade includes the same contract but in an opposite direction. For instance, assume you are long (*bought a buy to open*) a *call* option. To close this position, you have to trade a *sell to close* with the same contract call option (with same strike price and expiration). On the contrary, if you are short (*sold a sell to open*) a call option, you have to trade a *buy to close* with that same exact call contract. Similarly, put option contracts can be traded to close a position in a *put* contract.

Table 13-1 shows trade types, resulting position, and corresponding trade that offsets each position.

Table 13-1. Positions and Offset Trade Types

Open Trade	Position	Offset Trade
Buy to Open - Call	Long Call	Sell to Close - Call
Sell to Open - Call	Short Call	Buy to Close - Call
Buy to Open - Put	Long Put	Sell to Close - Put
Sell to Open - Put	Short Put	Buy to Close - Put

Option Exercise and Assignment

Based on the style of option contract, it can be exercised at any time through the contract term or on specific dates. As noted above, for instance, an American-style option can be exercised any day during the trading period, whereas a European-style option can be exercised only upon its expiration. The option exercise process may vary slightly by exchange and type of product. This section explains the general process of exercise. Option contracts are exercised in one of the following scenarios:

- In the case of the American style, a holder may choose to exercise anytime during the life of a contract.
- In the case of the European style, other unexercised options at expiration and all in-the-money options are exercised by default, unless the holder elects not to exercise it.

In the case of the European-style and other unexercised options at expiration, which are out-of-the-money (also known as a *pin risk situation*), the holder can choose to exercise them.

Note that some FCMs may require their clients to send exercise notice regardless of whether the option is in-the-money.

Automatic Exercise Some clearinghouses will automatically exercise any expiring call or put contracts that are in-the-money at a certain threshold amount, for instance $0.05 or more in-the-money. This is also known as *exercise by exception*.

Exercise Notice Process

In order to exercise an option on a particular day, the holder must notify the FCM before the FCM's *cutoff time* for accepting an exercise notice on that day. The cutoff time varies by broker and also by option class. The broker in turn sends the exercise notice to the clearinghouse before the cutoff time of the clearinghouse. The clearinghouse then pairs the long position holder with a short position holder. This is called the *assignment process*. The actual assignment procedure varies by clearinghouse. Figure 13-3 shows various cutoff points on a trading day time line.

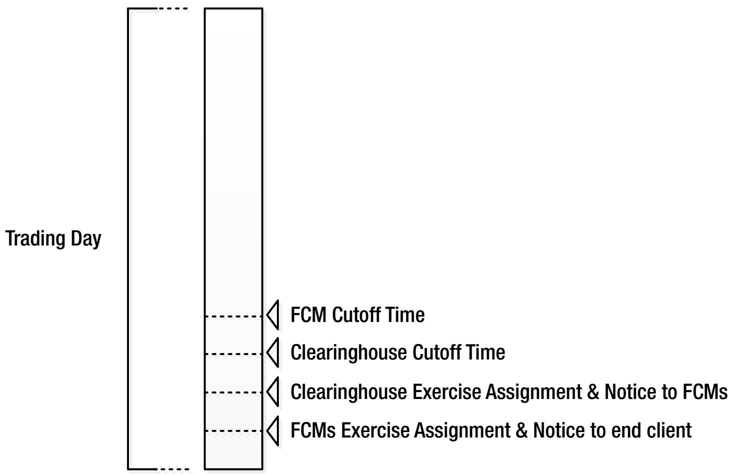

Figure 13-3. Exercise notice and assignment time line

Note that in case of a futures contract, a short position holder issues the delivery notice to initiate the delivery before expiration.

Combined Clearinghouse Some clearinghouses clear trades of multiple exchanges. For instance, CME Clearing in the United States clears the trades of CBOT, CME, COMEX, NYMEX, and KCBT.

Assignment at FCM

All end-client positions are held by the FCM (clearing member). When the assignment is sent to the broker, the broker assigns the exercise to one of the clients. Note that the FCM might be holding a position in that same contract on its own book. This is known as a *house account*.

The clearinghouse defines the assignment process to be followed by FCM. This process incorporates rules that promote the *fair, equitable, and non-preferential assignment* of exercise.

Figure 13-4 shows the flow of exercise notice, the assignment process, and the notice flow among clients, FCM, and the clearinghouse.

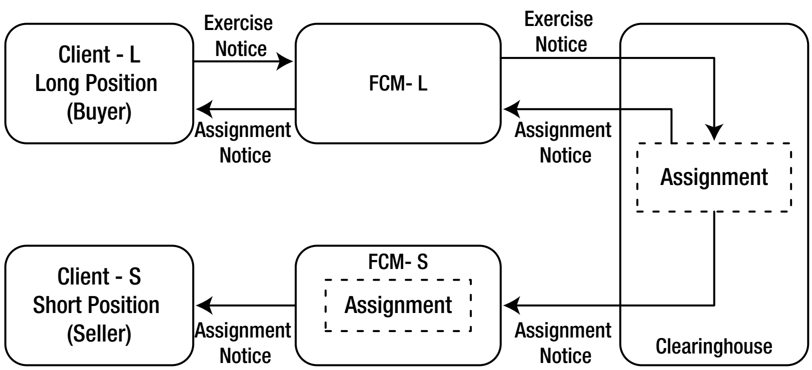

Figure 13-4. Option exercise assignment

Upon expiration as dictated by the exchange rules, all in-the-money contracts may get assigned unless exclusively notified by the long position holder.

Assignment Models Most exchanges publish assignment procedures online. You can learn about the assignment process of *options on futures* on CME at `www.cmegroup.com/clearing/files/IR-284_OptionsExercise.pdf`.

Options Margin Process

The margin process was discussed in Chapter 10. Clients maintain their margin accounts with their FCMs, and the FCMs maintain their margin account with a clearinghouse. Obligations resulting from trading activities are credited to or debited from the margin account.

In the case of an options transaction, a margin account is affected by the following factors:

- a new trade, an opening or closing of a position, an initial margin resulting from short positions, or premium payments from long positions
- daily market movements to which short position holders must respond to maintain a minimum margin
- option exercise in which the final amount results from exercise settlement

Margin requirements vary by contract. The clearinghouse sets the initial margin requirements, maintenance margin, and all other related rules. For option contracts, margin requirements vary based on the following:

- length of the contract, either short-term or long-term
- side of the position, either long (buyer) or short (writer)
- covered or uncovered (naked) shorts, in case of short position
- type of strategy, depending upon strategy being used

Long Positions

In the case of a long position holder (buyer), the option contract is the only option to exercise but not an obligation. Only a premium payment is required with no margin. A buyer must pay the total premium amount per the established settlement period. For example, if the settlement is T+1, the premium amount must be deposited one business day after the trade date.

Short Positions

The two types of short positions are *covered* and *uncovered* (or *naked*). If the option writer holds the underlying asset referred by the option contract (or some form of eligible asset to cover in case of exercise), then that short position is known as a *covered short*. If the option writer does not hold the underlying asset, then it is referred to as an *uncovered* or *naked short*.

Clearinghouse rules define the eligibility criteria of covered calls. The eligible assets or positions are held in a member account. For example, a member can have a certain amount of cash in the account, a long or short position on security, a short or long position on the similar option, a deposit certificate, or a letter from a bank. Similar procedures apply between the end-client and FCM.

Margin for Covered Shorts

Typically, no initial margin is required for covered calls, but the margin account must hold a certain percentage (typically 50%) of the underlying asset at market price. As the underlying asset price varies, the daily margin amount may vary and raise the need for an additional deposit in the margin account.

Margin for Uncovered Shorts

Uncovered shorts are not allowed on certain types of options to all investors. Trading is allowed to the limited clients chosen by the exchange. Usually these positions require the premium amount and a certain percentage of the current market price of the underlying asset. As the underlying asset price varies, additional deposits may be required to match the minimum margin requirements.

Netting

Final margin requirements of each account are the netted amount of all margin requirements of all positions in that account. Netting rules may vary by clearinghouse and FCM.

Margin Calculator To learn more about margin calculation of options, try the margin calculator for stock options and stock index options of CBOE on their website, `www.cboe.com/tradtool/mcalc/`.

Delivery and Settlement

After the assignment, a short position holder must deliver the underlying asset at the exercise price. Not all options need actual underlying asset delivery. Delivery can either be in the form of cash settlement or physical delivery based on contract specifications. Contracts such as index options are cash-settled. These transactions settle through the clearinghouse-designated payment system and a custodian.

Cash Settlement

In case of cash settlement contracts, the clearinghouse computes the difference between the underlying spot price and the strike price. This amount is settled between a long and short position holder. The underlying spot price is identified and set by the clearinghouse based on standard practices used in different markets. This value is also referred to as the *exercise settlement value* (or just *settlement value*).

Physical Delivery

For physical delivery of a contract, a long position holder provides the required cash while the short position holder delivers the underlying asset. Listed options exist on many different types of assets. The delivery process may vary by clearinghouse and asset type. Each clearinghouse has predefined procedures for the delivery process.

End-of-Day Activity

Chapter 12 summarized end-of-day activities in relation to futures, as well as a series of general processing steps. These steps are applicable to all listed products that the firm might be holding. The margin account of each client at an FCM combines all listed contracts of that client—even cleared and other contracts. Margin calculations and settlement are carried out at an account level for netted amounts.

At the end of each business day, buy-side firms and FCMs obtain the official closing prices of their option contracts and settlement values (such as index values), reevaluate their portfolios, and reconcile their option positions and margin calculations with FCM reports. The FCM in turn reconciles their positions and margin calculations with the clearinghouse. At the end, they terminate all expired and exercised contracts.

Summary

Options are popular risk management products. Listed options trade in very large volumes around the world. As for futures, option trading and contract processing procedures are standardized and all operations are largely automated. Exchanges and clearinghouses define and carry out most of the critical activities. Although option pricing is complex, trading and processing option contracts is relatively simple.

This chapter explained the various phases of the listed option contract life cycle and related operations. It detailed important aspects such as contract termination, exercise, and assignment procedures. Chapters 14 and 15 will cover OTC contracts. Chapter 15 will explore the life cycle of most OTC bilateral contracts, including OTC bilateral options.

CHAPTER

14

OTC Cleared Contract Life Cycle

The introduction of the Dodd-Frank Act and similar reforms across the world has changed the OTC markets. The new OTC market structure and new regulations were discussed in Chapter 9. As a result of these reforms, standardized *cleared OTC contracts* have been introduced. Today, cleared instruments are traded that have been derived from various OTC products, such as interest rate swaps, basis swaps, currency swaps, foreign exchange swaps, total return swaps, equity swaps, equity index swaps, debt and debt index swaps, credit default swaps, and other commodity swaps. Although the cleared contract market is still a relatively new market and there is trading of a limited variety of types of contracts, the cleared contract market is expected to introduce a larger variety of instruments and trade higher volumes.

Recall that cleared contracts are traded on electronic platforms, confirmed on affirmation platforms, and cleared through a clearinghouse. All these entities are licensed and regulated by regulatory agencies. The overall flow of a cleared contract resembles that of a futures contract.

Chapter 10 provided various details of a general contract life cycle. This chapter will focus on the life cycle of a cleared contract. The Dodd-Frank Act introduces many titles, terminology, and corresponding definitions (see Chapter 9), which are summarized in Table 14-1.

Table 14-1. New Titles Introduced through Reforms

General Term	Description	Alternative Terms
Eligible Swap Participants (ESP)	Registered participants	Market Participants, Market Players
Swap Market	In general, overall OTC Market	OTC Market
Derivatives Clearing Organization (DCM)	Licensed clearing firm	Clearinghouse, CCP
Designated Contract Market	Licensed swap trading platform	Swap Execution Facility (SEF), Organized Trading Platform (OTF), Exchange
Trade Repository (TR)	Swap trade warehouse	Swap Data Repository (SDR)
Swap Dealer (SD)	Licensed dealer	Broker, Broker-Dealer, Swap Broker, Sell-Side
Major Swap Participant (MSP)	Registered participant who holds substantial positions in a swap market	Typically a large bank that is not registered as a Swap Dealer
End User (EU)	Registered market participant who is neither SD nor MSP	End-client, Client
Nonfinancial end-user	Exempted end-client	Commercial End User

The objectives of this chapter are to

- explain the OTC cleared contract trading model and workflow
- outline the various phases of the life cycle of a cleared contract
- describe the process of netting (offset) the cleared contract
- discuss the margining and settlement process of cleared contracts

OTC Cleared Contract Workflow

OTC cleared contracts are new and have been introduced to provide the benefits of both listed and OTC contracts. OTC cleared contracts are traded in the new OTC electronic market and cleared by a central clearing entity (CCP or clearinghouse). The key players in cleared markets are the end users (registered institutions), FCMs (Futures Commission Merchants, also known simply as *brokers*), execution venue (SEF and exchanges), clearinghouses, and trade repositories. Figure 14-1 shows the high-level workflow of a cleared contract trading.

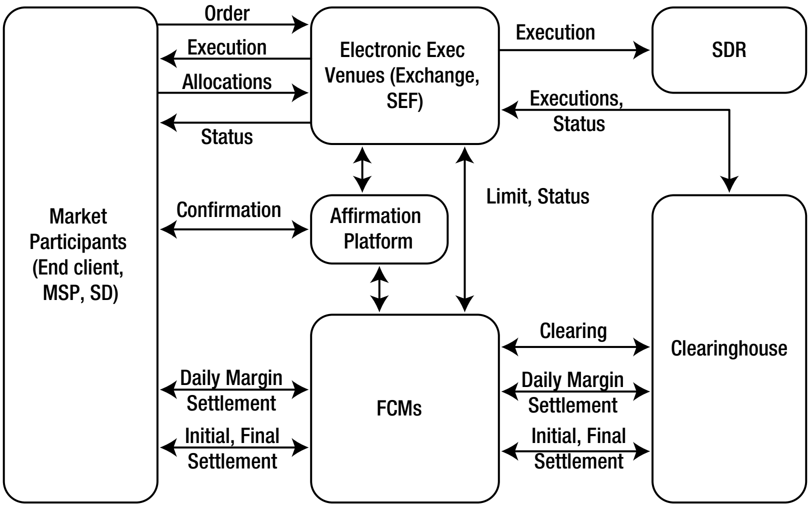

Figure 14-1. Cleared contract workflow

The key steps in a cleared contract end-to-end workflow are the following:

Execution:

- Clients (trading parties) submit their requests for quotes (RFQs) to dealers on an SEF or organized trading facility (OTF). They may use the current published quotes from a swap dealer (or any other trading party) in order to execute the trade.
- Dealers respond to client requests with their best prices.
- Clients pick the dealer to execute the trade.
- Before the trade execution, the SEF may check the credit limit (or allowable trading limits) of a client with the FCM.
- The SEF reports the trade to the clearinghouse, SDR, and affirmation platform, as required.

Clearing:

- Both counterparties confirm the trade on an affirmation platform.
- The FCMs of both sides accept the trade at the clearinghouse.
- The clearinghouse clears the trade if it is acceptable. The clearinghouse and FCM may reject the trade if there is any issue with the trade or counterparties, such as breaching limits.
- The clearing status will be transmitted to trading partners through either the SEF or some other channel.

Live Contract:

- After clearing, the clearinghouse becomes the counterparty for both initial trading partners. A live contract is governed by clearinghouse rules. Any required collateral is managed in a margin account of the client's FCM and in FCM's account at the clearinghouse until the expiration or termination of the contract.
- Contract obligations, margin, and other fees are settled according to the settlement terms throughout the life of the contract. Settlements take place between the client and FCM and similarly between the FCM and clearinghouse.

Each of these steps is further discussed in the sections that follow.

Contract Life Cycle

The following sections look into the various phases of a contract life cycle and highlight information specific to cleared contracts. *Chapter 10* discusses each step in detail and serves as the master reference.

Chapter 9 presented information on the new OTC market structure and the roles of all entities involved. In summary, all OTC market participants must register with regulatory agencies designated by the Dodd-Frank Act or similar acts in their respective region. These regulatory agencies oversee the OTC market. All trading activity is reported to the designated trade repositories in their markets, which in turn provide access to regulatory agencies. Trade repositories also publish limited data for the public.

Figure 14-2 shows key points that are specific to cleared contracts. The following sections will discuss each of them.

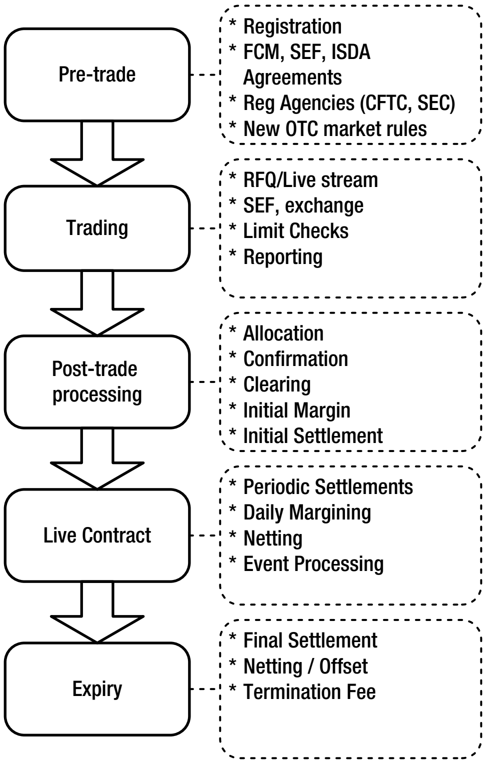

Figure 14-2. The cleared contract life cycle and key stages

Pre-Trade

Pre-trade involves the setting up of legal relationships among all market players. For cleared product trading, market participants execute legal agreements mandated by the FCM, SEF, clearinghouse, and other entities.

Trading

The cleared instruments are traded only on designated swap markets (execution platforms) such as SEFs or exchanges around the world. Cleared instruments are relatively new and, currently, limited instruments are being traded. As the market evolves, more OTC products are expected to be standardized and traded in the market. The cleared instruments are standardized by the market supported by clearinghouses instead of any specific electronic platform or exchange alone defining them. Executed trades are then submitted to the selected clearinghouse for clearing (Chapter 10).

In addition, execution platforms submit executed trades to the clearinghouse, trade repository, and affirmation platforms, as required.

Quotes

All cleared market quotes are published by trading platforms. To execute trades, clients can either request quotes from selected dealers or pick quotes published by any dealer (*live streaming*).

At the end of each business day, clearinghouses publish various reports including trading volumes, open interest, settlement prices, and other such information. However, more details such as high and low prices of contracts might not be published in order to maintain the private nature of OTC markets.

Trading Limit Checks

The SEF may check the credit limits of each client with its FCM before the trade execution to ensure the certainty of clearing. These electronic platforms are licensed by OTC market regulatory agencies and comply with the trading rules enforced by these agencies.

Post-Trade Processing

After the execution, trade details are pushed forward for post-trade processing. In cleared markets, most post-trade processing is done electronically. Since the trade is executed on an electronic platform, trades are processed much more quickly and with the least number of errors possible. Trading platforms, affirmation platforms, and clearinghouses are electronically connected enabling STP across the board.

Allocations

If a trade is not allocated before the execution (pre-trade allocation), the client must allocate the trade after the execution. Allocation must be done in order for the confirmation process to start. Allocations are usually done through an SEF facility (either through a trading system or online portal).

Confirmation

Executed trades are submitted to affirmation platforms of the client's choice, either by the trading platform or by the counterparties themselves. Using the affirmation platform tools (mostly online), both counterparties match the trade details and confirm (or affirm) the execution. This completes the confirmation process. After confirmation, the trade proceeds for clearing.

Clearing

The clearinghouse may accept trade execution details from either the SEF or another servicing platform. Typically, the trade is submitted to the clearinghouse right after the execution. Upon confirmation, the FCMs of both trading partners must accept the trade at a clearinghouse (known as *take-up*). After that, the clearinghouse either clears or rejects the trade, based on predefined criteria such as acceptable product types and the credit standing of the counterparties. Once a clearinghouse clears (accepts) the trade, the status will be reported back to the FCM and thence to the clients. After clearing, the original trade is replaced with two contracts between the clearinghouse and each counterparty. The clearinghouse becomes the counterparty to both original trading parties without any obligation or exposure to one another. Cleared contracts are governed under the rules of the clearinghouse rulebook.

If for any reason the clearinghouse refuses to clear the trade, it may be either nullified (voided) or turned into a bilateral contract, based on the preexisting legal agreement between the counterparties. Typically, the initial execution is based on an ISDA agreement that exists between market participants. This agreement may include language stating that if the swap is not accepted for clearing by the clearinghouse for any reason, the swap will be void and counterparties are not obligated to each other in any sense. This decision is usually made in a very short time after the execution. Most cleared trades are effective from T+1 (next day of trading day). Any issues with clearing or post-trade processing must be resolved before the end of the trading day.

Live Contract

The cleared contract becomes effective after clearing. Both parties of the original trade now "face" the clearinghouse (counterparty). As for listed contracts, cleared contracts cannot be amended in terms of notional or other economic terms. Instead, they can be netted partially or fully with new trades to reduce or increase the overall position. Netting rules may vary by clearinghouse.

Initial Settlement

As for listed products, cleared contracts require an initial margin. In addition, some swaps involve a premium and fees. These payments are settled between the client and the FCM as well as between the FCM and the clearinghouse upon contract initiation.

Settlement Price

The settlement price is an official price determined by the clearinghouse at the close of trading. It is used for the purpose of contract valuation and margin calculation. Underlying methodology of determining the settlement price may vary by instrument and clearinghouse. Typically, the settlement price is the average price of trades executed toward the end of the trading period such as the last 30 minutes. This process varies by clearinghouse and product type.

In the case of interest rate products, reset rates (index interest rates) and yield curves are also published by clearinghouses and are essential for the valuation of interest rate swaps.

Mark-to-Market

At the end of each business day, all open contracts are marked-to-market and even more than once a day in certain situations. The daily change in the *net present value* of a contract is known as a *variation margin*. It may even include any coupon payments on coupon dates of the contract. Variation margin is settled daily between clearinghouses and FCMs as well as between FCMs and end-clients. Typically, these payments are netted per each currency and account between these entities.

Settlements

As previously discussed, most cleared contracts are cash-settled. That means any change in contract value and obligations are settled using cash value. Most cleared contracts are settled daily, meaning a contract on any given day has an obligation resulting from just that day's price movements. The settlement process continues until either the contract is netted (terminated) or it has expired. Typically, cleared market obligations are settled on the next business day (T+1).

Event Processing

If there are any events or corporate actions affecting the underlying of swaps, corresponding swap contracts may be impacted. Those contracts are adjusted or the event is processed according to the advice of the clearinghouse and FCM.

For instance, in the case of a specific credit event, the related credit swaps will be affected. The credit event is processed per the rules, and long position holders receive a protection amount. At the end of the event processing, the contract may get terminated based on the instrument type. For instance, a single-name CDS contract is terminated after the credit event, whereas a CDS index contract may be altered to remove the defaulting entity from the coverage and a new version of the contract becomes effective.

Margining

As explained in Chapter 11, clients maintain their margin accounts with the FCM, while an FCM account is maintained with the clearinghouse. Typically, accounts may hold both listed and cleared contracts.

Each long trade (opening position) requires an initial margin amount as per the predefined rules. Similarly, a closing position will trigger the refund of the initial margin. However, in most cases, the initial margin is computed at the portfolio level combining all positions rather than at each trade level.

At the end of each business day, a position is marked-to-market, and the resulting change in the value of a contract is settled on a daily basis. When the position is offset (netted) on any given day after that day's margin settlement, the contract is terminated.

A clearinghouse separates the FCM's house positions and client positions, maintaining different accounts. Margin computation is done at an individual account level in order to avoid any leverage by the FCM.

The FCM may use the same margining rules as a clearinghouse. However, FCMs may charge additional collateral for extra protection in certain cases, at their discretion.

CME-CORE CME provides an online tool to calculate initial margins for IRS and CDS portfolios cleared by CME. The CME-CORE can be accessed online at `www.cmegroup.com/core`. Each clearinghouse uses its own margining methodology.

Portfolio Margining Including cleared products in portfolio margining provides greater capital efficiencies for market participants. This process is underway in most clearinghouses.

Expiry

A cleared contract expires upon maturity, or it can be terminated before maturity through an offset trade, as explained below.

Offsetting or Netting

To terminate an open position in a swap, a position holder must trade a similar contract in an opposite direction. Both contracts must have similar economic terms and maturity. According to clearinghouse netting rules, client positions will be netted at the end of each business day. Generally, there are two types of netting: *gross netting* and *selective netting*. *Gross netting* affects the overall position at the notional level of a client; *selective netting* allows the client to choose any specific open position to be netted. Availability of these options may vary by clearinghouse. In a nutshell, it is quite similar to the offsetting of futures contracts.

Termination Fee and Final Settlement

If the contract is terminated or expired on a specific day, settlement at the end of that day fulfills its obligation.

In the case of termination, certain contracts may require a termination fee and other obligations that are also settled as part of the final settlement.

Reporting

According to the Dodd-Frank Act (Chapter 9) and similar acts around the world markets, selected entities must report trading activity to trade repositories in real time, with some exceptions. Typically, SEFs, SDs, MSPs, and even end-users in some cases must report their positions to trade repositories.

End-of-Day Activity

In addition to standard end-of-day operations, if cleared contracts are held in portfolios, the operation teams collect market data such as daily settlement prices, reset rates (fixing prices), and yield curves to mark-to-market cleared contracts. Furthermore, clients collect various reports such as position reports, exposure by asset class, and the daily margin from the FCM for reconciliation. Similarly, FCMs receive reports from a clearinghouse for reconciliation.

Summary

The cleared contract market is new and evolving. However, the underlying concepts of central clearing, procedures, and operations are already well established in listed markets. All entities serving cleared markets (including electronic trading platforms, clearinghouses, and affirmation platforms) have been in use for a long time. The regulatory reforms moved some of the OTC contracts onto this market infrastructure and set certain rules.

This chapter explained the various phases and other details of a cleared contract life cycle. The next chapter will focus on the life cycle of OTC bilateral contracts.

CHAPTER

15

OTC Bilateral Contract Life Cycle

The previous chapter introduced the life cycle of OTC cleared contracts, which are created as a result of new regulations and whose life cycles resemble listed contracts. This chapter introduces the life cycle of OTC bilateral (or simply *bilateral*) contracts, which are the oldest of derivatives contracts. Bilateral markets have improved market practices and operational procedures to reduce the risk from derivatives and promote safer markets.

OTC bilateral contracts are a critical part of the derivatives market. An OTC bilateral contract is a direct agreement between two market participants, and contract obligations are settled directly between counterparties. No clearinghouse is involved in the contract, unlike listed and cleared contracts.

Chapter 10 explained the derivatives contract life cycle of OTC bilateral contracts and associated standard procedures. The present chapter focuses on these contracts and explains specifics peculiar to them. This chapter serves as an extension of Chapter 10, which introduced most of the terminology and procedures referred to in this chapter. This chapter also provides an in-depth look into the life cycle of a simple interest rate swap.

The objectives of this chapter are to

- outline the OTC bilateral contract workflow
- discuss the various phases of the life cycle of a bilateral contract

- describe the various options for terminating a bilateral contract
- discuss the collateral management and settlement process of a bilateral contract
- illustrate the life cycle of a simple bilateral interest rate swap contract

Bilateral Contract Workflow

In most bilateral contracts, one of the parties is the dealer. The unique nature of bilateral contracts is that they can be precisely structured to address an idiosyncratic set of participant needs. These contracts are generally established trade-by-trade, with any type of terms and conditions embedded in them. There could be many minor or major variations in the life cycle of these contracts. However, an overall contract life cycle can be generalized as most operations follow market standards. The following sections explain the most common elements of these contracts.

Chapter 10 explained various execution models involved and the high-level flow of bilateral contracts. Figure 15-1 shows a high-level workflow of bilateral contracts.

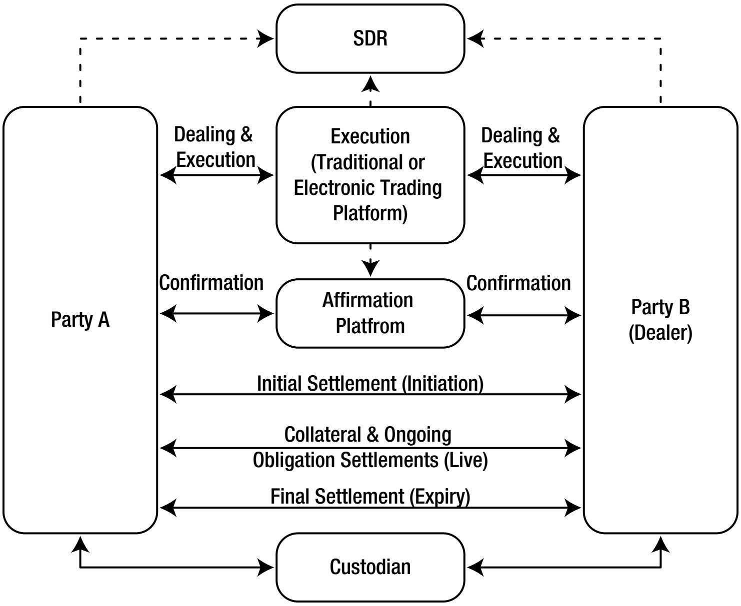

Figure 15-1. Bilateral contract workflow

The following are the key steps in the bilateral contract workflow:

Execution

- Trading partners negotiate the deal using traditional channels, such as voice broking, or through electronic trading platforms and execute the trade.
- A validated and enriched trade ticket is forwarded to the operations team for post-trade processing.

Post-Trade Processing

- The operations team validates the trade terms with the counterparty, either manually or over an affirmation platform. All economic and non-economic terms, cash flows, and other details are compared.
- Once the trade is matched at both ends, it is confirmed between counterparties.
- Both counterparties update the confirmation status and push forward for settlements if any payments result in contract initiation.

Live Contract

- After the confirmation, a contract is live and contractual obligations are effective from the contract start date. A live contract is governed under the master agreement, such as an ISDA master agreement, established between counterparties. The collateral management is also governed under collateral agreements, such as ISDA CSA.
- Initial obligations (notional exchange, premium, fees, collateral, and so on) are settled, if there are any.
- Periodic (daily or per contract terms) collateral exchange takes place between counterparties.
- One of the counterparties may amend the contract terms (economic terms) with an agreement from the other. This may trigger post-trade processing before it becomes effective again. An amendment may also involve a fee payment from the amending party.

- A contract may also be terminated (if allowed) by one of the counterparties with the agreement from the other. It may also involve a termination fee.
- If an event impacting the contract occurs, it will be processed according to the predefined rules.
- Contract obligations, collateral, applicable fees, and other payments are settled according to settlement terms throughout the life of the contract. Payments are exchanged between counterparties, mostly through a custodian bank.

Expiry

- Bilateral contracts expire when they reach an end date, or they may be terminated before the stated end date, if allowed.

Contract Life Cycle

Chapter 10 discussed each step of the contract life cycle for each category—listed, cleared, and bilateral products. The following sections presume knowledge of the information in Chapter 10 and highlight only information that is specific to the phases of the bilateral contract life cycle.

Chapter 9 covered the new OTC market structures and the roles of all entities involved. In summary, all OTC market participants must register with regulatory agencies designated by the Dodd-Frank Act or with agencies mandated by similar acts in respective regions. Regulatory agencies oversee OTC markets in their respective regions. Most trading activity is reported to the designated trade repositories in their markets and, in turn, trade repositories report to regulatory agencies and publish limited data to the public.

Figure 15-2 shows key elements that are specific to bilateral contracts. The following sections will discuss each of them.

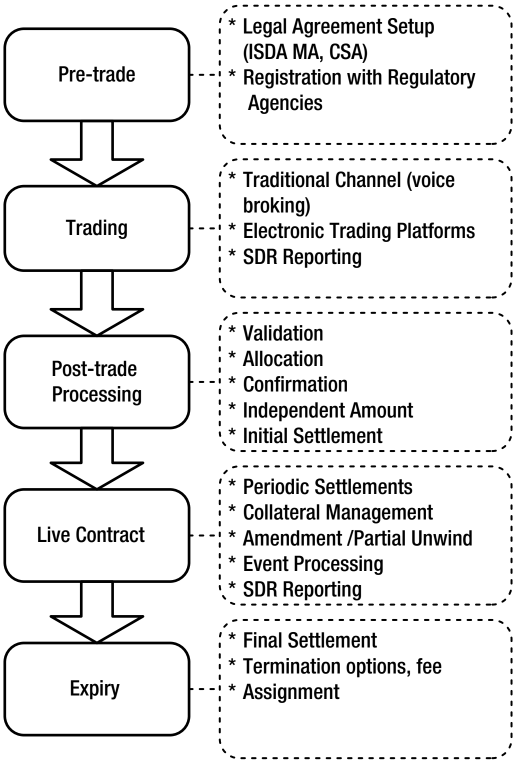

Figure 15-2. Bilateral contract life cycle and its key elements

Pre-Trade

As noted earlier, pre-trade involves the setup of a legal relationship among all market players. Under Dodd-Frank and similar regulations, all participants must register with the appropriate agencies unless exempted. In addition, counterparties establish a relationship through a direct agreement, such as an ISDA master agreement and CSA.

While an ISDA master agreement covers the non-economic terms of a swap contract, such as representations and warranties, CSA will cover terms related to collateral management. All agreements must be in compliance with regulatory requirements.

Trading

As explained in Chapter 10, trades in the bilateral market can be executed in several ways. The final contract will, however, always remain between two parties. In most cases, at least one of the counterparties is a swap dealer. In the case of an inter-dealer market, the contracts are between two swap dealers.

The dealing and execution is done either through a traditional voice brokering (*voice broking*) or over some kind of electronic platform, such as a multilateral dealer platform, inter-dealer platform, or SEF.

Post-Trade Processing

After the execution, the trade details are captured in the appropriate system and the post-trade processing starts.

Validation

As the first step of the post-trade processing, the trade details are validated. In case any differences are found, they must be resolved manually before the confirmation process starts. Since bilateral contracts are custom contracts, all economic details, cash flows, dates, and other details are validated thoroughly.

Allocations

If the trade is not allocated (assigned to an appropriate legal entities and/or portfolios) before the execution, both parties allocate and update each other before proceeding further.

Confirmation

In the bilateral market, a trade can either be directly confirmed between two counterparties (by email or fax) or confirmed over an affirmation platform. The affirmation process was detailed in Chapter 10. In particular, before confirmation, the contract details registered by both parties are compared and matched over an affirmation platform.

After confirmation, the bilateral post-trade processing ends and a contract will become effective from the stated start date.

SDR Reporting

All eligible bilateral swap trades are required to be reported to the respective *swap data repository* (SDR). The appropriate reporting party or parties report the trade to the SDR after the execution of the trade or immediately after the confirmation of the trade. In addition to new trades, changes to live contracts are also reported. Reporting is discussed in detail in Chapter 9 on Dodd-Frank.

Initial Settlement

Most bilateral transactions require an *independent amount* as part of the collateral management requirement, as explained in Chapter 11. In addition, a transaction may also involve fees, accrual payments if any, and possible other payments to be settled. The party with any such dues settles these payments as per the settlement terms.

For instance, a plain vanilla IRS swap does not involve a notional exchange; however, in the case of a currency swap, notional is exchanged. Furthermore, based on the structure of the trade, some exotic contracts require initial payments from one of the counterparties.

Live Contract

The bilateral contract will become effective on the start date after confirmation. From the effective date of a contract, the contract appears in all reports and is included in calculations such as profit and loss reports and risk analytics.

Bilateral contracts may have a variety of embedded options (terms and conditions) that, in turn, determine operations and procedures. Each bilateral contract is structured independently. The following sections explain some common activities that are applicable to most bilateral contracts.

Contract Valuation and Analytics

Each contract has a market value that can be calculated at any point during its life. Typically, at the end of each business day (or periodically as required), all live (open) contracts are marked-to-market or valuated using appropriate market data that is set and uses predetermined models. The present value of the contract is also known as the *marked-to-market value* or *fair value of a contract*. The present value is used for reporting, such as profit and loss reports, exposure calculation, and collateral management. The present value affects the unrealized profit and loss. Furthermore, various analytics are computed for risk management and to monitor hedge effectiveness, if the contract is used for hedging.

At any given point of time, the present value of the contract is the *net present value* (NPV) of all projected cash flows at that time. The *present value* of cash flow is the discounted value of cash flow calculated using prevailing rates. For instance, suppose a vanilla IRS has five pending payments of $1 million each, spread over the next five years at the end of each year. To determine the present value, these five payments are discounted using applicable forward interest rates (1y, 2y, 3y, 4y, 5y). The sum of these discounted payments is the *net present value* of this contract.

Market Data Management

Bilateral contract valuation and risk analysis requires a variety of market data, including standard market prices and interest rates. However, market standards and/or contracts prescribe the source of data and models used for contract valuation and analysis. While certain elements are used from sources such as closing prices, others are computed using mathematical models such as volatility curves.

On each business day, market data is obtained from data sources. Raw data is cleansed and validated for quality, and theoretical data (curves) is computed.

Obligation Settlements

While a majority of bilateral contracts are cash-settled, some of them involve the delivery of the underlying. Delivery procedures vary by underlying asset and market standards. A further detailed delivery process is beyond the scope of this chapter. In cash-settled contracts, the resulting cash flow from contract terms are settled between counterparties on predetermined payment dates.

Each contract is evaluated and cash flows are computed on all payment dates throughout the term of the contract. Like listed and cleared contracts, bilateral contracts may not involve daily cash flow exchanges. For instance, in the case of an interest rate swap with semiannual frequency, a floating interest rate is reset every six months, and both fixed and floating leg payments are settled between counterparties only twice a year.

The obligation settlement process continues until either the contract is terminated or expired.

Collateral Management

The collateral management process has been discussed in detail in Chapter 11. In summary, in most major markets of the world, eligible bilateral swaps (OTC bilateral contracts) are subject to new collateral management rules. New collateral rules prescribe independent amount rules, collateral eligibility, valuation, and other rules.

Event Processing

If an event that impacts the contract occurs during the life of the contract, the event will be processed as per the predefined rules. Furthermore, the contract is amended to reflect the impact of the event. Typically, market standards and contract terms define all events that impact and process procedures.

Reconciliation

Reconciliation is the process of matching the contract terms between the counterparties to ensure the contract terms are same on both sides. Each party periodically reconciles contract terms (economic terms, cash flows, schedule dates, and other details) with counterparties directly or through third-party reconciliation services. This is part of the risk mitigation task and may help to identify if there are any discrepancies in advance. More on third-party reconciliation services can be found in Chapter 5.

Amendment

Before the end date, if allowed, contracts can be amended by one of the parties. Typically, in the case of an amendment, one of the parties may pay the fees to compensate for the economic impact on the contract from the amendment. However, an amendment may not be allowed on all contracts. If allowed, amendable terms vary by contract types. This process is also known as a *restructure*.

Partial Unwind

Partial unwind is similar to an amendment, but it specifically reduces the notional amount of the contract. However, partial unwind is allowed only if the contract terms allow for it and/or the counterparty agrees to it.

Assignment or Novation

An *assignment* is another way of terminating a contract. In case of assignment, the party who wants to terminate the contract transfers the contract to a new party. The new party will take over all contractual obligations from that point in time onwards. This process is also known as *novation* or *step-out*. However, this process does need the consent of the remaining counterparty in the contract.

Partial Assignment

A *partial assignment* function is similar to the assignment but, in this case, only the partial contractual obligations are transferred (or sold) to a different market participant. A notional amount of an original contract is reduced and a new contract that is similar in nature is established between the remaining counterparty and new counterparty. The same as in a full assignment, the remaining counterparty consent is required for partial assignment.

Optionality

A bilateral contract may contain a variety of options that are embedded. Option execution procedures are typically driven by contract terms and market practices. Contracts with embedded options are generally referred to as *exotics*.

Expiry

A bilateral contract expires on a *maturity date* or an *end date* that is stated in a contract. A contract also can be terminated before a stated maturity date, if allowed (early termination). If any cash flows are due, they will be settled upon maturity. The expired trades are also known as *matured trades*. After an end date, the expired are not included in any reports or analytics.

Maturity

All contracts expire on a maturity or end date, as stated in the contract.

Early Termination

Many bilateral contracts are structured with early termination features. In general, there are several ways bilateral contracts can be terminated or a holder can achieve the effect of termination.

> **Termination.** Like any other derivative contract, a bilateral contract may have some market value throughout its life. A party with negative value can pay the market value to another party and terminate the contract, if the contract terms allow for such a termination. This is also called a contract *unwind* or *buy-out of the counterparty*.

Offset. To achieve the termination effect, one can enter into an offsetting contract that is similar and has opposite economic terms. For instance, a counterparty holding a vanilla swap (paying a floating and receiving fixed rate) could enter into a second swap that is receiving a fixed rate and paying a floating rate with the same maturity date and interest rate index, which will offset the cash flows of the existing contract. It has same impact as terminating the existing contract.

Assignment, novation, or transfer. As explained earlier, one can assign or transfer contractual obligations to other market participants and step out of the original contract.

Termination event. Certain contracts may have early termination features that are triggered by specific events such as failure to fulfill certain obligation, downgrade of credit ratings, or a merger or acquisition of one of the counterparties. When a trigger event occurs, the contract is terminated and there may be a cash settlement between the counterparties for any market value of the contract.

In general, the early termination process involves a termination fee. If one of the parties wants to terminate the contract at some point of time, that party can pay a termination fee and exit the contract. Termination fees are typically the present value of the contract. It may also have some additional fees as per the contract terms.

For instance, if a party holds a swap with the market value of $100,000, the party can settle the swap with the counterparty by having the counterparty pay $100,000 in cash. This payment terminates the contract between the two parties. On the other hand, the party holding a swap with a negative market value can terminate the swap by paying that value to the counterparty.

Final Settlement

If any obligations have resulted from the termination or expiry of the contract, they are settled between the counterparties based on the stated settlement terms.

Reporting

According to the Dodd-Frank Act and similar regulations, selected (designated) entities must report trading activity to trade repositories in real-time with some exceptions. Typically, the trading venue, swap dealer, or major swap participant is responsible for the reporting bilateral trades. More on reporting can be found in Chapter 9.

Settlement and Netting

Settlement and netting terms are covered under an agreement between counterparties. The ISDA agreements cover settlement and netting terms that are in compliance with new regulations.

A bilateral market uses various techniques to reduce counterparty credit risk. One of them is the payment netting that is governed by the *netting agreement*. As a result, most contract payment schedules are designed (payment dates are aligned) to accommodate payment netting between counterparties.

End-of-Day Activity

In addition to standard end-of-day procedures, an operations team collects required market data such as reset rates (fixing prices), various yield curves, and other data elements that are required to value bilateral contracts. Furthermore, end-clients collect various reports such as position reports and daily collateral reports from the counterparties (typically dealers).

Exotic Derivatives

Essentially, exotic contracts are standard bilateral contracts with several options embedded from one or both parties. In general, the life cycle remains the same, but with additional rules that are driven by embedded options. Typically, exotic (more complex) contracts are traded by professionals in large institutions that are well equipped with the required resources to manage those contracts.

Market reforms have changed the overall form of exotic contracts. Reforms are discouraging the use of more complex contracts. However, market participants are redefining the way they design and use exotics.

From the perspective of managing these contracts, managing and automating the processing becomes difficult owing to custom options and the complexity behind them. Most exotic contracts are manually managed. However, firms hold a relatively small number of exotic contracts and managing them is not an issue, provided that teams understand the product mechanics.

Interest Rate Swap Life Cycle

Interest rate swaps (IRS) are widely traded bilateral contracts. This section explains the life cycle of a plain vanilla bilateral IRS contract. This can be used as a reference to understand other bilateral contracts. Figure 15-3 shows a time line of a two-year contract and various activities throughout the term of the contract. The following sections explain each of these activities.

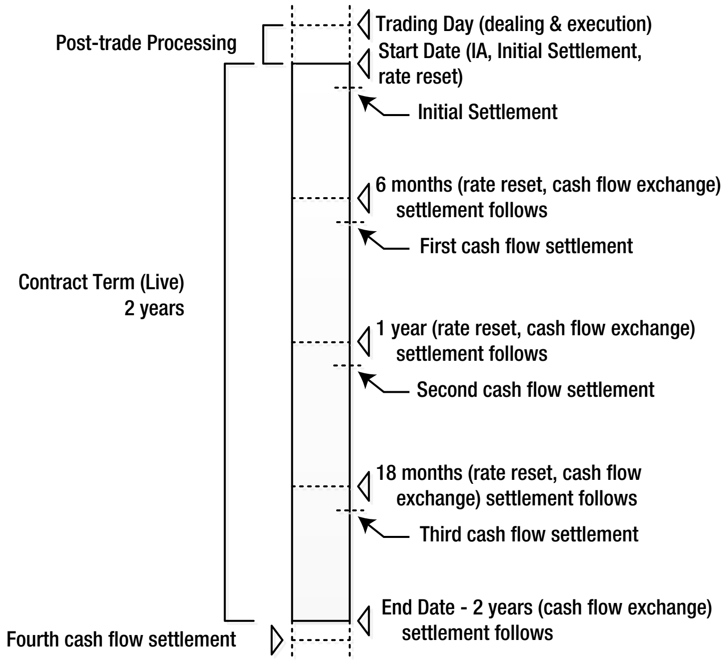

Figure 15-3. The IRS contract time line

Dealing and Trade Execution

Typically, the client requests the quote from a dealer for a swap with a required tenor (contract length) and the underlying interest rate index such as LIBOR 3M (LIBOR three-month interest rate). In the standard IRS contract, the buyer pays the fixed interest rate while the seller pays the floating rate based on the underlying reference rate.

A sample IRS contract's details are illustrated below. This example focuses on key concepts, ignoring some details for the sake of simplicity.

Assume a client sends the RFQ to buy a 2-year LIBOR 6M vanilla swap and receives the quote as "2.5% flat." This means the dealer (seller) is willing to enter into a contract by receiving 2.5% on the notional (per annum) and paying the prevailing LIBOR 6M index rate (*flat* means "with no margin on top of the prevailing floating rate"). Assume a client agreed and executed the trade. The key details of an executed swap are as follows.

Contract Terms	
Trade Date. 1/27/2014	Fixed. USD 2.5%
Duration/Tenor. 2 years	Floating. USD LIBOR 6M
Start date. 1/2/2014	Frequency. Semiannual
End date. 1/2/2016	Settlement terms. T+2
Notional. $100 million	Day count convention. 30/360
	Business day convention. Modified following, based on New York business days

The contract terms may be spelled out as follows:

- The swap contract is executed on 1/27/2014.
- It is a contract with 2 year term, starting on 1/2/2014 and maturing on 1/2/2016.
- The notional amount of contract is $100 million that is used to calculate the interest payments.
- There are 4 payments each at the end of a 6 month long term.
- The fixed leg interest rate is 2.5% throughout the contract term.
- The floating leg interest rate is based on USD LIBOR 6-month rate index.
- Payments are settled on the second business day after the payment date.
- Business days are working days in the New York markets. In case of a holiday, the following business day will be used (*modified following*).
- Interest payments are calculated based on a 30/360 day count convention.

Post-Trade Processing

After a trader executes the trade, the trade details are typically validated by the trading assistant and moved for post-trade processing. The operations team confirms the trade over the electronic platform or bilaterally, at the earliest possible time. Trade validation and allocations of all other post-trade processing activities are performed during this phase. In most cases, trades are confirmed before the start date.

Live Contract

The contract is effective from the start date to the end date, which is from 1/2/2014 to 1/2/2016. The key activities of a simple IRS are explained below.

Initial Settlements

In a simple IRS, the notional amount is not exchanged between two parties. It is used only for interest payment calculations. In most cases, a simple IRS contract doesn't have any initial payment obligation as they are mostly priced to have no value at the inception. However, there may be an *Independent Amount* (IA), *broker fee*, and an *accrued interest amount* to be settled upon the contract inception. Typically, IA must be deposited on or before the start date while other payments may be settled on settlement terms. Per the contract terms of this sample trade, all cash flows and are settled on T+2.

Cash Flows

While a fixed leg always pays the fixed amount, floating leg payments vary. This sample has six months frequency. That means there are four payment periods spread over two years. For a floating payment, the interest rate is set (rate reset or fixing) at the beginning of each period so the first payment is known at the inception date. Table 15-1 shows pay periods, the rate reset date, and payments.

Table 15-1. Cash Flow Dates

#	Pay Period	Rate Reset Date	Payment Date
1	Feb 1, 2014–Jul 31, 2014	Feb 1, 2014	Jul 31, 2014
2	Aug 1, 2014–Jan 31, 2015	Aug 1, 2014	Feb 3, 2015*
3	Feb 2, 2015–Jul 31 2015	Feb 2, 2015	Jul 31, 2015
4	Aug 3, 2015–Jan 31, 2016	Aug 3, 2015	Feb 1, 2016*

*Dates are adjusted to reflect holidays

Although an actual calendar is not used, the above dates do consider Saturday and Sunday, and accordingly, dates are shifted to the following business day.

Table 15-2 lists all cash flows and net payments. The net cash flows are showed from the buyer's (fixed leg payer) perspective. The LIBOR 6M floating rates shown are hypothetical.

Table 15-2. Cash Flows of a Two-Year IRS (in Millions)

Date	LIBOR 6M	Floating Cash Flow	Fixed Cash Flow	Net
Aug 1, 2014	2.5%	1.25	1.25	0.00
Feb 3, 2015	2.4%	1.20	1.25	-0.05
Aug 1, 2015	2.8%	1.40	1.25	0.15
Feb 1, 2016	3.0%	1.50	1.25	0.25

Each fixed cash flow paid by the contract buyer is. 0.5 * 0.025 * $100mm = $1.25 million. First, the floating cash flow is. 0.5 * 0.025 * $100mm = $1.25 million. Similarly, other cash flows are computed and are shown in Table 15-2. At the end of each payment period, the net cash flow is settled between counterparties. For instance, at the end of the second payment period (Jan 31, 2015), the buyer pays the seller $0.05 million. The net payment is the profit or loss to the buyer from this contract, which in this example is $0.35 million.

Cash Flow Projections and Present Value

A swap has a market value that can be calculated during its life. Live contracts are valuated (marked-to-market) using the prevailing interest rates for every business day for the reporting, such as the portfolio profit and loss, exposures, hedge effectiveness, and other analytics. The present value of the contract is also known as the *marked-to-market value* or *fair value of swap*. This present value affects the unrealized profit and loss.

At any given point of time, the present value of the contract is the net present value of all the projected cash flows at that time. The present value of the cash flow is the discounted value of the cash flow calculated using prevailing rates.

In case of this example, fixed leg payments are known and are the same in all cash flows. To project the cash flows of a floating leg, the expected future reference rates (rate curves) are used. As time passes, these curves may change and the value of the IRS will keep changing even if all other factors remain the same. In addition, discount rates may also change along with the time. So, the value of the contract is expected to be changing.

Generally, projected cash flow reports are generated in advance (typically 1–4 weeks) for cash management and planning. If you assume it is March of 2015, there will be two payments pending. Table 15-3 shows projected cash flows, discount rates, and the present value of each cash flow of this contract (rates are hypothetical).

Table 15-3. Cash Flows of Two-Year IRS (in Millions)

Date	LIBOR 6M	Net	Discount Rate	PV
Aug 1, 2015	2.8%	0.15	1.20%	0.1482*
Feb 1, 2016	3.0%	0.25	1.24%	0.2469
			Swap value (NPV)	0.3951

* The formula used here is

$$\text{Present value } (PV) = \frac{\text{Future Value}}{(1 + \text{Discount Rate})^n}$$

The swap value at the time of valuation is $0.3951 million. Since it is a positive value, the buyer has an *unrealized profit* from this contract.

Early Termination

Assuming the buyer wants to terminate the contract at some point in time (if the contract terms allow), the buyer can pay the termination cost and exit the contract. Termination fees are typically the present value of the swap.

For instance, if the swap seller wants to terminate the contract and the market value of the contract from the seller's perspective is $25,000, the buyer can pay this amount and terminate the contract. Similarly, if the market value is negative then the seller may have to pay the buyer.

Expiry

The contract expires on an end date if it is not terminated early. On maturity, the final cash flow is due. This payment is settled between counterparties after two business days, as per the T+2 settlement terms mentioned in contract.

Settlements

Most payments in OTC markets are settled on T+2 basis (two business days from the payment date) or as per the contract terms.

On settlement day, the settlement instructions are generated by the system. The back-office (payments and settlement team) validates and approves the payment and settlement instructions will be sent to the custodian.

All settlements (payments and receipts) are reconciled on a later date.

Summary

An OTC bilateral market is a large and critical part of financial markets. New regulations have changed the landscape of the OTC market. However, the OTC bilateral contract operational procedures mostly remain the same. Regulations mainly change the reporting and collateral management requirements and other underlyings. This chapter explained the various phases and other details of the bilateral contract life cycle. Finally, a detailed illustration of the life cycle of a simple IRS was given.

This next chapter examines the life cycle of credit contracts.

CHAPTER

16

Credit Contract Life Cycle

The credit derivatives market is one of the largest and most important segments of the OTC derivatives market. As explained in Chapter 2, the major credit derivatives contract types are the following:

- *single-name credit default swap* (CDS), which provides protection on a single reference obligation (bond) issued by a particular reference entity
- *credit default swap index* (CDX), which provides protection on a portfolio of reference entities
- *loan credit default swaps* (LCDS), which provides protection on a syndicated secured loan
- *index tranche*, which provides protection from a particular amount of loss on a portfolio of reference entities

Most credit derivatives contracts are OTC contracts, and they include both cleared and bilateral contracts, which are commonly traded on electronic markets such as SEFs and dealer platforms. Some bilateral contracts use traditional channels (*voice-brokered*).

Credit contracts have become standardized over the years, and their central clearing started well before Dodd-Frank regulation. Credit markets have well-established operational procedures and are quite transparent.

Previous chapters in this part of the book have explained the life cycle of cleared (Chapter 14) and bilateral (Chapter 15) contracts. This chapter primarily focuses on the fundamental processes related to the different types of credit contracts, particularly CDSs and CDXs.

As an alternative to OTC credit derivatives, some exchanges also trade credit options (listed credit derivatives). Their life cycle is similar to that of the listed options discussed in Chapter 13.

The objectives of this chapter are to

- discuss standardization of credit default swap products
- describe the general life cycle of a credit contract
- review various credit events
- discuss the process of settling credit events

CDS Contract Characteristics

Most credit default swap contracts are standardized in terms of maturity, coupon settlement terms, accruals, and other key characteristics. Standardization has many benefits, including simplified trading, fungibility (unwinds, assignments), and central clearing. However, bilateral contracts are customized to suit the needs of the end-client. Incorporating the general characteristics of derivatives contracts, the specific characteristics of standard credit contracts are explained below.

Maturity

Standard contracts have maturities ranging from six months to ten years. These contracts have fixed start and end dates. Standard contracts with five year maturities are widely traded.

Fixed Coupon and Upfront Points

The periodic payments paid by the protection buyer to the protection seller are commonly referred to as the *credit default swap spread*, expressed as a percentage of the contract notional. This is also known as the *premium or coupon*.

For standard contracts, the spread is split into two parts: the *fixed coupon* and *variable upfront points*. The fixed coupon is an ongoing periodic payment, and the variable upfront fee is paid initially to compensate for the difference between the market spread and the fixed coupon. If the contract is terminated, there will be a termination payment based on the market price. Fixed coupon and upfront points (simply *upfront*) are expressed as percentage points of the notional. Upfront points are also known as *trading points*.

Typically, the present value of the spread is paid by the protection buyer to the protection seller at the beginning of the payment term. For most standard contracts, the fixed coupon is paid quarterly.

Recovery Rate

The *recovery rate* is the percentage of the par value of the reference obligation (bond or loan) that the protection buyer will receive after a credit event. The recovery rate is determined after the credit event, using an applicable process. If, for instance, after the credit event, the market value (recovery price) of a bond is 40 cents on the dollar, the recovery rate is 60 cents on the dollar, or 60%.

Standard Pricing Model

To provide transparency of pricing to market participants, the ISDA has introduced a standard model available at `www.cdsmodel.com`. This model allows all participants to match market prices with their internal calculations.

Credit Events

ISDA defines various potential credit events and applicability. Typically, credit contract terms use credit events based on these definitions.

Settlement Protocol

Credit markets use standard settlement protocols, introduced by ISDA, to settle credit events, which will be discussed in later sections.

Quotes

The key elements of a credit contract quote are *spread or price* and *upfront points*.

Single-Name CDS

Single-name CDS contracts are quoted with a fixed ongoing premium (*coupon*) (500 or 100 basis points) and variable upfront points (*initial fee*). The ongoing periodic payment is based on a fixed coupon. A variable upfront fee is paid on the start of the contract. If the contract is terminated before maturity, based on the market upfront at that time, there may be a termination payment as well.

For example, if a protection buyer buys a CDS contract with a standard coupon payment of 100 basis points (annual) while it is trading at 120 basis points, he makes, in addition to his regular coupon payments of 100bp, an initial payment to defray the difference between 120bp and 100bp.

CDS Index (CDX)

Similar to a single-name CDS, most indexes are also quoted with fixed ongoing premiums (coupon) and variable upfront points. Upfront points are decided by the current market. In most cases, a fixed coupon is paid quarterly at the start of the term, and upfront payments are made at the contract initiation and the close of the trade in the case of early termination. However, some indexes quote in terms of *price*, where the price is par minus the present value of the spread differences.

Identifiers

Credit markets use *Markit RED* (*Reference Entity Database*) codes to uniquely identify all reference entities (six-digit RED), reference obligations (nine-digit RED), and loan facilities (nine-digit Markit Loan ID). These identifiers increase the efficiency in STP and other internal operations.

CCPs The clearing of credit contracts has been growing rapidly. There are currently several CCPs clearing CDS contracts. They include *ICE Trust* and *ICE Clear Europe*, both operated by the Intercontinental Exchange, *CME Clearing*, owned by CME Group, *Eurex Credit Clear*, operated by Eurex Frankfurt AG, and *LCH.Clearnet*, operated by the LCH.Clearnet Group.

Contract Life Cycle

Chapters 14 and 15 explained the cleared and bilateral contract life cycle. In general, the life cycle of cleared and bilateral credit contracts follow the steps explained in those chapters. This section explains topics specific to credit contracts, such as credit events and the settlement. Figure 16-1 shows the general life cycle of the credit contract.

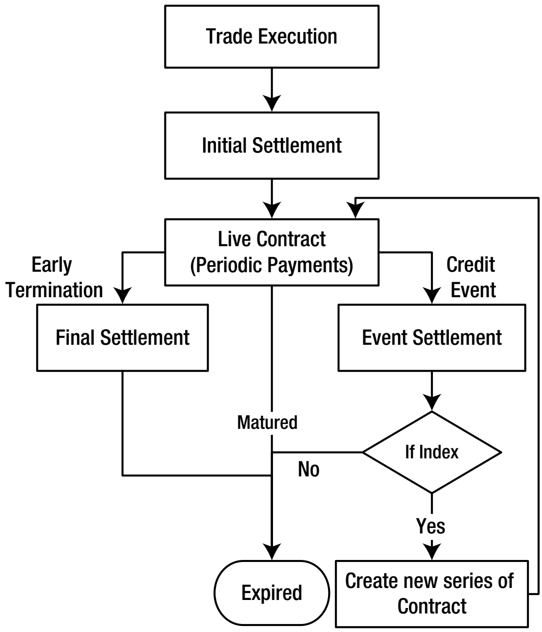

Figure 16-1. General life cycle of a credit contract

The following steps explain the life cycle of the credit contract:

1. At the beginning of the contract, the protection buyer pays an accrued coupon payment and upfront points, if there are any.
2. Periodic coupon payments are made by the protection buyer to the protection seller until the end of the term, unless the contract is terminated or if an applicable credit event occurs.
3. If any party wants to terminate the contract, the party can offset (unwind or transfer) the contract, as applicable.
4. During the term of the contract, if any applicable credit event occurs, a credit event settlement process starts. As per the settlement protocol, a protection amount is settled between contract holders.
5. If the contract is effective until the maturity date, it will expire at the end of the term. After this point, the protection as well as coupon payments end.

Each of these steps is further explained in the remainder of this chapter.

Cash Flows

The following list explains various cash flows related to CDS contracts:

Initial Settlement

At the start of the contract, typical cash flows include the first premium payment or accrued premium, upfront points, and any applicable fees.

Periodic Premium Payments or Coupon Payments

The periodic premium is paid by the protection buyer to the protection seller until the end of the term of the contract. For most standard contracts, coupon payment is paid quarterly; for the remainder, it is paid semi-annually.

Termination Fee

If the contract is terminated before its full term, based on the market price, one of the parties pays the termination fee.

Credit Settlement

In case of a credit event, the final settlement amount is paid by the protection seller to the protection buyer. The settlement amount is either the full protection amount or the net amount based on the settlement method, which will be explained in a later section.

Termination of Contract

As explained earlier, cleared contracts are offset through an opposite trade; bilateral contracts are closed-out (unwind) with a counterparty through an applicable termination payment. When cleared contracts are offset, the holding CCP aggregates positions to reduce the net position. Actual details vary by CCP.

In case of a bilateral contract, one of the parties can compensate the other party with the difference between the current market price and the contract's coupon. Again, actual payment details vary by contract terms.

Novation or Assignment

Like most bilateral contracts, bilateral credit contracts can also be transferred to other parties if allowed by the terms of the contract.

Index Roll

Each index is reconstructed every six months, and a *new series (new version)* is published for trading. This process is known as *index rolling*. The latest index version is known as an *on-the-run series*. The previous version is known as the *off-the-run series*.

Credit Events

A credit event is an event that leads to a diminished market value for a reference obligation (corporate debt security or loan) other than market interest rates. Contract terms specify a set of applicable credit events, one of which must occur for the protection seller to compensate the buyer. Various credit events as defined in *ISDA Credit Derivatives Definitions* include the following:

Bankruptcy. Event in which a reference entity has filed for relief under bankruptcy law (or an equivalent law) that includes insolvency, appointment of administrators (liquidators), and creditor arrangements. Typically, it applies to corporate reference entities, but not for sovereign entities.

Failure to pay. Event in which the reference entity fails to make interest or principal payments toward its debt after the expiration of any applicable grace period.

Restructuring. Event that refers to an action such as coupon reduction or maturity extension, undertaken in lieu of a default. It is typically applicable to corporate entities.

Repudiation or moratorium. Event that refers to repudiation or moratorium on debt payment. This event essentially refers to the government reference entity that refuses to pay or delays the debt payment.

Obligation acceleration. Event in which obligations become due and payable as a result of default or any other condition.

Succession events. Event that includes most corporate events such as a merger, split, transfer of assets or liabilities, and other similar events in which the obligations of one entity are transferred to another entity, as a result of some corporate activity.

Note that some of these events may be applicable to a particular reference entity and are included in contract confirmation documentation, while other events are excluded.

Big-Bang Protocol

After the financial crisis of 2007–09, ISDA has introduced a series of changes in the credit market to facilitate market standardization. These changes are referred to as the CDS *Big-Bang Protocol*. Highlights of the changes to the CDS market include the following:

- The establishment of an ISDA's *Determinations Committee* (DC) to make decisions regarding CDS market issues such as credit event occurrence, succession event occurrence, and deliverable reference obligations, following a credit event declaration.
- Introduction of the cash settlement of a defaulted CDS, via ISDA auction's *final price* as a default settlement method.
- The establishment of a standard bond-like coupon methodology for the first CDS coupon payment.
- A 60-day look-back period for credit events from the current date.
- A 90-day look-back period for succession events from the current date.

Credit Event Processing

Each contract type has associated credit events that trigger the settlement process. On a credit event, the contract coupon (premium) stops accruing. A credit event settlement procedure has been evolving as a result of various events that had occurred in the recent decade. Credit events can be settled either through a physical settlement or a cash settlement.

In the physical settlement method, the protection buyer physically delivers the underlying reference obligation to the protection seller. The protection seller in return pays the full protection amount.

In the cash settlement method, the protection seller pays the difference between the current value of the obligation and protection amount to the protection buyer. For instance, the market price of the defaulting credit is 15 cents for every dollar; the protection buyer gets 85 cents for each dollar of the protection amount (contract notional).

The day of the credit event is known as the *credit event date* on which coupon accrual stops. The day on which the final settlement takes place, either through physical or cash settlement, is known as the *credit settlement date*.

The following sections explain how credit events are processed for single-name CDS contracts and CDS indices.

Single-Name CDS

Following a credit event, the ISDA's Determinations Committee will publish a *settlement protocol* for the defaulted credit (reference entity). The settlement protocol includes details of a time line of events and list of obligations (bonds or loans) that can be delivered to settle the contract.

As per the protocol schedule, the following events take place. The following list is an overview of the whole process:

1. Contract holders can decide whether or not to be part of the settlement protocols. All parties send notice to the ISDA prior to the cut-off date.
2. The contract holders who opt out bilaterally settle an obligation without participating in the auction process.
3. All participating parties join the auction and agree to settle at a single price, known as a *final price* determined by the auction.
4. On a scheduled date, the auction process takes place.
5. In the auction process, all buyers and sellers participate, either with the intent to settle the transaction physically by delivering eligible bonds or with loan or cash settlement.
6. The auction process involves two phases. In the first phase, the *Inside Mid-Market* (IMM) price and *open interest* are determined based on bids and asks. In the second phase, the final price is determined. The final price is the price at which the last physical settlement request can be filled.
7. All open contracts are settled using the recovery rate *(1 - final price)* of the defaulting reference obligation. The recovery rate is used across the market to settle trades, ensuring all contracts are settled at the same price.

Physical Settlement

As per the protocol schedule, the protection buyer notifies the details of bonds or loans that will be delivered. The buyer can deliver any bonds issued by the reference entity meeting the eligibility criteria (as referenced in the contract). On the delivery date, the protection buyer delivers the bonds or loans with the face amount equal to the contract notional. The protection buyer also pays the accrued spread from the last coupon payment date up to the day of the credit event. The protection seller pays the protection amount to the protection buyer.

Index Event Processing

In the case of a credit event with any entity covered in the index, there will be three auctions to determine the recovery rate of the defaulted bond. The average price of all the three auctions will be the final recovery price. Index holders will receive protection based on this recovery price.

All names in the index are equally weighted in terms of the default protection. After the settlement of a credit event, the index will no longer include the defaulted name. The new version of the index will be issued with the defaulted entity removed. This change is reflected through a change in the notional value of the contract. Note that the coupon rate of the index is not changed. Assume that if there is a credit event in one entity of the index that has 100 names, the notional value of index contract will fall by 1/100.

For example, if an investor originally purchased $100 of the index that has 100 names, the new notional value of the trade will be $100 * (99/100), or $99, and their coupon payments will be based on this new notional value. If the coupon is 500bp, the new coupon payment will be 500 * 99, instead of 500 * 100 prior to the credit event. The new notional is referred to as the *factored notional*.

Assuming a recovery price of a defaulted name is 70 cents on the dollar, the index protection buyer is compensated (1/100 * 0.3 * notional), where the recovery rate is the following: (1 - .7 = 0.3).

Physical Settlement

Physical settlement functions the same way as in single-name CDS. The protection buyer delivers the debt and receives par on the portion of the index made up of the defaulted reference entity.

The Auction Process

An auction is administered by *Markit* and *Creditex* using the ISDA settlement protocol. All of the auction results of each step of the process are published on www.creditfixings.com.

In summary, the auction process has two phases. In the first phase, all participants may submit physical settlement buy/sell requests (orders) to trade obligations of a stated size at the auction's final price. In this phase, the IMM price and open interest are determined and published.

In the next phase, all participants submit their limit orders, which include the quantity and trade price. The *final price* is the price at which the last limit order is used to fill the open interest, discovered using the *Dutch auction* style (defined below). This final price will also serve as the *recovery price* and market price. Even the physical settlement happens at this recovery price. The process of determining the final price is also referred to as *credit event fixings*.

Assuming a recovery price is 70 cents on the dollar, all protection buyers are compensated at 30 cents (1- 70) on the dollar on the defaulted name. The net settlement amount is the (notional * 0.30).

Auction Primer For more information on the auction process, refer to the document at www.creditfixings.com/information/affiliations/fixings/auctions/docs/credit_event_auction_primer.pdf.

Dutch Auction An auction model in which the lowest price necessary to sell the entire offering becomes the final price at which all the securities offered are sold. Once all the bids are submitted, the offers are assigned to the bidders from the highest bids down until all of the offers are assigned. However, the price that each bidder pays is the final price that is the price of the last successful bid. Therefore, even if a buyer bids $100, if the last successful bid is $80, then the buyer pays only $80, not $100.

Benefits of the Auction Process

The auction process allows an efficient settlement at a single price for all adhering parties. It ensures that the final price is reflective of the market value of the defaulted entity's obligation. This also provides an opportunity for participants to finish with the same net bond or loan position that they would have had under the physical settlement.

Succession Events

Succession events (or corporate events) may have an impact on the reference entity of contracts. These events are processed based on the guidelines provided by the *ISDA Determinations Committee* (DC).

For simple renaming events, old names on applicable contracts will be replaced with new names. For splits and mergers, the contract national may be split or combined with new names, as per the event and guidelines issued by the ISDA DC.

Credit Portfolio Compression

Portfolio compression reduces the overall notional size and number of outstanding contracts in credit derivative portfolios without changing the overall risk profile or present value of the portfolios. This is achieved by terminating existing contracts and replacing them with a smaller number of new replacement contracts that carry the same risk profile and cash flow as the initial portfolio. As a result, new portfolios require a smaller amount of regulatory capital to be held against the positions. This process is also known as *tear-up*.

Portfolio compression cycles are run on a regular basis in various regional markets to compress the most actively traded single-name CDS contracts across all major sectors.

Market Data

Chapter 8 discussed various elements of market data. Major sources of market data related to credit derivatives include Markit and other trading venues. Markit publishes end-of-day quoted spreads and other related data.

End-of-Day Operations

Overall end-of-day operations are discussed in previous chapters under each type of contract. Those daily activities also include tasks related to credit contracts such as loading official spreads (valuation prices), reference data updates, event data, affected changes, recovery rates, reversioning of indexes, and factor adjustments.

Summary

Today, most financial institutions and large corporations use credit derivatives to manage their credit risk. In addition, credit contracts promote the efficiency in managing and trading risk as well as flexibility through a wide variety of contracts. Although most credit derivatives are OTC instruments, credit contracts and market practices are standardized. Clearing of credit derivatives has been rising due to standardization and regulatory reforms.

There are two major categories of credit contracts—bilateral and cleared—in addition to credit options trading on exchanges. Previous chapters explained the life cycle of listed, cleared, and bilateral contracts. This chapter explained specific topics related to credit contracts, such as general life cycle, cash flows, credit events, and credit event settlement procedures.

The life cycle part of the book ends with this chapter. Part IV will focus on the systems that constitute a derivatives information technology platform.

PART

IV

Systems

CHAPTER 17

Derivatives and Information Technology

Although fundamental derivative products are not new to markets, many complex derivative contracts have been introduced in the last decade. The systems dealing with listed derivatives have matured, but because of the complexity and customized nature of OTC derivatives, systems are still evolving in this market. Although there are many well-developed products serving specific independent areas such as trade processing, analytics, and risk management, there is still room for an integrated, efficient platform that supports end-to-end derivatives business activities. Immature processes, use of distributed data across multiple systems, and poorly functioning systems increase operational and other risks.

A successful IT solution provides a powerful service offering to help navigate the myriad aspects of derivative transactions processing. Derivatives software systems are the most complex in the capital markets area. Continued innovation in IT and the increased risk involved in derivatives have led the market to employ the best technology available to help manage the day-to-day challenges of managing derivatives. Ongoing changes in the regulatory landscape are driving increased transparency, efficiency, and security in derivatives markets.

The preceding parts of this book have presented various aspects of derivative contracts and markets. This part focuses on the underlying technology platform that runs this business. This chapter presents the technical challenges of managing derivatives and describes the functional requirements of the systems. This chapter also expands on the introduction in the first part of this book to the importance of IT in managing derivatives, laying the foundation for the final chapters, which detail IT systems in use.

The objectives of this chapter are to

- define the derivatives contract from technology's perspective
- discuss how information technology (IT) is addressing the challenges in managing derivatives
- outline the importance of IT strategy and its alignment with organization strategy
- understand the requirements of successful IT organization structure, team, and talent

Contract: The Technical Definition

Part I defined and explained the derivatives contract from the business perspective. From the technical perspective, a financial derivatives contract is an agreement between two corporations (counterparties) to exchange cash (cash flows) or assets such as securities and commodities (known as *obligations*), which are driven by terms specified in a contract for a specific duration (known as the *contract terms*). Contract terms vary by the type of product that the contract represents. The exchange of cash flows may or may not happen, the number of flows may vary, flows may be unidirectional or bidirectional (one or both parties may pay), or flows may even be triggered by an external event. The actual value of contract and cash flow may vary over the contract terms and may depend on various market parameters. This is a precise definition for a system's personnel. From a technical point of view, then, the key elements of a derivatives contract are the following:

- Contract (defines all terms)
- Counterparties
- Obligations (flows)
- Contract terms
- Events

Figure 17-1 illustrates the life of a contract from the origination to the end.

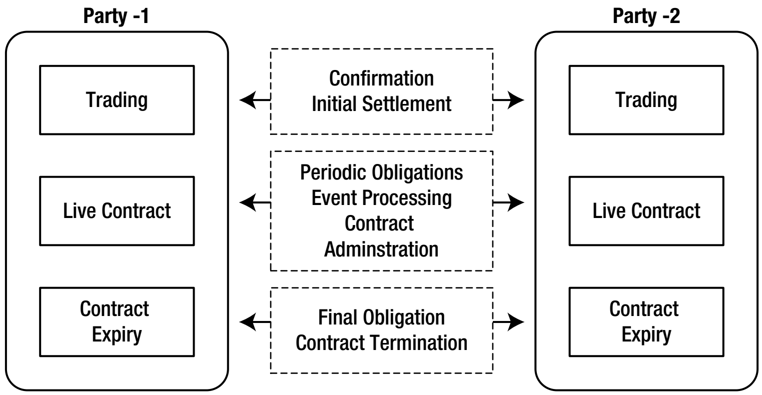

Figure 17-1. Life of a derivatives contract

Recall that if Party 1 to a listed and cleared contract is a buy-side firm (client), then Party 2 is a clearing firm (member of a clearinghouse).

In an OTC bilateral contract, both parties could be any two market participants. Typically, one would be a buy-side firm and the other would be a sell-side firm (dealer). All transactions take place between the two entities directly without any intermediary.

In other cases, contracts can be made between two sell-sides (dealers) or between clearing firm and clearinghouse.

Derivatives IT Platform

A *derivatives IT platform* (DIP) is a collection of software systems that supports derivatives business activities, including front-to-back processing of all types of contracts, trading, and risk management (see Chapter 18). The present chapter uses *platform* and *systems* as synonyms for *DIP*.

The Role of IT and Its Challenges

Increased use of derivatives has caused the market to grow exponentially over the last two decades. Starting with spreadsheets, derivatives management has evolved to highly complex systems. Over the same interval, contracts have become increasingly standardized and operations have become increasingly automated to reduce business and operational risk and manage volume. While many complex contracts in OTC markets resist automation and create operational challenges, market regulations are pushing OTC markets toward standardization.

The role of an IT platform is to support managing the contract from its origination to its termination, including the obligations during the term of the contract and also operations and events that impact the contract. Derivatives IT systems are necessarily complex due to the large number of contract types and the complex structure behind most contracts.

Figure 17-2 shows various data elements and business functions that an IT platform supports. The following list outlines the complexities and challenges involved in each area and the role of IT in addressing these challenges:

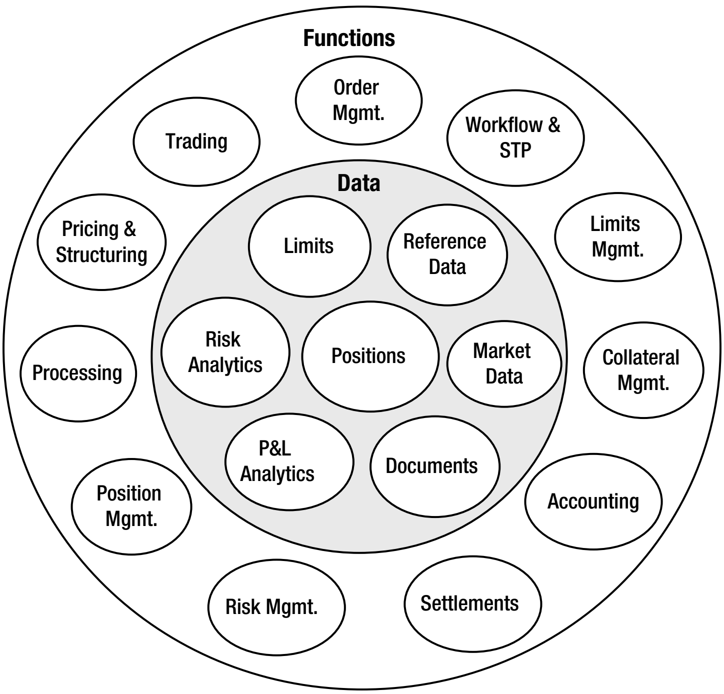

Figure 17-2. Derivatives IT systems: Data and functions

> **Order management.** Derivatives order management involves pre-trade compliance, documentation, and multilevel approvals. The challenge is to provide all the required controls for operations risk mitigation without impeding efficient and swift processing of orders. Well-designed IT systems can provide flexible workflow and efficient end-to-end process automation while satisfying auditing requirements and controls.

Trading. Derivatives trading is mostly electronic, except for some OTC bilateral trading. To achieve STP, a derivatives management platform must be electronically connected to trading platforms. This connection also prevents manual trade capture and operational failures. Other aspects that heavily rely on systems are quick market reach and best execution. In addition, systems provide for implementation of pre-trade compliance rules and trading limit controls, which are part of the risk management process.

Pricing and structuring. The derivatives pricing and structuring process uses standard and custom analytical models. Well-designed systems support industry standard models with the ability to customize and add new methods.

Processing. Derivatives processing includes allocations, trade confirmations, settlement processing, reconciliations, and other activities. The transaction processing employs various technical communication methods and protocols such as FIX, FpML, and SWIFT. Integration systems using communication protocols enable firms to achieve efficient transaction processing with the least number of failures possible, which is critical to lower operational costs and potential losses.

Position or life-cycle management. Derivative contracts are long-lived and liable to be affected by various internal and external events. Contracts are subject to regular valuation and analysis. These activities employ complex mathematical models, mostly involving the processing of large data—in some cases, in real time. These functions require a well-designed and technologically advanced platform.

Risk management. Risk analysis is another business activity that employs complex mathematical models using voluminous data. It involves activities such as real-time calculation of risk analytics, scenario analysis, stress testing, end-of-day risk reporting, and the monitoring and control of real-time limits. Again, these functions require a well-designed and technologically advanced platform.

Settlements. Timely and accurate settlements are essential to avoid unexpected losses and reputational damage to the firm. In today's market, the settlement of cash and securities, including the approvals workflow and operational risk control, is fully automated. Participants are connected to financial institutions through SWIFT infrastructure.

Accounting. Derivatives accounting is one of the most complex tasks because of the varying nature of derivative cash flows and accounting standards. Adherence to accounting rules is critical to avoid fines and reputational damage. Systems enable automation of complex accounting rules, thereby avoiding booking errors and marking cash flows of both simple and complex derivatives, which ultimately results into properly classified ledger entries.

Workflows and STP. It is critical for firms to automate most of their processing and STP. To achieve the highest level of STP, firms must automate operations, including order origination, trade processing, final settlement, event processing, and well-defined workflow. Only advanced technology platforms can provide this level of automation.

Collateral management. Timely and accurate exposure and margin calculation are essential for efficient collateral management, which is the most important business function of counterparty risk management. It also requires collateral optimization, dispute management, inventory management, workflows, and other functions. All of these activities are extremely cumbersome to do manually and only automated systems can accomplish them adequately.

Trading limits and control. As part of the risk control process (market risk, credit risk, compliance risk), trading limits are set and controlled from various dimensions such as exposure, notionals, and other risk measures. Systems provide various tools to monitor and control trading, even in real time.

Market access and integration. For successful automation and efficient trading, firms must connect to various market players such as data providers, execution venues, servicing platforms, and internal upstream and downstream systems. There are many different systems involved, and integrating these systems is critical for reliable and uninterrupted communication. Today's advanced systems with integration models provide secure, fast, and reliable communication.

Reliability and scalability. Systems must be highly reliable and scalable to support constantly changing markets and to avoid unexpected costs from operational failures. In addition, derivatives analysis involves large volumes of data only reliable and scalable systems can accommodate.

Security and transparency. The 2008 financial crisis has highlighted the need for regulations supporting transparency, safety, and security to protect overall financial systems. Given the size of market activity, industry-wide adaptation of advanced technology is the only solution.

Information Technology Strategy and Road Map

An efficient IT platform is essential for the success of any derivatives business, whether it is a small buy-side firm or a large sell-side firm. It provides an effective foundation for the execution of business strategy, serving current IT demands while reserving the capacity to grow with the changing needs of the business.

Essential organization elements required to develop an ideal platform are pertinent IT strategy, visionary leadership, successful execution, and a motivated team. A well-defined and vigorously executed strategy exists behind every successful business. IT strategy is an integral part of the overall strategy of any organization in the derivatives sector.

A firm's IT strategy must be precisely aligned with its business strategy. In many firms, the challenge is the lack of alignment between IT and the business. To develop and execute a successful IT strategy, firms must create an environment that brings the business management (the visionaries) and IT leaders together. Business and IT managements must jettison the pernicious notion that IT is part of the back office or is a supporting tool. They must embrace IT as a mission-critical pillar of business strategy.

IT must assume a proactive role in identifying areas for improvement and aligning requirements with what is practically possible. IT must generate and persuasively present new ideas to help realize new business opportunities, galvanizing the IT organization into an innovative environment rather than merely plodding along as a service organization. For all this to happen, the IT organization must be driven by people with strategic business vision.

Developing an excellent strategy is futile unless it is actualized by proper execution. Firms must adopt a well-defined *IT engagement model* in addition to allocating eligible and sufficient resources to it. An IT engagement model is the system of governance that ensures the delivery of IT solutions to realize the IT strategy and the organization strategy it serves. This model clearly defines the following key ideas to accommodate the alignment between the IT and organization strategy:

- Define the relationship between IT and business management
- Define the working model of IT and business in developing IT solutions
- Define the decision-making process

The *IT road map* is the operative plan for implementing the IT strategy. Every firm, small or large, must develop an IT road map as part of its IT strategy detailing short-term, medium-term, and long-term goals. An IT road map provides details of steps, the time line, deliverables, and the budget required to meet business goals.

To develop an effective road map, a firm must gather and synthesize input from its strategic decision makers—at a minimum, its senior management, including its CEO, CIO/CTO, COO, and CFO.

A well-defined IT strategy with a road map helps business in the following ways:

- It enables leaders to envision the future growth of the business, market changes, regulatory environment, and resulting IT needs.
- It ensures that IT expenses are thoroughly budgeted.
- It improves the productivity of the IT organization and supports enterprise-wide goals.

Firms whose IT strategy and road map are poorly articulated and implemented sooner or later end up with incomplete IT services, dysfunctional IT organizations, unpredictable costs, and failed operational risk controls.

The following list identifies key points to be considered and goals to be addressed while developing your IT strategy and road map and in building your IT platform:

- Comprehensive trading functionality, supporting a listed and wide variety of OTC contracts
- Automated contract lifecycle management promoting full STP
- Portfolio management tools to supporting multi-asset class contracts, sophisticated pricing and valuation models, P&L, and risk analysis
- Real-time risk analysis capabilities to support market risk, credit risk, and compliance
- Enterprise risk management and reporting capabilities to provide a consolidated view of firm wide risk management, compliance, and control
- Flexible workflow management and auditing tools
- Fast, secure, and reliable connectivity with external systems of execution, post-trade processing, and settlements
- Support for a global, multi-entity, or multibranch organization structure
- Unified platform or array of tightly integrated systems, providing seamless contract flow and integration with other internal systems
- Open, modular, and scalable architecture

The preceding list contains just a few key goals, which will be explored in detail in subsequent chapters. Each firm must build its own exhaustive list of IT organization goals to match its overall business needs.

IT Organization

Typically, IT organization is one large division of the firm, whose component teams are aligned with the particular business units they serve within the company hierarchy (Figures 17-3 and 17-4).

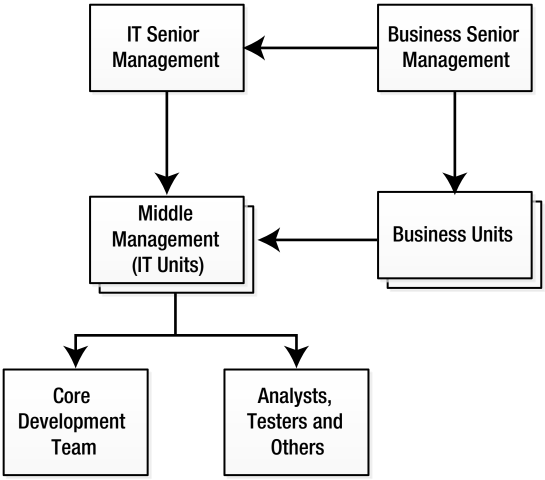

Figure 17-3. Hierarchical organization structure

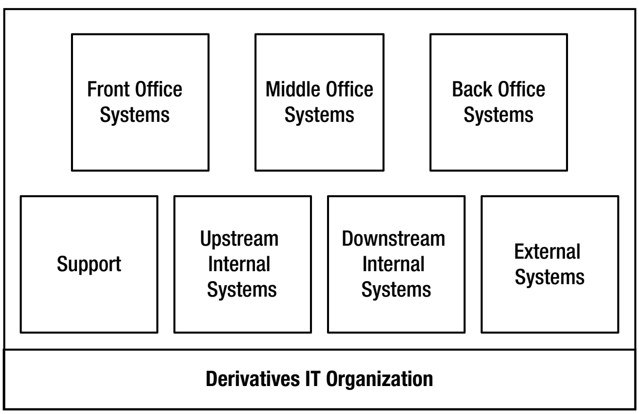

Figure 17-4. Derivatives information technology (IT) organization units

There is, however, no standard IT organization structure. While many firms choose a traditional hierarchical structure with multilevel middle management, other firms prefer a relatively flat structure with fewer middle managers. Hierarchical and flat structures have their respective advantages and disadvantages.

The universal key to successful IT organization is its strategy and teams. Building an IT organization to serve the derivatives business is a peculiarly challenging task, largely due to the need to assemble experienced teams with the perfect blend of technology and domain expertise. Only management teams with a vision and motivation can build IT teams with such talent and balance. Over time, there has been good progress in building such teams because of the standardization of market practices and attractive compensation. Today, the systems for managing listed markets business are mature, whereas the systems for managing OTC business continue to evolve.

Functional Groups and Talent

Most organizations that use derivatives are big. For an IT organization to be successful, its component teams must understand and serve the overall business of the firm and its derivatives operations. In turn, any team within an IT organization is composed of various groups characterized by their skills and roles, exemplified in Figure 17-5.

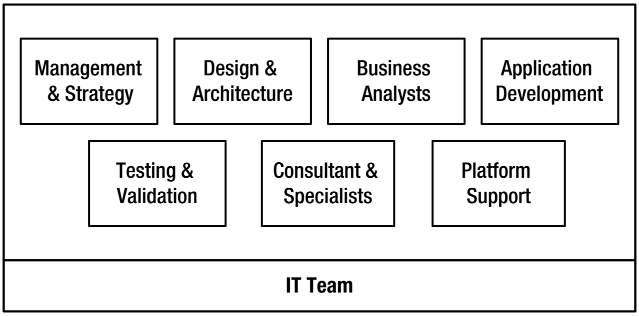

Figure 17-5. Talent groups within an IT organization

The following list explains the roles of each of the groups shown in Figure 17-5.

Management and IT strategy. This group includes the senior management at the IT division level as well as at the organizational level. Typically, IT strategy is developed in conjunction with business unit management. This group sets the goals of the IT organization and manages the execution process.

Design and architecture. Large IT organizations generally maintain a separate group that is responsible for high-level design and architecture application. At a minimum, certain team members must be designated to specialize in these functions. The right architecture and design are critical for the success of applications.

Business analysis. To redress lack of domain expertise, most teams employ analysts who understand the business and are capable of communicating with technical teams. They are commonly part of application development teams.

Application development. An application team consists of project managers (mostly middle level), architects, technical leads, and developers. This team is responsible for developing and implementing software applications. In developing derivatives-related applications, this team plays a major role in delivering efficient solutions.

Infrastructure and systems support. Availability of IT infrastructure is mandatory for any financial institution to operate their business. Support groups focus on all aspects of systems and infrastructure to ensure business continuity. Typically, support activities include application support, database support, and infrastructure support.

Product specialists or consultants. These are subject matter experts (SMEs). In case of new projects or vendor product implementation, firms tend to hire SMEs to help in the application development process. Although most firms try to employ SMEs in their core development teams, acquiring and keeping such talent is a chronic challenge because of shortage of talent.

Testing and validation. Testing teams are also known as *quality assurance* (QA) teams. Their core responsibility is to test the applications before they are deployed for use by the business. This team must have a good understanding of the derivative business. Since there is a lack of talent in this area, testing activities are usually performed by business users or analysts.

Core Derivative Skills

In addition to all the IT and management skills universally required across the IT landscape, derivatives IT teams must possess special domain expertise to build a platform that meets strategic goals. Certain team members, such as analysts and testers, must have in-depth business and products knowledge. They typically hold special certifications such as *Chartered Financial Analyst* (CFA), *Financial Risk Manager* (FRM), and *Professional Risk Manager* (PRM). Minimum required expertise and skills include the following, which have been covered in the preceding parts of this book:

Nature of contract. Details of various types of derivative instruments and important characteristics of each contract, including the difference among various types of contracts and their characteristics.

Contract life cycle. A complete understanding of the life cycles of each category: listed, cleared, and bilateral. Clear knowledge of each phase from the start of the contract origination to expiry.

Operations and events. Different types of events and operations of each type of contract, and how those events affect the contract.

P&L analytics. A clear understanding of the various components of profit-and-loss analysis of contracts. Knowledge of elements such as valuation, mark-to-market, realized and unrealized gains and losses, computing trade, and portfolio level P&L are required.

Cash flows. A clear understanding of each type of contract, its corresponding cash flow, the types of each cash flow, and the premises of cash-flow calculations such as the bases of payment calculations and payment schedules. Furthermore, fundamental accounting rules and accounting treatment of different types of cash flows.

Risk analytics. An understanding of various risk measures and how they are connected to different types of contracts, including the bases of their use and calculations.

Market data. The knowledge of various market data elements used in derivatives and how they are used in computing cash flows, P&L, and risk measures.

Systems integration. The use and context of an upstream systems that supply data and downstream systems that consume derivatives data.

Summary

The derivatives market today is one of the most important segments of the financial market. Derivatives trading and transaction processing are highly dependent on IT infrastructure. Proven IT infrastructure is essential for the success of any derivatives business. It improves the transparency of positions and risk, and it addresses the regulatory and nonregulatory business requirements.

Advanced IT platforms feature various systems and tools for trading, risk management, and operations. Building a derivatives IT platform is inherently challenging. Although there have been huge advances in technology and business practices since the early days of spreadsheet-based operations and vendor products, building an efficient and complete IT platform using a combination of vendor and internal products remains difficult.

This chapter introduced derivatives IT, giving the technical definition of a derivatives contract, identifying various business challenges, charting how IT can help address those challenges, and underscoring the importance of IT strategy and road mapping to overall organizational business strategy.

This chapter discussed typical IT organization structures, various functional teams, and the domain expertise required to build and operate a derivatives IT organization. The next chapter will discuss the IT platform and each of its systems in detail.

CHAPTER

18

IT Platforms and Systems

The previous chapter introduced derivatives IT. It outlined the technological challenges and requirements of a successful technology organization. The objective of the present chapter is to discuss the various systems employed by buy-side and sell-side firms and to introduce derivatives IT platforms.

This chapter begins by defining the IT platform: its characteristics, data, and various systems. It goes on to discuss buy-side systems typically incorporated in a functional platforms. Buy-side systems include *investment management, order management, trading, portfolio management, trade processing, risk management*, and other back-office systems.

Finally, a hypothetical sell-side IT platform is presented with a brief description of each system and its function. No single pattern of IT systems characterizes sell-side firms because they provide many different types of services.

Most of the platform architecture models discussed in this chapter are based on the general functional needs of firms rather than the provision of specific solutions. As technology and business processes mature, however, firms are adopting uniform-architecture models at a high level. Developing and operating an IT platform is a challenging task for most firms. It is essential for all personnel—from executives to interns—to understand their firm's IT platform and its systems.

The objectives of this chapter are to

- discuss the characteristics and components of derivatives IT platforms
- list and study the various systems incorporated in a buy-side IT platform
- discuss the sell-side IT platform and its functions

IT Platform

Managing derivatives is a very complex and broad business area. Servicing derivatives end to end requires that multiple software systems and external systems—such as affirmation platforms and banking systems—all work in concert. A *derivatives IT platform* ***(DIP)*** is a collection of software systems that are used to service derivatives contracts, including the most complex tasks such as trading, risk management, and front-to-back processing of listed as well as OTC contracts.

Essentially, the term *IT infrastructure* is used to refer to both software systems and the underlying hardware, or sometimes just hardware such as servers, desktops, cloud, or grid computing environments. Advances in the hardware field have been exponential in the last decade. Demands such as computing power, operating cost, security, leverage, and network capabilities have been addressed with today's advanced hardware. Because, hardware is not within the scope of this book, this chapter uses the term *IT platform* instead of *IT infrastructure*.

The term *IT platform* covers a lot of ground in consideration of the many software applications in use today in the financial industry—especially in the derivatives area. At the enterprise level, IT platforms are built to service the full spectrum of investment activities, including securities and other assets along with derivatives. For the sake of simplicity, however, this chapter confines itself to the derivatives IT platform, ignoring other portions of an enterprise IT platform.

Although systems servicing listed markets have matured, systems servicing OTC markets are still evolving. Certain OTC instruments and operations are being standardized and OTC systems are converging with listed market systems, trending toward a unified platform servicing all derivatives.

The ideal DIP is an integrated cross-asset solution, supporting business processes from pre-trade analytics, trading, and position management; to collateral and margin management, risk management, and compliance; right through to settlement and clearing, accounting, treasury management, and reporting. Specific requirements vary with the nature of a firm's business. For example, insurance firms are typically focused on hedging, which is the governing theme of their platforms. Whatever its theme, a proven IT platform infrastructure is essential to optimize the transparency of a firm's positions and risk, address regulatory requirements, utilize tools for analysis, and provide a holistic view of overall operations.

Throughout this part of the book, the term *IT platform* (in short, *platform*) *is synonymous with DIP. System* refers to an independent software application; *module* refers to a part of the system. Throughout this section, *system* is used to refer to each independent business function. In practice, some functions, such as order management and trading, could be implemented as modules of a larger system.

Figure 18-1 shows various business activities and functional aspects of a DIP.

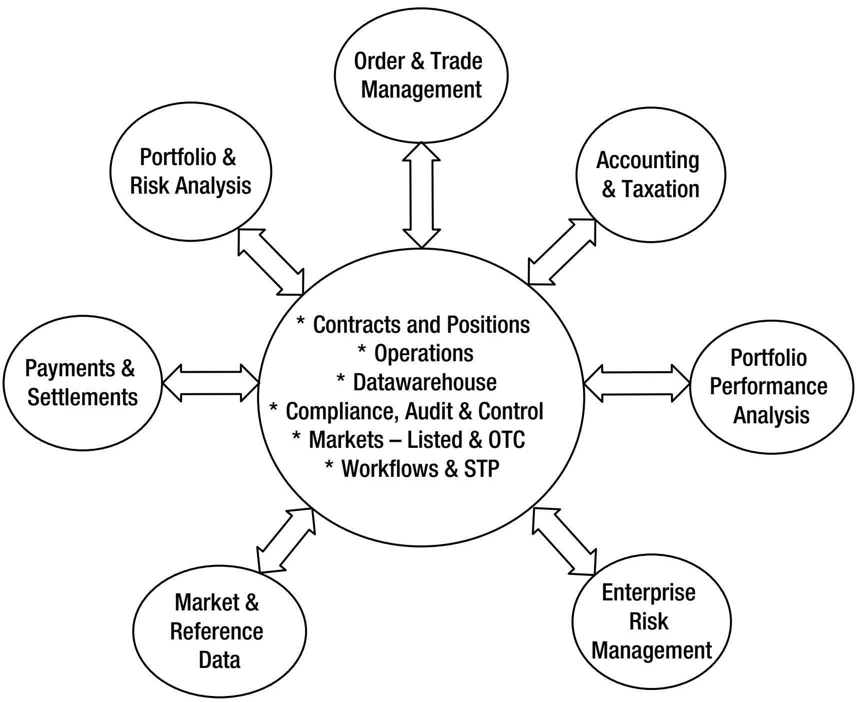

Figure 18-1. IT platform context

A growing number of firms are turning toward a unified or single platform, addressing business needs end-to-end. However, some small size firms are leaning more toward hosted solutions or outsourcing. This chapter discusses a unified platform that consists of *in-house applications*, *vendor products*, or a combination of both.

The layers of a platform include the following (Figure 18-2):

- The *IT infrastructure* layer represents hardware such as servers, storage, and networks, whether hosted within the organization or at external data centers.
- The *data layer* represents numerous databases that hold derivatives-related data used by various systems across business lines.
- The *middleware layer* represents the software components that allow various systems to access data seamlessly.
- The *systems layer* represents various independent or interdependent systems, each composed of several functional modules.

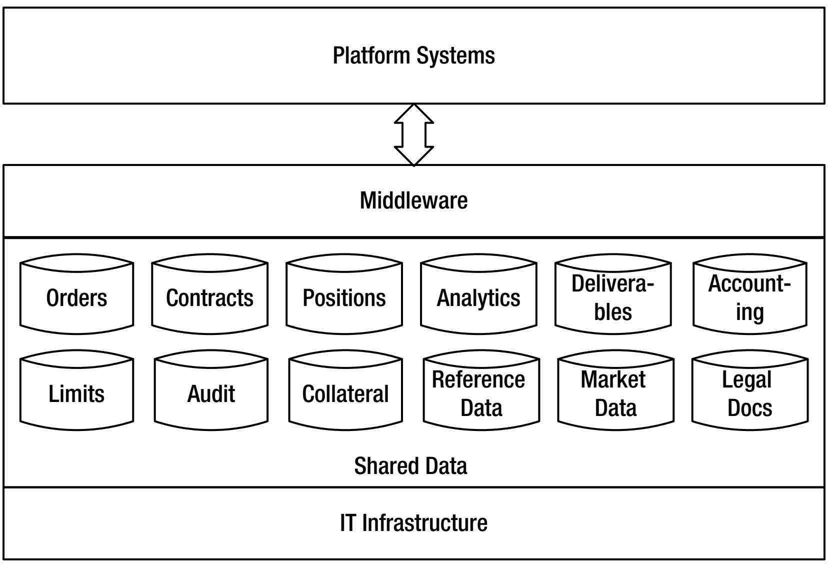

Figure 18-2. Derivatives IT platform layers

Historically, systems of different types of technologies coexisted and cooperated using several integration models. Some of these models are *real-time*; others are *batch-oriented*. Today's integration technology and models achieve seamless integration between systems from multiple vendors, even those running on different operating environments, such as Unix, Windows, and Linux.

Heterogeneous Systems In practice, IT platforms are built using different technologies running on different infrastructures containing various products supplied by several different vendors. All components must work together seamlessly to form an IT platform.

Once market participants enter into a derivatives contract, their responsibilities remain essentially the same regardless of whether they are on the buy side or the sell side. They need to manage the contract in a similar way, although their purpose and risk management strategies may vary. The sell side differs in certain aspects because of its volume and business objectives. In most cases, sell-side firms enter into a contract to offset risk, but their obligations remain and they need to manage the contract until the end of the term. Most functions related to derivatives are applicable to both buy-side and sell-side firms. The focus of the following section is on the operations of buy-side platforms rather than on the business itself.

Buy-Side Platform

Recall that buy-side firms include institutions such as asset managers, pension funds, hedge funds, insurers, and corporations from regional to global companies, across all industries. The primary purpose of derivatives is to hedge risk; the secondary purpose is to earn profits from speculation and leverage. Because buy-side, risk-taking transaction volume is limited, the buy-side profile is very different from that of the sell-side profile. A buy-side derivatives contract is typically associated with some asset position of the firm or is a part of a specific risk management strategy. However, some hedge funds may involve in derivatives speculation heavily.

An integrated cross-asset platform incorporates all functional layers, from trading activities in the front office, through risk management and control in the middle office, to processing and accounting in the back office.

The various systems of the buy-side platform are slowly converging to a single system or a couple of systems integrated seamlessly. The drivers of this convergence are the need for seamless workflow and *straight-through processing* (STP), transparency, and enterprise-level risk management. This convergence has become easy because of seamless integration of different systems through the use of standard protocols, matured integration models, and advanced technology architecture. Many vendors are competing to deliver single-platform solutions that meet the needs of the buy side end to end. In most cases today, a deal is captured only at one point and flows through various systems serving different business functions.

IT platform sizes and operations vary by volume of derivative transactions. Figure 18-3 generalizes the architecture and various systems of a buy-side platform.

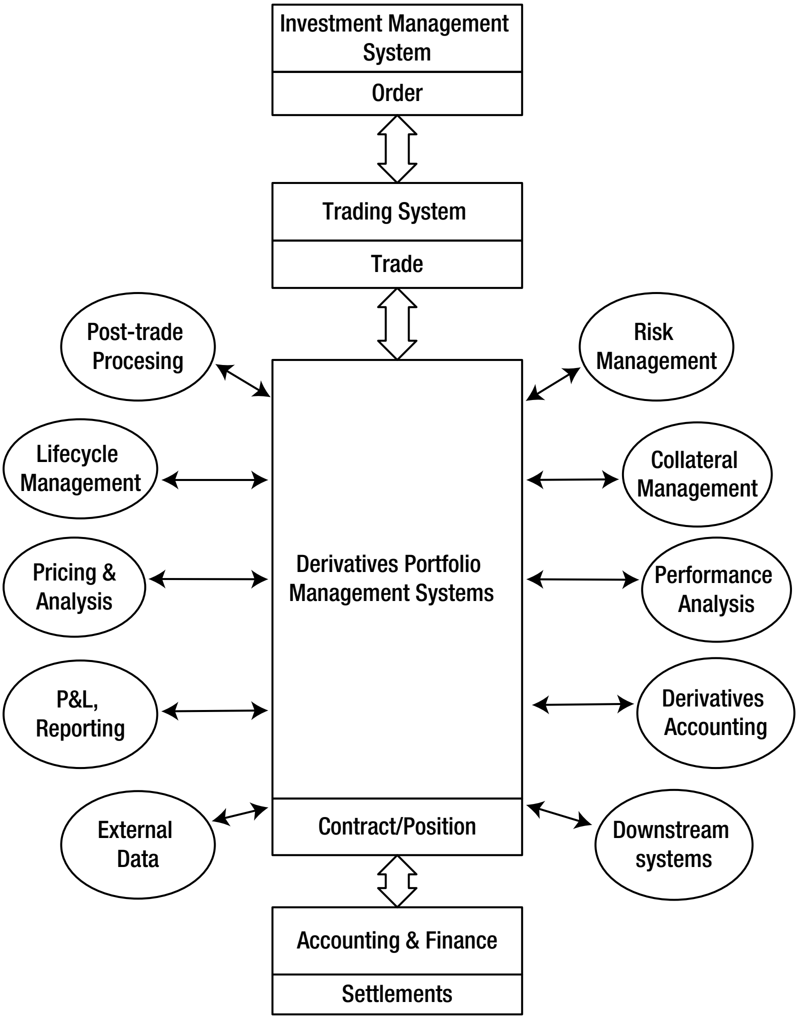

Figure 18-3. Buy-side IT platform (hypothetical)

The following sections explain the major functional areas of a platform. Each functional area may be an independent system or part of another system of the platform. Regardless of how the component systems are integrated, they are all considered part of the overarching platform.

Investment or Asset Management System

The purpose of an investment management group is to develop and implement effective investment management strategies while quantifying and controlling risk (see Chapter 6). Investment portfolios may hold simple securities, complex structured products, real estate, derivatives, and many other assets. Typically, an investment portfolio holds assets such as equities, fixed income, credit, FX, commodities, swaps, and exotic asset classes. Derivative instruments are used in investment strategies for risk control, profit generation, or both—depending on their function in a given portfolio.

The core function of an *asset* or *investment management system* is to help asset managers in developing and executing trading and hedging strategies across multiple asset classes by providing portfolio analytics, risk analytics, position management, and other tools that help investment managers in the decision-making process.

Firms holding a wide range of assets typically employ multiple systems, each to deal with different type of assets managed by different groups of investment managers. In practice, derivatives are often held in different portfolios and managed separately. In such cases, all positions are combined periodically to test hedge effectiveness, compute risk, and perform scenario analysis and stress tests to study the impact on *profit and loss* (P&L). This may happen in certain downstream systems referred to as *enterprise risk and reporting systems*. Derivatives portfolio management topics are discussed in later sections.

Another term in use is *portfolio management*, where *portfolio* refers to a group of assets of the firm, including derivatives. The group that manages assets is known as a *portfolio management group, investment management group,* or *asset management group. Key definitions include the following:*

> **Asset management.** Investment management of collective investments on behalf of many clients (investors).
>
> **Investment management.** Professional asset management of various financial and nonfinancial assets—such as securities, commodities, and real estate—in order to meet specified investment goals of investors. Investors include institutions such as insurance companies, pension funds, corporations, fund managers, and private investors.
>
> **Wealth management.** Investment services for high net-worth clients. In addition to investment management, it typically includes financial advisory, insurance, legal, or other services.

Managers. People who are responsible for decision making are variously known as *portfolio manager*, *investment manager, fund manager, investment advisor*, or *money manager*.

Hedging derivative. When the change in fair value or cash flow of an investment and that of the hedging derivatives offset each other, no change results to the overall value. This offset is not assured, for the value of the investment and derivative may change independently. Positions are valuated periodically to check whether a hedge is still effective.

In an ideal platform, the derivatives trade request (*derivatives order*) goes through the *order management system* before it is executed. The next section details this step.

Derivatives Order Management System

A derivatives *order management system* (OMS) is primarily an order-tracking system that manages (receives) orders from initial request (capture) to final execution. In the process, an order may go through certain validations and approvals. In a regulated firm, this is an important process. Order origination and approval may involve documentation and pre-trade compliance checks. The task of the OMS is to track and keep the complete audit trail before an order is sent for execution.

The key functions of a derivatives OMS are to do the following:

- automate workflow to track and process an order from origination to execution, facilitating the recording and tracking of multi-level approvals and document management (all paper trails). The OMS helps to avoid errors and promote STP and compliance.
- support pre-trade compliance through various validations and checks
- provide access to underlying positions and other information
- support listed and most common OTC derivative contracts
- support multiple origination points and allocation across multiple investment portfolios

- provide flexible role definition and configuration of workflow
- support the processing of large volumes of orders
- provide security, controls, increased transparency, reporting, audit trail, and to comply with regulatory and internal compliance goals

Since the order management process is simple, it is often part of the asset management system, the trading system, or some other system. In addition, *OMS* is often used to refer to a broader functionality including trading and risk management, because most vendors combine these functionalities into a single system. However, large firms may have a separate system just to deal with the order management process. These functions are discussed here separately for the sake of clarity.

Trading Systems

Most derivative trades are executed via an execution broker. Some large firms may even access exchange markets directly. Recall that the executed order is referred to as a *trade*. Approved orders are passed on to the trading desk (trader) for the execution. Systems used by traders are known as *trading systems*.

Traders (buy-side) reach markets either through an electronic channel or through other traditional channels such as phone. The several types of electronic channels that a trader can use to reach sell-side firms or exchanges include the following:

- client interface provided by sell-side firms (dealer-provided ETPs). It is online interface over the Internet or through a desktop application.
- independent third-party trading systems that provide access to multiple ETPs, such as electronic communication networks (ECNs) and swap execution facilities (SEFs)
- in-house or proprietary applications that connect to ETPs (mostly using APIs provided by ETPs or protocols such as FIX)
- exchange client interface in case of listed product trading directly on exchange, provided by exchanges
- SEF client interface to reach to OTC and cleared markets

Trading systems provide connectivity to these channels and accommodate communication. In addition, trading systems provide many other features, including the capabilities to do the following:

- access market data, news, and analysis from various sources
- access markets, including exchanges, OTC markets (ETPs, broker-dealer platforms), and global markets
- conduct pre-trade analysis, scenarios analysis (*what-if* analysis), stress testing, and other forms of risk analysis
- calculate real-time P&L, real-time risk analytics on both pre- and post-trade bases to reflect ongoing trading activity, real-time calculation of positions, cash flow, and other numbers
- define, execute, and manage sophisticated trading strategies, support rollovers, rollbacks, splits, and close-out trades
- automate pre-trade and post-trade compliance and control
- provide user-friendly and customizable user interfaces
- support the trading of a wide variety of derivatives, including swaps, options, futures, and other derivative instruments covering various asset classes such as interest rates, equities, FX, and commodities
- support standard and custom analytical models for pricing, valuation, and risk analytics
- calculate and suggest automatic hedges as required. Based on risk factors and strategy, systems my suggest trades to balance the hedge
- capture trades by various ways, including manual entry, electronic protocols, and file imports

Traders use multiple systems in parallel for their trading activities. Most trading systems are a combination of vendor and internal systems and ETPs. Figure 18-4 shows various applications that traders use. Traders typically run many applications on multiple screens on their desks.

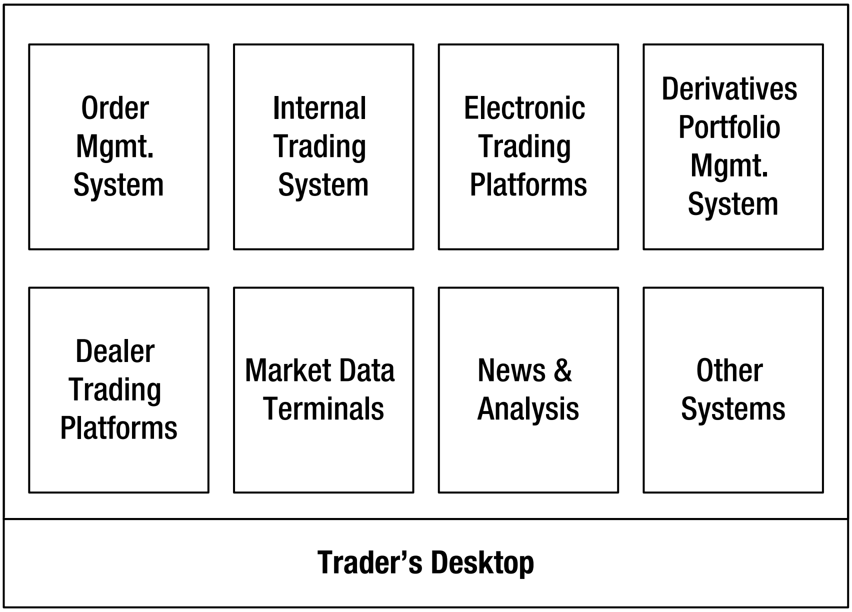

Figure 18-4. Types of applications on a trader's desktop

In listed markets, trading systems are more advanced, providing features such as complex strategy setups, basket trading, and access to in-depth markets. In the OTC market, cleared products trade on SEFs and bilaterals using single-dealer and asset-class specific platforms. SEFs provide desktop interfaces to buy-side and sell-side firms. SEFs are mostly simple trading front ends, providing features such as access to dealers, limit checking, market data, and *blotter*, as defined below:

> **Trading strategy.** Most trading strategies involve multiple trades in combination. It is necessary for traders to execute these trades together as a group to avoid any unwanted risks introduced by market movements.
>
> **Blotter.** A screen that lists all trader's trades from all different sources (the trading activity of the day)
>
> **Trading floor.** Synonym for *front office* (also known as. *trading room*, *trading desk*, *dealing room*, or simply *floor*)

Derivatives Portfolio Management

A *derivatives portfolio management system* ***(DPMS)*** is the centerpiece of a derivatives IT platform. Managing a derivatives portfolio is typically much more complex than any other asset type. Derivative positions are long-lived and liable to risks that need active risk management. Of course, all investment positions are subject to risk, but derivatives may carry much larger risks as discussed in earlier chapters (see Chapter 3). During their term, derivatives are also subject to certain events that need to be processed. When OTC exotics are added, the process becomes much more complex. As the market landscape changes, products and processes are being standardized and market participants are getting better at managing complex derivatives and adapting to robust risk management techniques and standardized operational procedures.

A portfolio management system is also known as a *position management system or simply a position system*.

The portfolio management comprehends a broad set of functions. The core functions of DPMS are real-time pricing, position keeping, trade processing, risk management, reporting, and the generation of accounting entries.

Because this chapter divides platforms conceptually into multiple systems, some functions in this chapter are treated separately that might be more properly considered as part of a DPMS. This chapter as a whole covers most DPMS functions.

The core functions of a DPMS include

- trade capture
- pricing and valuation
- market data management
- real-time position keeping
- portfolio analytics
- risk analytics
- settlement and deliverables
- derivatives accounting
- STP, life-cycle management, processing, and workflow
- multi-asset class contract support
- reporting

- integration with upstream, downstream, and external systems
- security, compliance, and audit control
- support for multi-entity global organization structures

In the following section, minor functions are classified into several groups, some of which overlap one another and are in practice combined into a single feature.

Portfolio Analysis

Portfolio analysis includes portfolio performance analysis (P&L analysis), risk analysis, composition, simulation, optimization, and other portfolio management activities.

Portfolio analysis tasks and features include but are not limited to the following:

- calculation of P&L at different levels, such as trade, position, trader, and desk, including flash P&L, P&L variance, and carry components
- study of impacts on P&L using various methods such as stress testing and scenario testing
- P&L calculation by components including realized, unrealized, interest income, fees, and commissions for multiple periods or for a specific historical date
- all calculations in real-time or intraday on-demand basis at both summary and granular levels
- tools such as interactive simulations, stress testing, scenario testing, and possible hedge suggestions
- flexible P&L reporting by period—daily, weekly, month-to-date, year-to-date, relative-to-tenor, and relative-to-absolute dates
- analysis tools allowing slicing and dicing of portfolios to study risk exposures by different portfolios
- detailed portfolio performance reports at various levels, such as individual business lines, to help assess business performance, with the ability to drill down from portfolio to trade level. Also includes detailed performance analysis based on factors such as interest rate and volatility movements, FX, time decay, and change in positions.

- features to navigate through the portfolio and study analytics by tenor, product, trader, portfolio, currency, and so forth
- P&L scenario analysis with parameters such as time, market parameters, scope of deals, and so on
- pre-trade analysis such as studying the impact of trade on P&L and risk before trading
- support for standard market models as well as complex models with the ability to customize
- cash-management reports such as cash-flow projection

Some of the key terms in the preceding entries are defined in the following box.

Profit & Loss (P&L or PnL) the change in value of a position or portfolio. In the case of a portfolio, the P&L is reckoned over a specified period of time. Typically, the P&L is computed daily as a representation of the gain or loss relative to the preceding day.

P&L Attribution the daily P&L and, as such, the root cause for the change in P&L. It is also known as the *P&L Explained.*

Portfolio vs. Book Although *book* and *portfolio* are often used interchangeably, a *book* refers to a small set of positions of a specific trader or desk, whereas a *portfolio* is a broad set of positions.

Simulation the process of evaluating the impact on a portfolio of adding simulated trades or positions.

Scenario Analysis the process of analyzing a portfolio by shifting one or more market factors such as interest, volatility, and spot rate. It is also known as a *what-if analysis.*

Trade Capture

Orders are executed over different channels and desks. After the execution, all trades are transferred to DPMS for further processing and life-cycle management. The ways for loading trades into a system include the following:

- manual deal entry (keyed)
- automated import from the source system
- direct transmission from external execution platforms such as ETPs via supporting protocols such as FIX

Trade capture is the initial step of the trade processing, triggering trade validation (pre-trade and post-trade) and further processing.

Pricing, Valuation, and Structuring

Derivative contracts are complicated instruments, and their pricing and valuation relies on complex analytical models. Derivatives trading also involves structuring complex trading strategies. Systems provide the following tools:

- pricing of trades before trading—including simple and complex contracts and strategies
- valuation (mark-to-market or mark-to-model) of current positions
- tools to structure (design and value) simple and complex strategies, including multi-leg structures

Real-Time Position Management

Position management functions include the valuation of positions, P&L, and risk analytics in real time as market data change and as traders execute trades. They include the abilities to aggregate by legal entity, product type, business line, geography, or any other deal-level attribute.

Position management is also known as *position keeping*.

Risk Management and Analytics

Risk management is the most critical task and includes portfolio-level operations and overall firm-level aggregated risk management.

Portfolio-level risk analysis includes intraday and end-of-day risk measure calculations. During trading hours, a portfolio's exposure changes as the market moves. Traders periodically monitor risk factors, apply different scenarios, and perform what-if analyses. Traders monitor risk at the portfolio level, desk level, and position level, reaching to the source. In addition, they also study the impact of potential new trades.

Periodic (end-of-day) risk analytics are monitored by traders as well as desk heads and risk managers (the risk management team). These numbers are fed into an enterprise-risk scenario.

The core functions of the portfolio risk management process include the following:

- calculation of various risk measures at different levels—such as trader, desk and portfolio—on demand as well as periodically
- ability to drill down through risk numbers by book for a given desk down to the source position and to view the risk as being bucketed in a variety of ways
- support of a comprehensive list of contract types, including complex OTC contracts
- support of scenario analysis with factors such as the shifting of a single factor or of multiple market factors simultaneously
- valuation of hedge effectiveness (*hedge effectiveness analysis*)

Lifecycle Management and STP

Lifecycle management includes the contract origination, post-trade processing, event handling, and all other tasks from front office to back office until the contract expiration. The core functions include the following:

- automated trade capture from multiple sources and execution of pre-trade validations
- post-trade processing from validation to live contract
- real-time, straight-through processing of all steps from beginning to end
- flexible, event-driven, roles-based, and customizable workflows for four-eye verification with secure and robust processing combined with controls and audit trail
- processing of events that occur throughout the contract term such as credit events, corporate actions, amendments, and novation consent processing
- periodic payment calculations, deliverables, settlement netting, reconciliation, and so on
- connectivity with a servicing organization such as affirmation platforms and portfolio reconciliation for post-trade processing and portfolio optimization

Periodic Operations

Support exists for daily and periodic operations such as rate fixing (rate resets), cash flow generation, contract expiration, daily and monthly report generation, among other housekeeping activities. Typically, these activities are scheduled to run on a daily basis.

Multi-Asset Class Support

The ideal DPMS supports a broad range of derivatives, including all listed and most common OTC contracts. In addition, a DPMS must provide the flexibility and ease to add new contract types appropriate to various asset classes.

Many firms organize their business into different groups separated by asset classes or markets. To accord with their business team structure, firms may use several different systems to manage derivative contracts. In such cases, all these positions are consolidated into a single central database (system) for tasks such as risk analysis, P&L analysis, and reporting. This database is typically known as the *derivatives trade repository or warehouse*.

Reporting

The reporting feature includes the generation of such reports as the following:

- front office reports such as daily trading activity, risk, and P&L reports
- operations reports such as the daily business activity, reconciliation, and exception reports
- P&L reports—daily, weekly, monthly, quarterly, and annual P&L reports aggregated at different levels
- position reports with an overall picture of any outstanding hedges, including valuation
- cash flow reports—immediate and projected
- performance and compliance reports such as hedge effectiveness reports
- enterprise risk reports such as market risk, credit risk, VaR, capital adequacy, and other exposure reports
- intraday P&L, risk, position, and other snapshot reports
- reports on all aggregation levels, from an individual position to an entire portfolio or firm

Global or Multi-Entity Structure

Most large organizations are global with multi-entity organization structures. Systems must support management of portfolios in hierarchical structures, multiple business units, operations, and P&L centers spread across multiple geographical regions and time zones.

Documentation

Derivative transactions involve several types of legal agreements such as give-up agreements, netting agreements, ISDA master agreements, and collateral agreements (including CSAs and CSDs). Systems must provide a digital document repository to store all relevant legal agreement terms and conditions in a searchable and easily accessible format.

Integration

DPMS systems are integrated with upstream, downstream, and external systems using standard messaging protocols: FTP, electronic communication protocols (FIX, FpML, and SWIFT), emails, and others. Real-time communication is critical for efficient STP and to reduce operational risks. Systems must support most communication models in order to seamlessly integrate internal and external systems.

Derivatives Accounting System

All cash flows generated from derivatives transactions must be reported to a firm's accounting system for corporate-level bookkeeping. Essentially, a derivatives accounting sub-ledger system generates sub-ledger entries that eventually feed into a *general ledger* (GL). These entries are generated periodically or on an on-demand basis. Accounting entries that have been generated are validated before being loaded into a general ledger.

The key functions of derivatives accounting are the following:

- generation of accounting entries (GL entries) for all economic events impacting the economics of contracts
- real-time (intraday) and end-of-day, end-of-period processing abilities
- ability to add simple and complex accounting classification rules to comply with accounting standards
- support for multi-currencies, multi-entities, and most contract types

- support for hedge accounting with various methods to comply with regulatory requirements (FASB133, IAS 39, IFRS9), known as *hedge effectiveness analysis*
- financial reporting for decision makers, senior management, and business managers
- security and reliable access, control, and audit trails

Derivatives accounting functions are generally combined with the core derivatives system (DPMS).

Enterprise Risk Management and Reporting

Enterprise risk management (ERM) is a firm-wide or group-wide risk management function supporting the analysis of credit and market risk exposures (see Chapter 3).

ERM functions include the following:

- market risk management
- credit risk management
- liquidity risk management
- operational risk management
- settlement risk management
- capital requirements reporting
- limits and control
- collateral management
- compliance monitor and control
- enterprise reporting and auditing

The following sections describe technical aspects of the functions listed above. Most of these functions are generally implemented as independent systems—for instance, market risk management systems, credit risk management systems, and compliance systems. Risk management activity focuses on every level of transaction processing from pre-trade analysis through the deal capture and from confirmation through the settlement in order to control the operational risk.

Market Risk Management Systems

Market risk management systems (MRMSs) capture trade valuations of all portfolios and calculate various market risk measures, such as *value at risk* (VaR), at different levels.

The key features of MRMS include the following:

- calculation of VaR using various analytical models—such as *historical, Monte Carlo, and parametric*—at different levels
- calculation of various risk measures such as delta, duration, convexity, risk decomposition, and hedge recommendations in real time and on demand
- scenario analysis functions such as simulations, advanced *what-if* analysis, and P&L decomposition
- portfolio stress testing with custom scenarios and back testing functions
- real-time and historical market data management

Credit Risk Management System

Credit risk management systems (CRMSs) provide comprehensive calculation and control of credit exposures at various levels, including the enterprise level. Exposure details include mark-to-market exposure, *potential future exposure* (PFE), gross exposure, net exposure, and collateral values. In most cases, calculation of economic and regulatory capital requirements is included in a CRMS.

The key features of a CRMS are the following:

- calculation of exposure and various credit risk analytics at different levels
- real-time or periodic computation of exposures at various levels such as counterparty, entity, currency, instrument, portfolio, and country risks
- production of various enterprise-level reports including regulatory reports such as economic and regulatory capital—*Risk Weighted Assets* (RWAs)—per Basel II or III (as applicable), VaR, and other measures as required

CRMS may also include limits-management abilities based on credit exposures and other factors. Limits management is explained in the "Limits Monitoring and Control" section below.

Operational Risk

Operational risk arises from all operations across an organization, and enterprise-level operational risk controls are implemented in almost all systems. Operational risk control functions include the following:

- implementation of four-eye rules for critical transaction operations such as trade booking, payments, and deliverables processing
- capture of audit data in each system for all most all user operations
- capture of system access data for each user
- planning and building of reliable and high-availability systems to avoid system failures
- provision of robust workflows to reduce processing failures and handle exceptions efficiently
- implementation of a high-availability and robust technology solution to reduce or eliminate IT infrastructure failures
- implementation of compliance monitoring procedures and dashboards

Compliance Monitoring and Audit

A compliance monitoring system is a central enterprise-level system used to monitor adherence to compliance rules and other characteristics such as concentration, diversification, and various statistical measures. When it is not practical to build such systems because the process is too complex and fluid for automation, teams perform the monitoring and audit activities, collecting data from various systems for various types of audit.

Settlement Risk

Settlement risk exposure is usually calculated at various levels—such as counterparty, region, and currency—and reported daily to appropriate internal teams.

Enterprise Reporting

Enterprise reporting provides various reports for senior management of the firm, internal audit, and external regulatory agencies. These reports include P&L reports, VaR, and capital requirements.

Banking Book vs. Trading Book *Banking book* refers to the portfolio of long-term positions of the firm, whereas *trading book* refers to short-term positions taking place in mostly a single trading day.

Limits Monitoring and Control

The *limits management system* (LMS) plays a critical role in controlling risk by monitoring and limiting the trading activities. As part of the risk management process, various limits are set to control trading activity. Limits are based on such factors as credit exposure and such market risk measures as notional, duration, VaR, maturity, delta, specific trader, desk, and compliance rules. These limits are set at different levels and monitored in real time or periodically. In recent years, systems have evolved to the point of monitoring these limits in real time and alerting or even stopping the trade. Thus, the LMS plays an important role in the risk control process.

LMSs are also known as *trade control or compliance monitoring systems*.

LMSs do the following:

- provide the ability to set limits using a number of elements such as various risk factors, exposure at different levels, aggregated notional at different levels, types of instruments, contract term, currencies, credit ratings, business lines, traders, desks, and the combination of multiple factors
- allow periodic, on-demand, and real-time limits calculation and reporting
- provide tools to analyze current exposures and limits with drill-down ability
- provide enterprise-level reports to efficiently utilize limits across the organization

Although the LMS concept is new and not many firms have one, limits have long been set and reviewed by management using generated reports.

Collateral Management System

A collateral management system is a critical process in mitigating credit risk. Collateral management includes margin management of listed and cleared contracts and collateral from the counterparty in OTC contracts. The term *margin management* is often used in listed markets, while *collateral management* is used in OTC markets. Although functionally their overall objectives are the same, their underlying methods may vary. Traditionally, firms use different systems for these two functions. In recent years, however, these two functions are increasingly being combined in a single system or module. Collateral management is discussed in detail in Chapter 11.

Listed market margin management is a mature and well-defined process, whereas collateral in the OTC market is an evolving and complex process. As discussed in Chapter 11, cleared OTC collateral management is similar to the futures margining model.

Key functions of a collateral management system include the following:

- managing legal agreements among the firm, FCM, and counterparties (including give-up agreements, master agreements, CSAs, CSDs, netting agreements, and so on)
- managing all data elements such as thresholds, ratings, counterparties, initial margins, independent amounts, haircuts, minimum transfer amounts, and rounding tolerances
- supporting listed product margining as well as the collateral of simple and complex OTC contracts
- providing workflows for all operations—margin call creation, counterparty margin call processing, reconciliation, dispute management, and other operations
- performing collateral valuations, margin calculations, and margin calls generation
- processing counterparty and FCM margin calls and validating, allocating, approving, and delivering collateral operations
- managing collateral positions including securities and multi-currency cash (held and pledged)
- managing interest, coupons, and dividends of collateral held and pledged
- providing collateral eligibility calculations to process margin calls
- supporting collateral substitution and corporate action processing
- supporting handling of collateral valuation disputes and resolutions
- providing reconciliation and dispute resolution workflows

- providing collateral optimization features through producing efficient margin requirements, lowering collateral funding costs, and leveraging collateral securities and cash
- providing various reports such as daily collateral and margin movements, projections, reconciliation reports, and inventory

---

Collateral Types Besides securities and cash, other collateral types such as guarantees and letters of credit are also used in the derivatives market. Nonetheless, cash and securities are the most common collateral types.

Compliance Monitoring and Control

The key function of compliance is to provide oversight of all investment activities while complying with regulatory requirements and internal policies and procedures. In the derivatives environment, the oversight includes monitoring derivative trading programs through pre-trade and post-trade rules, concentration and diversification, operations, and adherence to procedures. In addition, functions include periodic review of risk management policies and operations.

Most compliance and control functions are built into order management, portfolio management, and other systems where applicable. All systems maintain and supply audit data to the compliance team periodically or on demand. The compliance team may also run reports against the firm's central trade repository for audit and investigation purposes.

Data Warehouse or Contract Repository

Firms maintain central data warehouses that hold all derivative positions (along with other securities, in most cases) for all departments and systems. Alternative terms for such a central database are *data repository, trade repository, positions repository, and position warehouse*.

All systems feed their daily trades and other related transactions to a central warehouse and keep the database up to date. Usually, a load runs at the end of every business day.

Data warehouses are typically used for the following functions:

- collection and storage of all derivative trades and transactions (including nonderivatives in the case of larger-scope warehouses)
- collection and storage of P&L and risk analytics
- reporting at various levels, including the enterprise level
- servicing the requests of internal and external auditors and regulators
- ad hoc query and analysis using *business intelligence* (BI) tools
- storage of trades in a common format enabling sharing with other systems in organization

Payment and Settlement Systems

Holding derivative positions results in two-way transactions between counterparties, such as obligation payments and receivables and various types of fee and collateral transfers. The transactions typically involve either cash or securities movement. The *payment and settlement* (P&S) system receives instructions to process these transactions on a daily basis from the derivatives management system. It receives immediate settlements as well as future settlements as early as two to ninety days in advance.

The key functions of P&S system are the following:

- manage settlements with pre-settlement validation workflow, rule-based netting, and audit control
- process all outgoing and incoming cash and security transactions
- reconcile all transactions
- generate various reports such as cash-flow and security projections, daily transaction reports, reconciliation reports, inventory reports, and others
- communicate with custodian banks using appropriate protocols

A P&S system may process derivative transactions along with other transactions from investment management and other business activities of the firm.

Reconciliation the process of comparing and confirming actual versus expected transaction details. All financial transactions are reconciled as they settle.

Treasury Management

The corporate treasury is responsible for a firm's finances. Treasury management systems provide comprehensive financial functions such as planning, funding, portfolio management, financial risk management, stakeholder reporting, and hedging. Derivatives management is part of the financial risk management function of the treasury. Typically, treasury portfolios hold a corporation's debt, investments, and derivatives. The key functions related to treasury portfolio management include the following:

- valuation of all portfolio positions including debt, cash, and derivatives
- calculation of various risk analytics with the ability to drill down to the source of risk
- provision of scenario testing and other tools for portfolio analysis and investment planning
- generation of various reports tailored to the different groups within the organization
- all other standard portfolio analysis features

Sell-Side (Dealer) Platform

Chapter 7 introduced the organization structure and business activities of a sell-side firm. Sell-side firms are part of the foundation of financial markets and play many different roles. They are heavy technology houses. All of their operations are technology intensive and run multiple business lines operating in parallel. While some business lines are totally independent, others merge into either the middle or back office. Each business line may use one or more systems either as independent systems or as one integrated platform. Their variety makes generalizing about these systems hazardous.

There is no standard or universal paradigm describing how sell-side firms structure and operate their IT organizations. In consequence, this section presents a hypothetical or logical platform covering mainly derivatives business lines.

The sell-side business is competitive, and firms compete with each other to provide the best services as a function of how well built their systems and how advanced their technologies are. This race motivates sell-side firms to build their own systems rather using general vendor products.

The major objectives and challenges of a sell-side technology platform are the following:

Effective risk management tools. Being a risk taker, the sell-side must effectively monitor and manage various risks such as market risk, credit risk, and operational risk.

Custom analytics. To stay competitive, sell-side firms develop custom analytical models for pricing, structuring, and valuation of simple as well as complex instruments.

STP and automation. Automation of contract lifecycle management and transaction processing reduces the cost of operations while increasing profitability and controlling the operational risk.

Trading controls. A sell-side firm must employ monitoring and tight control of trading activities to stay within limits set to protect the firm's interest rather than that of a specific trader or desk.

Compliance and audit. Because sell-side firms are subject to strict regulatory oversight and requirements, they need to develop and implement strict monitoring, compliance, reporting, and control policies.

Scalability. To stay competitive, sell-side firms must continually innovate and deliver new scalable products and services to accommodate the growing needs of market participants.

Service standards. High service standards must be maintained to satisfy and retain current customers.

Figure 18-5 shows a logical platform with limited hypothetical systems. It is designed to be suggestive of general features rather than to represent a fixed entity.

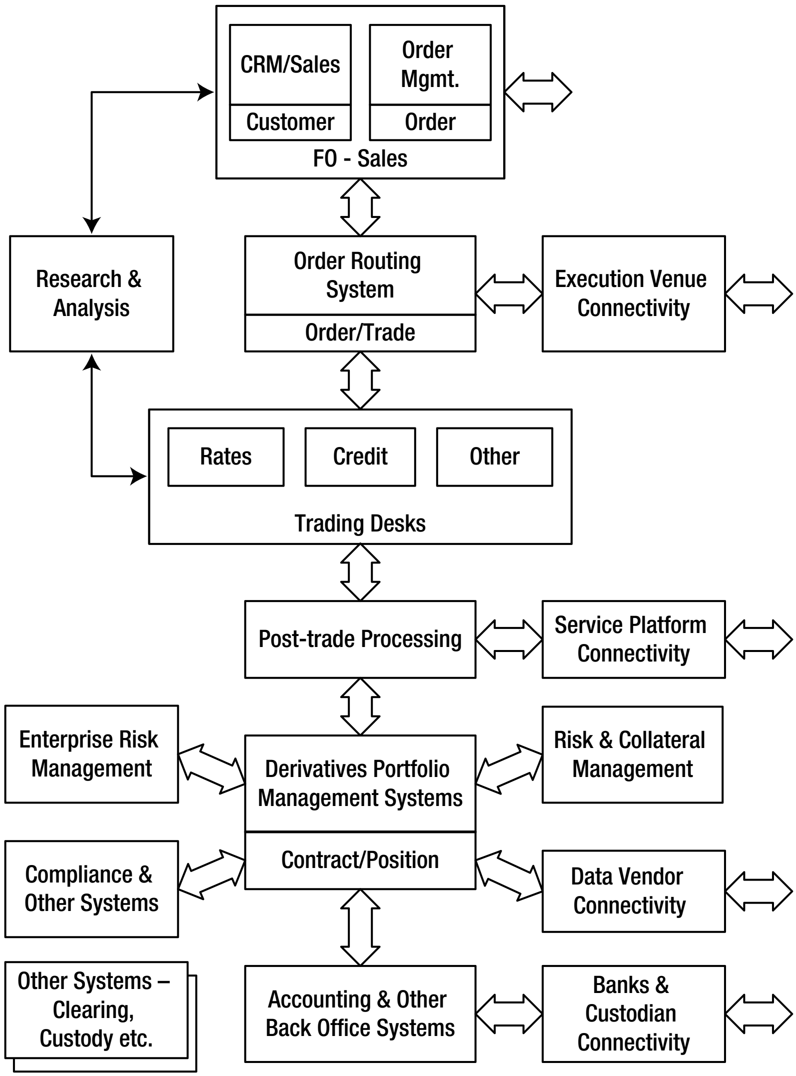

Figure 18-5. Hypothetical sell-side IT platform

The portfolio management, risk management, and operations functions of sell-side firms are fundamentally the same as those of buy-side firms. The differences in their respective risk management techniques and tools stem from the differences in their business objectives. Most sell-side activities are segregated by product desks and markets. Systems are built to suit these business units. For instance, a large sell-side firm may have totally independent system groups for each asset class, such as FX, interest rate products, and credit products.

A sell-side firm generally holds large portfolios managed by independent divisions, each focused on a specific market segment. For instance, the FX department's main focus is FX products, including spot products and derivatives. Likewise, equities, rates and commodities may remain independent. However, all are aggregated at a higher level for firm-wide risk management reporting and other purposes.

In addition, sell-side firms may run many other business lines such as clearing services, custody services, and prime brokerage. Each line generally uses its own independent set of systems. Sell-side IT departments are typically very large and consist of many smaller teams delivering independent systems.

The remainder of this chapter outlines the functions of these various systems considered hypothetically in order to present a broad-stroke picture of the sell side.

Sales and Customer Relationship Management

Sales and *customer relationship management* (CRM) are the core processes of the front-office sales department. Of the many tools used in the sales process, two systems are significant for traders: the *order management system* (OMS) and the *customer relationship management system* (CRMS). Beyond logging raw customer information, firms develop and incorporate many creative features in their CRMSs to enable the growth and expansion of their business by analyzing customers' needs and behavior and targeting their products and services appropriately.

Order Management System

A sales team receives orders from clients and routes them to the appropriate desk or trading venue. They track orders, executions, and allocations using an *order management system* (OMS). A sell-side OMS provides many features enabling sales traders to attain the shortest possible response time, maintain a competitive edge, and promote business growth.

Order Routing System

An *order routing system* (ORS) is essentially a routing system that sends an order to a selected destination for execution. Since sell sides maintain connectivity to many execution venues, ORSs aid in the automation of message flow. It is nonetheless possible for an OMS to connect directly to executing venues without ORS.

Research and Analysis

Research and analysis comprehend a large array of tasks that combine to produce analysis and reports on relevant topics. Each firm organizes its data and research in ways best adapted to its particular business. Some firms leverage advanced technology to aid their research and analysis tasks; others use technology primarily for information storage.

Trading Systems

Most sell-side firms operate various desks dealing with different classes of products and develop proprietary models for pricing, valuation, structuring, and risk management. Because each product line relies on in-depth specialist knowledge, each trading desk tends to develop and maintain independent trading systems. Sell-side trading systems are comprehensive and advanced, supporting standard and custom trading algorithms. They are tightly integrated with middle-office systems to provide STP.

Market Connectivity Systems

Most sell-side firms have access to most of the market, including local exchanges, global exchanges, electronic platforms, and other dealer systems. They operate a large array of systems connecting to all these venues, mostly one for each venue. These systems are also known as *gateways,* such as *exchange gateways* and *ECN gateways*.

Client Connectivity Systems

Most sell-side firms provide direct access to their clients through connectivity systems or through dealer trading platforms that use standard protocols, APIs, or online applications. These systems connect clients to internal trading systems or desks directly.

Post-Trade Processing

Post-trade processing at sell sides involves dealing with large volumes and is critical for ensuring timely settlements and customer satisfaction. Sell-side firms typically employ trade-processing systems and dedicated teams for processing transactions in different markets.

Derivatives Portfolio Management Systems

Because sell-side firms hold large portfolios, they maintain multiple systems serving different desks, with all positions being consolidated in a central repository for enterprise-level risk management and reporting tasks. The functions of DPMSs explained in the buy-side section of this chapter apply generally to the sell side, although they vary in details.

Enterprise Risk Management

As noted in the buy-side section, an *enterprise risk management* (ERM) is a broad set of tasks implemented using several systems and parts from various systems. The high-level functions of the ERM are the same on both sides, but sell-side firms face much larger risks than buy sides and employ different proprietary techniques to mitigate their risk. Note that the buy side and sell side carry different risk profiles.

Back Office Systems

The back office typically runs a *payment and settlement* (P&S) system, an accounting system, and other systems used for corporate governance.

Collateral Management Systems

Although overall collateral management functions are similar on the buy-side and sell-side, sell-side firms may employ multiple systems for collateral management. Since they deal with multiple clearinghouses and large number of end-clients, their systems and operations are large and complex.

Other Systems

Many other systems in sell-side firms serve various business lines such as clearing services, market making, custodial services, and prime brokerage. Most of these business lines stand independently and use dedicated systems for their business activity.

Summary

The very complexity of the derivatives business makes the understanding of and ability to operate its underlying systems indispensable. Moreover, tightening regulatory regimes mandate unprecedented transparency and efficiency in the management of derivative portfolios.

This chapter introduced the IT platforms of buy sides and sell sides. It defined in general the functions and component systems of an IT platform. These systems cover all critical operations related to derivatives, together with ancillary systems.

Common patterns are evident among the derivative IT platforms of buy sides, owing to the evolution of the market and the prevalent use of vendor products across the industry. This chapter accordingly discussed buy-side systems in detail but discussed sell-side firms in more amorphous terms because of the greater complexity and more heterogeneous architectures of their IT systems.

In practice, one system may serve multiple functional areas, and multiple systems may serve one functional area. Regardless of how a particular IT platform is formed, the higher-level functions of IT platforms are broadly similar across the derivatives industry on both the buy side and sell side.

The next chapter discusses aspects of systems architecture that technology managers and developers focus on when building and managing a derivatives IT platform.

CHAPTER

19

Platform Architecture and Implementation Guidelines

The previous chapter presented various systems that contribute to the support of the derivatives business. The collection of all those systems was treated as *a* single logical software platform, alternatively called a *derivatives IT platform* (DIP) or a *derivatives systems platform* (DSP). Throughout this chapter, it is simply referred to as a *platform*.

Corporations must design and implement scalable infrastructures that simplify technology, streamline operations, and provide sufficient transparency to effectively manage operations and systems risk. The objective of this chapter is to discuss key design principles and guidelines of software architecture and implementation processes with a focus on DIPs.

This chapter starts by explaining key challenges in building DIPs and the general steps involved in the implementation process. It identifies the various architecture styles and desiderata relevant to DIPs. It looks at the various approaches to designing and building a DIP and explains the advantages and disadvantages of each approach. Finally, this chapter provides guidelines on how to perform a build-versus-buy analysis and how to choose a vendor product.

This chapter uses many IT-related concepts and presumes an IT background.

The objectives of this chapter are to

- study challenges in building derivatives systems platform
- identify the functional and technical requirements of a derivatives IT platform
- understand the platform implementation process
- discuss various software architecture styles and recommendations
- identify and discuss various system platform development approaches such as vendor products, in-house development, SaaS, or a combination of these
- discuss various external systems' integration methods and protocols, such as FIX, FpML, and SWIFT

Challenges

Today's derivatives trading volume, complex business models, and increasing regulatory requirements demand efficient and robust systems platforms. Earlier chapters explained the complexity involved in operations and challenges in managing derivatives contracts. This section discusses the various challenges that firms face in building a platform:

Family of diverse applications. A DIP includes many systems supporting a wide range of functions. Integrating a variety of applications and operating them while sharing the same underlying data is a complex task that requires a well-designed platform.

IT organization structure. Many firms conceptualize and manage their DIP as a set of independent applications run by different independent groups. This approach creates many practical challenges in implementing and managing an overall platform. Single-platform vision and well-integrated applications are essential in building and managing a DIP.

Complex user applications. Client applications for front-office and operations systems require unique features associated with long-running processes for such data-intensive and time-consuming functions as simulations, portfolio analysis, and pricing complex contracts.

Complex OTC contract structures. OTC contracts are generally complex and involve a wide variety of structures. They create many challenges such as inconsistent pricing models, operational challenges, accounting complexities, and compliance challenges.

Communication challenges. Derivative systems communicate with many different external systems including multiple trading venues, post-trade processing institutions, multiple data vendors, and custodians. Platforms must support various standard and nonstandard protocols to communicate with external systems.

Operations risk management. Derivative operations risk management requires sophisticated workflow management systems that must support audit, compliance, and regulatory requirements.

Advanced software development method ologies. Due to the complex requirements of DIPs, corporations are required to employ strong teams and adapt state-of-the-art software development methodologies.

Resource challenges. DIP implementation requires a team with a good working knowledge of derivative products and IT skills. Hiring and retaining such human assets is difficult owing scarcity relative to demand.

Support for global operations. On account of the global nature of the derivatives business, DIPs are expected to operate around the clock to support the business activities of global firms that operate in various countries. In addition, a platform must support different business practices and regulations in different regions.

Lack of strong vendor products. Although many out-of-the-box and customizable vendor products are available in different areas of DIPs, there is no well-established vendor product that addresses all end-to-end needs. It is often difficult and expensive to customize and integrate multiple vendor products.

Platform Development Life Cycle

Although building a derivatives IT platform is a challenging task, with the right design and implementation strategy you can build a platform that will serve the diverse needs of your derivatives business operations.

A combination of business knowledge, a thorough understanding of each function, and a proficient technology team will allow one to deliver an effective solution. By way of background, software systems development is briefly outlined below.

Systems implementation and management are iterative processes with multiple phases. Figure 19-1 shows the key phases in the process, each of which is explained in the following sections.

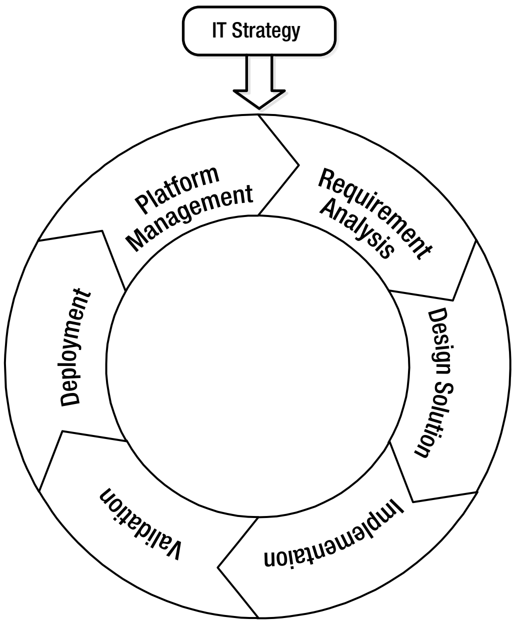

Figure 19-1. Platform development life cycle

IT Strategy

The derivatives business is highly dependent on IT infrastructure (software and hardware). To build and manage an effective IT platform, a firm's corporate strategy must include a well-aligned IT strategy. Typically, an IT strategy includes strategic planning and budgeting, strategic sourcing and management, and consolidation and standardization. The key points to consider in developing an IT strategy are the following:

- a focus on a business-driven technology solution
- long-term derivatives platform goals that may help to make the right decisions in the short term and provide a transition plan

- short-term derivatives platform goals that may help identify suitable tactical solutions
- a strategy in respect to owning or outsourcing business functions
- a strategy in respect to in-house development or vendor product usage
- a strategy for building and managing in-house technical capabilities and long-term goals

Business Requirements Analysis

Requirement analysis is the process of understanding a business and defining business challenges that are required to be addressed by the IT department. This process will produce the list of business functions, problems, challenges, and expectations from an IT solution.

Designing IT Solutions

Designing an IT solution is a function of the IT department. Members of this department will analyze business requirements and design an IT solution. The objective of this process is to design effective IT solutions to address all requirements that are defined during the requirements analysis phase. Furthermore, the design must also consider overall IT strategy and include strategic requirements for the firm.

IT solutions include details such as logical design, technical architecture, technical design, information architecture with data model, and infrastructure architecture.

Implementation

Implementation is the process of developing and/or integrating various components of software solution to form an overall functional platform (DIP). This process may involve many different tasks, such as software development, customization of vendor products and/or software libraries, establishing the connectivity with outsourced functions, and external systems of business partners.

Validation

Validation or *testing* is the process of validating various aspects of software solutions before starting to use systems. This process involves the testing of each business function and system qualities that are defined during the requirements phase. It may involve tasks ranging from high-level business scenario execution to minor operational and technical tasks. Typically, systems are validated at multiple levels, including during development and integration by development teams, and before deployment by business users (user acceptance test). The validation process is also known as *quality assurance* (QA).

Deployment

Deployment is the process of installing software and non-software components of the solution for business use. Deployment involves activities such as installing hardware and software components, user training, support team training, migration of existing processes and data, and establishing a governing process.

Platform Management

Platform management is the process of monitoring systems and responding to the issues raised. It relies on analysis of environment changes, requirement changes, and responsive platform enhancements. Platform management subsumes infrastructure management, software management, change management, requirements management, and stakeholder management.

Iterations

Business environments continuously change, both endogenously and exogenously. If an existing platform doesn't support these changes, it must be enhanced. If the solution cannot adapt to the change on time and deliver what the business requires, the shortcoming may have a severe impact on the business. The capability of the platform decides the lifespan of the solution. In tandem with changes in the business environment, the whole process is iterated to enhance systems and align system capabilities with business needs.

Platform Requirements

The deliverables of an IT platform are dependent on the scope defined during the requirements phase, the most important phase of the systems development process. Today's derivatives business demands a superior level of service to enable firms to deal with tougher regulatory requirements and to keep up with market developments and opportunities. Platform requirements must include these demands in addition to functional requirements, platform qualities, and the short- and long-term strategic goals of the firm.

DIP deliverables can be measured through various factors including product coverage, cost of ownership, scalability, and responsiveness to changes in the business and regulatory environments.

The requirements of DIPs fall into three major categories: *functional, technical,* and *general*.

Functional Requirements

Functional requirements refer to the set of functions that are required to operate the business and make decisions. Figure 19-2 shows the layers of platform requirements and the following list briefly explains them.

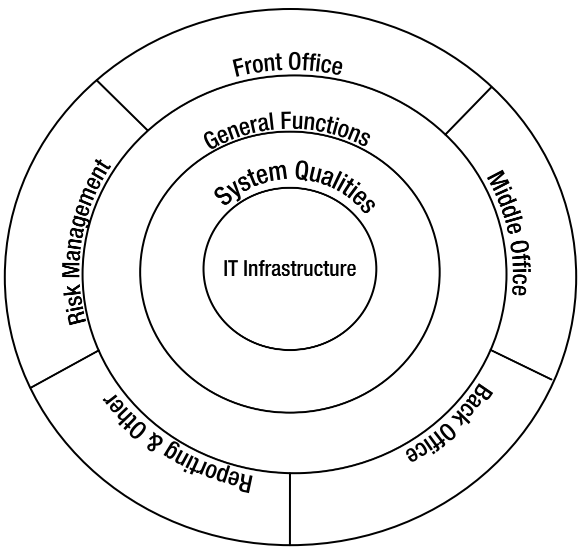

Figure 19-2. Platform requirements

Front-Office Functionality

The functional requirements of the front office include pricing, deal capture, real-time trading, analytics, and risk management functions. In addition, a platform must support a wide variety of derivative contracts and standard and exotic pricing models. It must also enable users to structure new types of contracts as needed.

Portfolio Analysis and Simulation Tools

It is critical to have sophisticated analysis tools that allow the slicing and dicing of portfolios to understand the risk exposures, profit, and loss impact at various levels.

Cross-Asset Product Support

A platform must support end-to-end processing of derivative contracts based on major asset classes (credit, interest rate, equity, and FX derivatives) including structured products. In practice, firms are forced to use different systems for different asset classes owing to lack of systems support.

Risk Management and Reporting

A platform must support the risk management functions of various roles including individual traders, desk heads, middle-office personnel, and portfolio managers. The requirements include a high-level risk view—such as dashboards with near real-time risk and reporting functionality—and enterprise risk management—including capital reporting, risk reporting, collateral management, and limits management functions.

Central Data Warehouse

A platform must incorporate a central database that collects all data, including positions and market data. The central database must be capable of dealing with a large volume of data while providing for faster access than regular transactional databases and facilitating the generation of risk, compliance, and regulatory reports.

Workflow and STP Capabilities

A platform must provide overall workflow and STP capabilities. It should also provide end-to-end integrated cross-asset straight-through-processing to support processing a variety of contracts. In addition, the workflow must be flexible enough to support the ongoing changes, process optimization, and productivity enhancements.

Accounting

A platform must support the complex accounting and taxation rules of derivative contracts. It must provide a flexible framework that can accommodate accounting-rules configurations for various accounting standards, such as FASB and GAAP.

Comprehensive Reporting

A platform must provide a comprehensive reporting module that provides the ability to run, track, and review reports quickly.

Rich User Interface and Functionality

All user-facing applications must provide robust user interfaces with the ability to handle large volumes of data, rich graphic interfaces, customizability, and user friendliness.

Audit and Compliance

A platform must incorporate end-to-end audit functionality that collects all required data to comply with internal and regulatory requirements.

Global Organization Structure

A platform must support multi-entity, multi-currency, and around-the-clock operations to accommodate the global operations. It must be capable of vertical separation of data and functions, and centralized global reporting as needed.

Technical Requirements

To be effective, a platform must be robust and scalable with open architecture, and it should have provisions to integrate third-party products and hosted applications seamlessly. Discussion of these critical requirements follows.

Open Platform Architecture

The platform architecture must be open and modular, supporting multi-technology, multi-vendor applications rather than being a monolithic, single-vendor technology platform. It must support popular and standard integration methodologies without adversely impacting performance or architecture and without requiring unreasonable development time.

Scalability

The platform should allow for vertical expansion as easily as possible. A platform must allow for seamless scaling in terms of users, trading volumes, and new product coverage. Infrastructure must provide load-balancing capabilities that allow multiple application engines or processes to provide additional computing power as needed.

Performance

Performance is the key quality of an effective DIP. A platform must deliver the highest possible performance consistent with the computing needs of the derivatives operations. A platform with *high-performance computing* (HPC) capability and *clusters* may be needed for risk and P&L analytics. *Grid computing* may be needed to distribute pricing, analytics, stress testing, scenario analysis, and simulation analyses across multiple machines for improved performance and scalability, enabling even large portfolios to be processed in real time. Firms must consider all options when they are designing new systems or enhancing their infrastructure.

High Availability and Fault Tolerance

The platform infrastructure must include a fault-tolerance framework that provides high availability and fail-over capabilities for all applications and services that are part of the platform.

Customization

To support business growth, a platform must scale and provide flexible technology options that can be adapted to a changing environment. A platform must support customization to support the expansion of business to new geographic markets and to comply with new regulations. Provision must be made for incorporating responses to future changes, such as changing organization structure, growing product range, changing procedures, new regulatory requirements, and continuous improvement of risk management processes.

Cost Efficiency

The overall cost of ownership must be within reasonable limits. The major components of the cost are initial implementation, ongoing maintenance, and licensing costs. Each must be carefully studied and estimated.

Large Data Capabilities

A platform must accommodate multiple databases with large data volumes while delivering high-performance and real-time processing capabilities. In addition, analytics, reporting, and historical data management require support for different types of databases such as multidimensional and in-memory databases.

Monitoring and Administration

A platform must include monitoring and administration tools to facilitate an enterprise-wide view of systems, services, and integration gateways. Also, these tools must offer the ability to reduce system failures and enhance a support team's ability to respond quickly and provide high-quality service.

Market-Wide Connectivity

A DIP platform communicates with a variety of external entities such as exchanges, electronic trading facilities, clearinghouses, post-trade processing firms, and other market participants using various standard and nonstandard protocols. Platform solutions must accommodate the robust connectivity to various external entities.

General Requirements

In addition to the functional and technical requirements outlined above, the general requirements of a platform include the following capabilities.

Security and Access Control

A platform must provide secure access to components that are exposed. Multiple levels of entitlement management are critical in complying with internal and external regulatory requirements.

Exception Management

All errors must be logged in with as much detail as possible. Platforms must be provided with exception monitoring and communication tools that allow support teams to identify and resolve issues.

Auditing and Logging

It is critical to control the operations risk. Each user activity and other key operations must be logged for auditing. In addition, the platform must provide easy and meaningful access to these logs.

Data Encryption

A platform must provide strong encryption to support secured communication with external entities.

Platform Architecture

Enterprise IT platform architecture is the blueprint of the entire software platform. The ideal platform is designed to be aligned with an IT strategy of the firm. The enterprise architecture includes three major components: *application, information,* and *infrastructure architectures*.

Application or Software Architecture

The application architecture is the blueprint of each application, interactions among applications, and how they deliver business processes. Typically, application architecture includes the catalog of application services, the functional requirements of the overall platform and each application, the application relationship model, the data flow diagram, and the interface model.

Information Architecture

Information architecture is the blueprint of data model, including data objects and the relationship among them. It also includes details such as data storage, access, and other considerations.

Infrastructure Architecture

Infrastructure architecture is the blueprint for the total technology infrastructure intended to support all applications of the platform. Infrastructure architecture components typically include the technology services catalog, technology inventory, nonfunctional requirements, network diagram, IT security model, server diagram, and storage diagrams.

Outsourced Functions

A DIP is a family of multiple independent systems serving different business functions. In practice, not all firms build their platforms with all required functions. Many firms outsource at least a few of their business functions. For instance, a collateral management service may be outsourced to a professional firm. In that case, the firm simply needs to send position information to a servicing firm at the end of each business day.

The outsourcing option will save the firm from building and managing the system and employing the expertise required for all these functions. They may simply need a small operations team to manage the outsourced function. Firms can outsource some of their functions to external institutions and build their extended DIP platform. For example, a medium-size hedge fund can simply own front-office systems and outsource all middle- and back-office functions. The outsourced functions of a DIP are referred to as *extended components*. High-level corporate and IT strategies must treat these outsourced functions as a part of the overall DIP.

Many large organizations and sell-side firms tend to build and manage their own platforms. However, it is a growing trend that even large buy-side organizations outsource certain technological functions to reduce costs and operational risks. Figure 19-3 shows a platform some of whose services are outsourced.

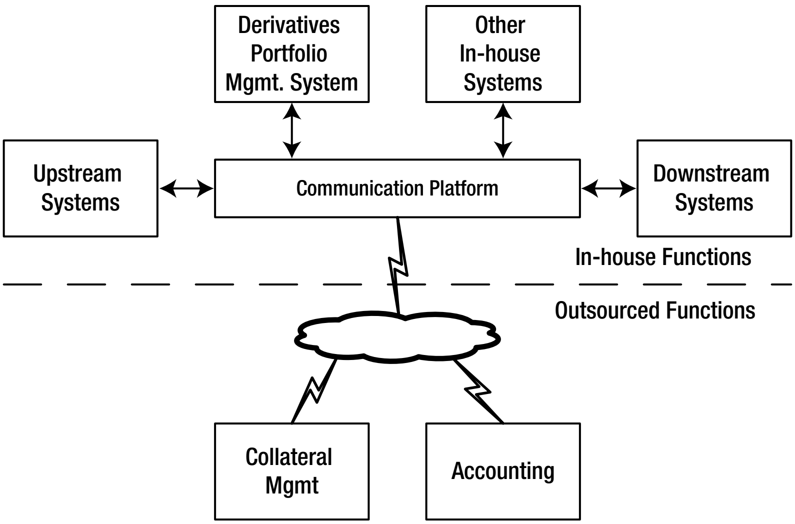

Figure 19-3. Derivatives IT platform with outsourced functions

Software Architecture

Software architecture is the process of defining a structured solution that meets all technical and functional requirements while optimizing selected attributes of a system or family of systems. This process involves a range of decisions that are based on various factors. Some of these decisions may have considerable impact on the qualities of the end-product. A software system represents a collection of components or subsystems that accomplish specified functions.

An architecture is the process of organizing various components of the system, including the communication among components, deployment of components, and other details that enable the system to deliver the functionality and qualities intended. The architecture process includes the selection of components, their structure, behavior, and interfaces.

Architecture Process

The objective of the architecture process is to combine all design decisions, including quality attributes, architecture styles, application types, technologies, deployment, and lay the foundation for the system's implementation.

The architecture process is an iterative and incremental process, through which decisions are continuously refined until the desired design solution is achieved. Initially, the architecture process is iterated until the most suitable solution is reached. After that, the process is iterated at specific stages or intervals over the life of the software platform.

The following steps explain the general architecture process. However, these steps represent a high-level general approach. Each corporation may have a set of precise steps that suit its IT organization governance. Figure 19-4 shows the overall architecture process, whose successive steps are discussed in the following sections.

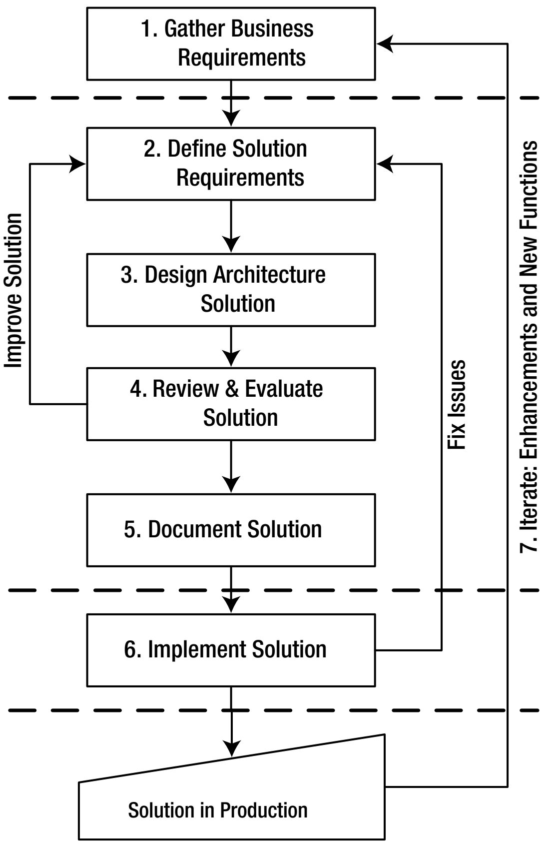

Figure 19-4. The architecture process

1. Gather Business Requirements

The first step is to gather business requirements. Business requirements include all operations, functions, short-term objectives, long-term objectives, users and their roles, current and potential challenges, and other details. Gathering business requirements is the first and foremost step of the overall process. Many system failures are attributed to poorly defined business requirements. In addition, any failures or shortcomings in this phase can lead to requirement changes throughout the design and development phase. Such changes during the development phase may be expensive and disruptive to the overall design and implementation process. It is important to capture and define the business requirements in the best possible way.

Furthermore, consider the fact that all requirements are subject to change and the requirement definition itself must explain the possible change. Such definitions would preempt the design team to accommodate potential expansion of the solution. Eventually, this will result in a scalable solution.

2. Define Solution Requirements

All business requirements must be translated into *solution requirements,* which are also referred to as *system requirements*. System requirements include functional requirements, technical requirements, and general qualities of the expected solutions—as opposed to platform requirements, which include both business and solution requirements.

3. Design Architectural Solution

The system is implemented based on the final solution that this process develops. This process involves the following steps:

- identify the application type, deployment architecture, architecture styles, and available technologies that suit your business needs
- derive a solution using the most suitable architecture styles, architectural requirements, deployment environment, and predetermined constraints
- choose the most suitable technologies for the implementation of the solution

4. Review and Evaluate Solution

It is critical to evaluate the solution and determine whether it serves the original requirements with the given constraints. Evaluation is the process of testing a solution against key scenarios, functional and technical requirements, known constraints, architectural qualities, deployment environment, and other known factors.

The evaluation process is the most critical step of the architectural process. Use appropriate methods to evaluate the solution. A thorough evaluation process leads to better solutions and systems. Also, this process helps to find and fix architectural issues, which are a major cause of system failures. It will prove more expensive to fix architectural issues the later they appear. It is important to review the architecture at major project milestones and whenever significant architectural changes are done.

After the evaluation, if the solution is not considered to be optimal, go back to the design step and repeat the process until the best solution is determined.

5. Document Solution

The selected architecture solution must be communicated to all involved parties using proper architectural documents. Architectural documents are critical to ensure the right implementation. Although any type of architecture diagrams or documents may serve this purpose, there are several standard methods, such as *UML, 4+1,* and *agile modeling* for documenting architecture. Adopting such standards is preferable to devising nonstandard methods.

6. Implement Solution

Implementation is not a part of the architecture process itself, but it is quite connected. The implementation process involves the development and deployment of actual software solutions.

During the implementation process, it is quite common to find architectural issues that may require changes in architecture. It is important to address such issues in the earliest possible iteration. It is also important to conduct architectural reviews at certain milestones of the implementation phase. Such milestones added in the original project plan would accommodate architectural changes without impacting the overall timeline and any unexpected impacts.

7. Iterate the Process

Building any software system—a fortiori a derivatives platform—is hard. Iterative and phased implementation is the common and proven approach for building large and complex systems. Firms can adapt the iterative principle in many different ways to suit their projects. Enhancements and new business functions can be added to the platform through an iterative process.

The best practice is to iterate on vertical slices that involve functionality across layers that comprise a complete business function. Especially for multi-layer and complex DIP-like systems, business functionality must be divided into multiple iterations that suit the business and strategic vision. In practice, there are more precisely defined iterative methodologies such as *extreme programming* (XP) and *agile software development methodology*.

Key Design Principles

A software solution must be built on a solid architectural foundation to serve business needs successfully, whether the software solution is a single application or a family of applications. Although today's design methodologies and tools are highly matured, they do not guarantee the best end product. They can only simplify the overall process. The best product can result only from the best design, implementation, and application methodologies.

The design process must start with the identification of business scenarios, long-term and short-term requirements of the business, system quality attributes, risks, deployment platform, and metrics to measure the success. Each key design decision must consider long-term consequences and risks. Consider the following key principles when designing the platform:

> **Collection of subsystems.** View the platform as a collection of many subsystems working together. Design each system while keeping all other systems in mind.
>
> **Categorize requirements.** Divide requirements into multiple categories based on functional, technical, and other criteria. Map each of these categories to the corresponding solution areas (also known as *traceability matrix*). Furthermore, map each high-level business requirement to functional and all the way to the actual implementation items. It helps to guarantee the deliverables that match with functional requirements without leaving any functional gaps.

Divide and design. Minimize the complexity by separating the design into different areas of concern. For instance, the user interface, communication, business processing, data storage, and data access each represent a different area of concern. Solutions to each area of concern should focus on that specific area and should not mix with any other.

Consider the change. Consider that systems may need changes over time to address new requirements and business challenges. Adapt flexible design principles to support easy enhancements.

Adapt better design tools and techniques. Adapt design tools, modeling systems such as *Unified Modeling Language (UML)*, functional or nonfunctional prototypes, and other visualization techniques where appropriate to help capture requirements and to make architecture and design decisions. They help to analyze the design and identify gaps if any.

Communication and collaboration. Adapt better communication through proper documentation and visualization tools. Communicate with all teams and stakeholders throughout the process. Communication will help all teams to understand the process, as well as to participate and contribute constructively.

Adapt iterative process. Consider using an incremental and iterative approach to refine an architecture solution. First, start with baseline architecture to get the big picture right, and then iteratively test and improve the lower details of architecture, one level at a time. Avoid diving into details too quickly and make sure to evaluate the architecture in each iteration. During the evaluation, consider items such as assumptions made, requirements of the iteration, risks involved and mitigations, and improvements in each phase.

Discipline. Establish and adhere to key principles such as design practices, application layer principles, component design principles, communication standards, and others.

Architecture Styles

The *architectural style* or *model* is a set of design principles used to design a single or family of systems. It is also referred to as an *architectural pattern*. A design pattern provides a solution to frequently recurring problems. There are patterns at every stage of software implementation, right from the architecture. Well-known architectural patterns are generally referred to as *architecture styles*.

An architecture style provides a technologically agnostic solution to common software architecture challenges for systems ranging from a small to large complex family of systems. There are several architecture styles in practice that address current challenges of designing IT solutions (Table 19-1). However, each of these styles has its own strengths and weaknesses because each of them focuses on a specific area of the problem. In practice, therefore, experts choose to combine different styles to deliver the most suitable architectural solution for a given scenario. Table 19-1 shows various styles, their focus areas, and key features. The listed styles are critical for any enterprise-level application design. Each of these is further explained below.

Table 19-1. Architecture Styles and Focus Areas

Style	Focus Area	Key Features
Layered Architecture	Structure	Divides overall application into stacked layers, each corresponding to a specific concern.
N-Tier Architecture	Structure	Divides overall application into tiers, each located on a physically separate computer.
Component-Based Architecture	Structure	Decomposes applications into reusable functional or logical components.
Service-Oriented Architecture	Communication	Decomposes applications into services, each service providing a specific functionality. Service consumers use contracts and messages to communicate with each service.
Message Bus	Communication	Prescribes a transparent communication model that can be used by software components to send and receive messages without knowing details of each other.
Object-Oriented Architecture	Structure	Decomposes applications into individual and self-sufficient objects containing the data and behavior relevant to the object.

Layered Architecture

On a high level, the *layered architecture* style is the most appropriate for complex and large systems like DIP. This style prescribes a grouping of related functionalities into distinct layers that are stacked vertically on top of each other. Each layer implements the functionality by certain related criteria, such as a common role or responsibility. It is also recommended to keep the communication between these layers loosely coupled or to use some standard communication model. This kind of layering promotes flexibility, maintainability, and loosely couples software components.

Figure 19-5 shows the possible layers of complex distributed systems.

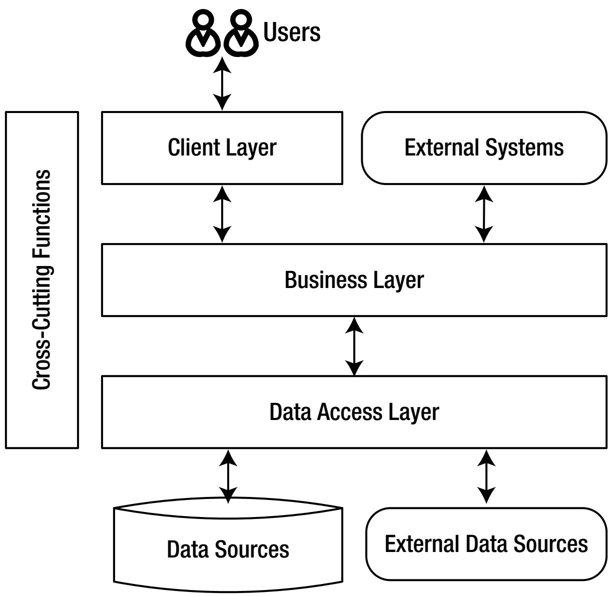

Figure 19-5. Layered architecture

Some of the design principles used in layered architecture style are well defined functional layers, loose coupling between layers, clear encapsulation, and abstractions of each layer. The components of each lower layer are typically reusable by components residing in the upper layer. An example of this is the design of a data access layer to be independent, well encapsulated, and reusable by all components of the business service layer. Also, design market data components, pricing, and other services from a business layer can be used by different components of the user interface layer.

N-Tier Architecture Styles

The n-*tiered architecture* style is similar to the layered architecture, but it is based on an underlying software component deployment. It recommends multiple (*n*) tiers that are located on physically separate computers. Hardware infrastructure has evolved a great deal, introducing totally new concepts such as clusters. The concept of a physical server is slowly becoming obsolete. New infrastructure models are providing some kind of transparency of physical servers to software architects. A layered architecture model can be considered an advanced or enhanced version of *n*-tier architecture style.

Like the layered architecture style, *n*-tier architecture style provides scalability, flexibility, and better maintainability. In practice, a layer can be mapped to a tier for deployment purposes. While the layer is a logical abstraction, a tier is a physical abstraction. One or more layers can form a tier based on deployment. A combination of these two styles provides the advantage of moving layers from one tier to other, as required.

Object-Oriented Architecture Style

The object-oriented architecture style is a programming and design paradigm that promotes the division of a system or large program into multiple individual, reusable, and self-sufficient objects, each containing the data and behavior relevant to the object. These objects are discrete, independent, and loosely coupled. Objects communicate with each other through their interfaces. An object can call methods, access properties of other objects, and send and receive messages to and from other objects.

The benefits of the object oriented architecture style are abstraction, composition, inheritance, encapsulation, polymorphism, and decoupling. These features make this style a perfect model for the development (programming) of complex and large systems. There are many *object-oriented design patterns* that are widely used and can resolve most design and programming challenges.

Service-Oriented Architecture Style

Service-oriented architecture (SOA) is another style that focuses on dividing systems into a set of services, each providing a certain application functionality. SOA services use standards-based interfaces that can be published, discovered, and invoked, irrespective of the technology used to build them and the technology platform that they are running. Functionality, provided by each service, is typically a full business function instead of partial or simple function. The service can be a simple software component or a set of components packaged together to provide the intended functionality.

Services can be accessed by clients or other services either from the same layer (tier) or from different layers using the standard interface. Nonservice (nonstandard)-based components may have certain access limitations because they require interface information and must use a compatible communication protocol.

Essentially, the service is autonomous, distributable, and loosely coupled software. Although they provide many benefits, not all parts of the system are candidates for a service model. An architecture team must go through the evaluation process to make this decision.

DIP Architecture Solution

The architecture of a software system is almost never limited to a single architectural style; rather, it is usually a combination of architectural styles integrated into a complete system. This section presents a purely hypothetical DIP architecture solution that uses a combination of different architecture styles.

Do not confuse layers with tiers. A *layer* refers to the logical grouping of functionality and components in an application; whereas *tier* refers to the physical distribution of the functionality and components on separate servers, computers, networks, or remote locations. On the highest level, both provide a similar solution with very little distinction. However, the concept of layers is quite suitable for much larger applications for reasons that are explained earlier. A logical layer can reside on the same tier (physical) or multiple tiers (multiple physical servers). In addition, this distribution may change over the life of the software without impacting the architecture. A layered style is preferred for a DIP or any system of that nature. The following sections provide some design guidelines based on these styles.

DIP Architecture

A layer is a logical group of software components performing a specific type of task. Moreover, each logical layer contains a number of discrete components, each performing a specific task. It can even be organized into sublayers as another level of separation.

This type of distinction promotes the design of reusable components, increases the maintainability of the code, provides multiple ways of production deployment, and provides clear delineation between locations where certain technology or design decisions must be made.

At the highest and most abstract level, the logical architecture of the system can be considered a set of cooperating components grouped into layers.

First, an overall DIP is divided into three main layers: the *client layer,* the *business services layer,* and the *data access layer*, with each layer comprised of a group of functions of a specific type. Note that data sources are sometimes considered as a part of the *data layer*. In addition, common functions such as security, operational management, communication, logging, and exception management are common to all layers, and they are known as *crosscutting functions*. Figure 19-6 shows these layers and high-level components of each layer.

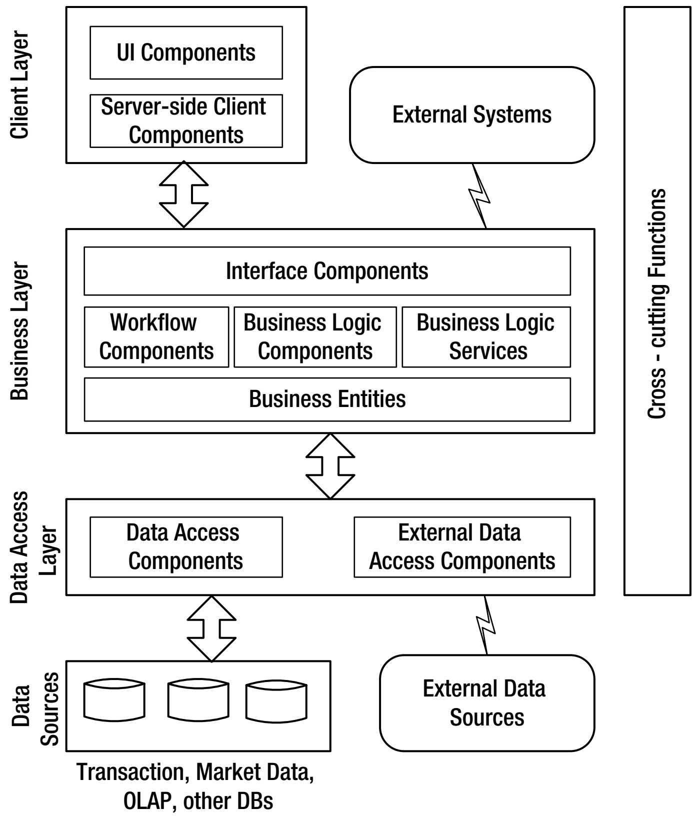

Figure 19-6. DIP architecture layers and components

DIP Design Principles

The following list explains some of the design principles for designing a DIP with a layered architecture style.

Separate the areas of concern. Break the whole system into distinct features that overlap in functionality as little as possible. The main benefit of this approach is that a feature or functionality can be optimized independently of other features or functionality. In addition, if one feature fails, it will not cause other features to fail as well, and they can run independently of one another. This approach also makes the application easier to understand and design, and it facilitates the management of complex interdependent systems.

Do not mix different types of components in one layer. Start by identifying different areas of concern, and then group components associated with each area of concern into a logical layer. For example, the UI layer should not contain business processing components, but instead should contain components used to handle user input and process user requests.

Be explicit about how layers communicate with each other. Make explicit decisions about the dependencies between layers and the data flow between them. Allowing every layer in an application to communicate with other layers will result in a solution that is more challenging to understand and manage.

Use abstraction to implement loose coupling between layers. Loose coupling can be accomplished by defining interface components such as a *façade* with well-known inputs and outputs that translate requests into a format understood by components within the layer. In addition, you can also use interface types or abstract base classes to define a *common interface* or *shared abstraction (dependency inversion)* that must be implemented by interface components.

Keep the data format consistent within a layer or component. Mixing data formats will make the application more difficult to implement, extend, and maintain. Every time you need to convert data from one format to another, you are required to implement a translation code to perform the operation and incur a processing overhead.

Client Layer

The client layer contains components that can provide the user interfacing and related components. The client layer is also known as a *presentation layer*. Most client functions in DIP are complex and require more memory and processing power on the desktop than normal client applications. In addition, some functions are long-running, such as analytics, simulation, and reports. To build such application features, the client layer can be further divided into two sublayers, known as the *user interface* layer (UIL) and the *server-side client layer* (SCL).

The UIL contains the *graphical user interface* (GUI) components that present data to the user. The SCL runs on a server instead of a desktop and connects to business layer components. SCL components are separated to run on a server environment to leverage higher resources available. This division supports faster and more robust client applications that provide uninterrupted processing for long-running functions. Figure 19-7 shows these sublayers.

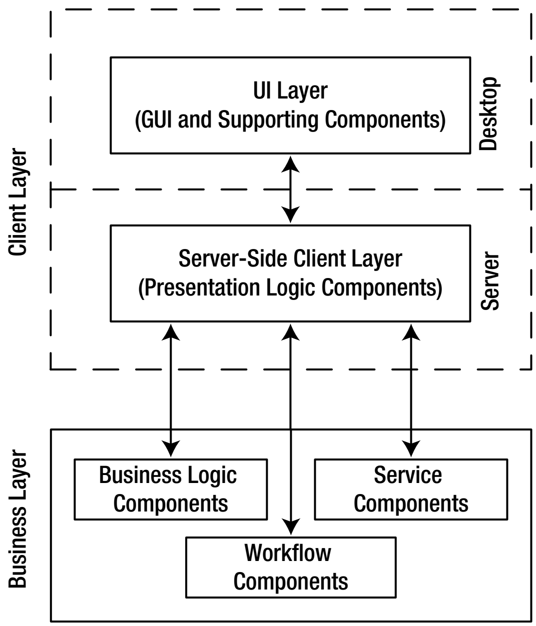

Figure 19-7. Client layer components

It is important to note that the SCL is separate from the business layer. Although this layer is deployed on a server, it must be treated as a client for all design purposes. This is one of the architecture solutions to support complex and large client applications. A separate SCL can also address various client layer challenges such as caching, client session fail-overs, long-running requests, and resource issues.

Communication Strategy

Develop a communication strategy for the communication between UIL and SCL, and SCL and business layer components. Communication between the UIL and SCL must be simple and efficient to reduce complexity and provide faster data transfers. Choose the most appropriate communication model to fit each client function. Ideally, only data should flow between these two layers. The preferred data format is usually XML, although other formats such as tabular data stream will work. It is also critical to design a user interface to reflect a communication model to provide an appropriate response to users.

An SCL communicates with different types of components of business layers such as business service components, workflow components, and service-based components. Typical communication models are the direct method call, SOA-based service calls, and the messaging model. Choose the right communication method based on the type of business layer component being accessed and the function that is being processed. Some key design considerations are listed below.

There are three common types of client applications: *thin-, thick-, and rich-client* applications. The thin client refers to the client application that runs on the browser. The thick client refers to the application with all client functions built into one layer and runs on a user desktop. The rich client typically refers to a client application that is split between the desktop (user interface) and server. The rich client is suitable for data-intensive and complex client applications. The rich-client application (with two layers) is preferred for client applications used by traders and risk managers.

DIP client functions vary by type of platform user, such as *traders, risk managers, operation teams,* and *administrators*. Choose the client application type based on the complexity of the user functions.

- Identify and select the appropriate technologies with the right GUI components for data presentation, caching, and other advanced features.
- Develop a prototype to evaluate the client solution. Resolve any architectural issues and prove the capabilities of selected technologies. Provide reference implementation for the next phase, if possible.

- Categorize all calls between these two layers. Preferably use direct method calls for blocking calls, and use the asynchronous messaging model for non-blocking and long-running operations. The communication model is the key to achieve a better response time.
- Develop standards for user interface design, communication, and other critical developmental tasks.
- UI layer should contain dedicated UI components that focus on rendering, display, and user interaction.
- Consider SCL components to provide features such as data caching and asynchronous communication models for a robust client application.
- Design SCL components to work independently, even when UIL is disconnected. This allows the ability to support long-running processes, and UIL to continue the previous session after a break or recovery.
- Balance ideal design principles and practical challenges to achieve optimal performance. In general, feel free to move any processing logic from the UIL to the SCL or vice versa to improve performance and user response time.
- There are many standard design patterns in use for client layer design. It is highly recommended to use standard patterns, appropriate UI controls, and standard usability practices.
- Other design considerations include data caching, user input data validation, exception handling, error reporting, logging, personalization, navigation, and usability (user experience).

Technologies

The UI layer requires advanced controls such as spreadsheet control, data analysis tools, and charts with large data handling capabilities. Popular technologies for the UI layer are Java, C# with vendor, and open source UI toolkits.

For the SCL, choose the same technology platform used for the business layer or any compatible technology. Again, Java and .Net platforms provide most of the required features.

Business Layer

The business layer is also referred to as an *application service layer* or *business application layer*. This layer implements all business logic and functions. Business logic is the computation or process that is concerned with the retrieval, processing, transformation, and management of application data, application of business rules and policies, and management of data consistency and validity checks. This layer provides access to the data layer, both internal and external.

The main components of this layer are the standard application interface (façade), business logic components, and business entity components. Business logic components may include processing components, workflow components, and external system interfacing components.

A standard interface component, typically referred to as *application façade,* is used to access different business layer components by a client layer. It simplifies access and reduces the dependency on specific objects. It may also facilitate routing and load balancing features that enhance performance and the efficiency of the platform.

Business logic components can be packaged in different ways based on the way they are accessed. For instance, some components could implement web service interface, some may use a messaging based interface, and others may use application level protocols.

Business entities (also known as *business objects*) encapsulate the business logic and data necessary to represent real-world elements such as trade, contract, position, and security. Typically, each entity is an object that stores various data elements in the form of object attributes and functionality related to data manipulation in the form of object functions. Each entity must encapsulate data and provide validation and processing logic in a simple format.

In a derivatives environment, many processing functions are complex. Such processing logic can be developed as a common library instead of embedding into entities.

The next set of components is workflow components that provide the automation of operations and processing functions. Design of workflow components is briefly discussed in a later section.

The business layer must also provide the components to access external data, either from a different application within the firm or outside of the firm. Such components in the business layer will provide transparent access to those resources.

General Design Considerations

Key points to consider while designing business layer include the following:

- Thoroughly study requirements and develop business scenarios and derive functional components of the business layer.
- Focus on minimizing complexity through the abstraction of business functions.
- Identify all potential consumers of each business function and consider their use during the design of each component.
- Keep the business logic components free from any presentation functions or data access functions.
- Do not design components with a large number of functions unless doing so is justified.
- In case of multi-threading functions, design thread-safe components.
- Any large pure data processing or business logic functions can be API-style libraries rather than full-blown components.
- Calculate the number of round trips required between the business layer and other layers to perform each business function, and optimize this number to attain the best response time.
- As a general principle, implement only business logic and keep behavior-related logic out of business layer components.
- The common areas to consider during the design are authentication, authorization, caching, exception management, logging, and auditing.

Technologies and Tools

The two major technology platforms for business layer implementation are .Net and Java. Although it may be better to use a single platform, it is not necessary given the advancements in both technologies. In most cases, components developed using different technologies can easily coexist and communicate with each other. So, the choice of technology is a firm's strategic decision rather than the capability of the technology used.

In the case of the .Net platform, there is a broad set of products and libraries ranging from GUI to server-side technologies, workflow components, and more.

In the case of the Java platform, in addition to standard libraries, there are many third-party and open source libraries and products that can be used to build a robust platform.

In addition to vendor-specific tools and techs, firms must also evaluate some of the open source products.

DIP Business Layer Components

Divide the DIP business layer component into the following categories and apply design principles for each category. If required, create more categories to address your design.

> **General components.** Provide general request response-style functions for activities like static data management, reference data management, and other queries that fetch business data.
>
> **Workflow components.** Implement functions such as trade processing, life-cycle management, and other operations.
>
> **SOA components (services).** Implement common functions—such as pricing and analytics functions—that can be reused by the client layer as well other services that run on the same or a different platform.
>
> **Batch components.** Deal with long-running processes such as stress tests, simulations, and reports.

Figure 19-8 shows the various components by business function.

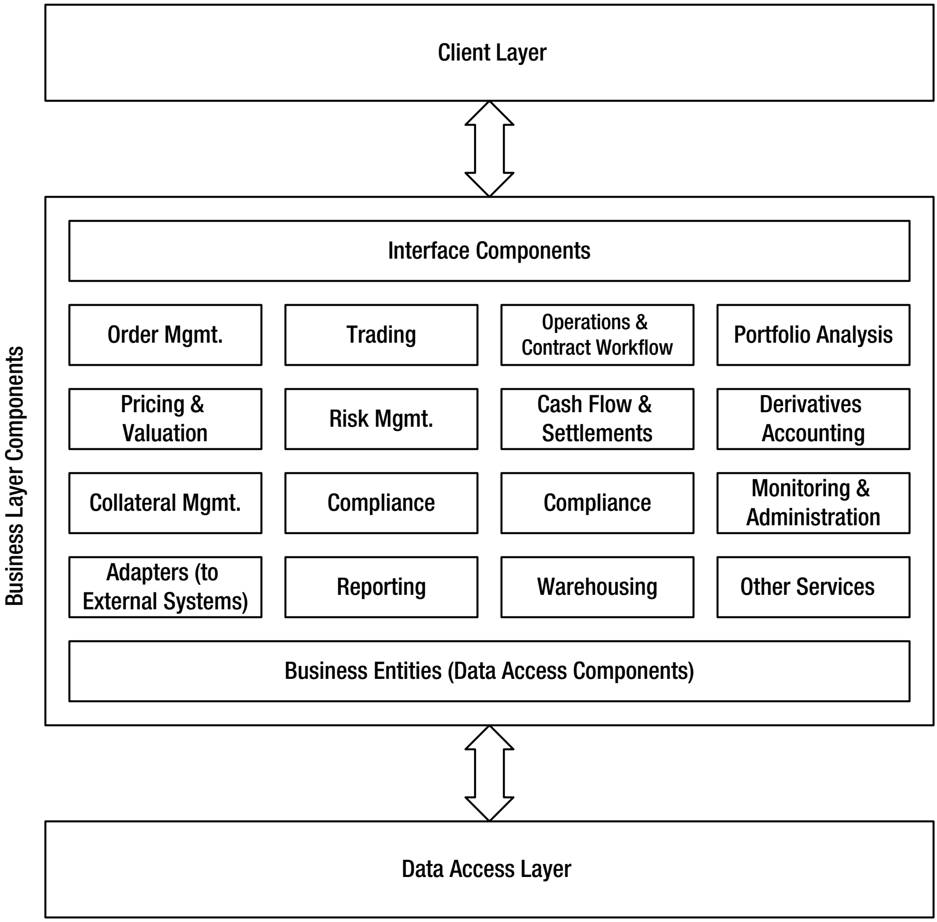

Figure 19-8. Business layer components arrayed by business function

Data Access Layer

The data access layer contains the components that provide access to all the data sources to its upper layers. They encapsulate the data source where the data is stored and access data logic. Typically, most application environments use *relational database management system* (RDBMS) servers to store transactional data. However, new types of databases are being introduced to handle specific scenarios such as large-volume data storage for *big data* and complex processing for analytical purposes, such as *online analytical processing* (OLAP).

The key objective of the data access layer is to provide the transparency and abstraction from data storage, access, and format. Common components of the data layer are *data access components, service agents,* and helpers.

> **Data access components.** These components contain all the logic required to access the underlying data providing the transparency to the business logic layer. All data access logic is encapsulated in these components. Typically they are implemented using common data layer patterns such as *helper objects* or *ORM frameworks*.
>
> **Service agents.** Data access components can be directly accessed by the business layer or through service agents that provide the standard interface. Access through standard interface would add an additional layer of data source transparency. In addition, service agents may provide additional services such as caching, offline support, and basic mapping between the format of the data exposed by the service and the format your application requires.
>
> **Helpers.** Helpers include all other components that are used in data access layer.

Key design principles for the data access layer include the following:

- Design data layer components to access all sources, including new and legacy data sources.
- Keep performance and scalability in mind and set benchmarks for validation.
- Develop prototypes that access these components directly to test the performance of data access components. These components should provide the maximum performance as all other layers depend on these.
- Data access performance is the key to the success of overall platform architecture. Run performance tests in early stages of the process to validate the technology and selected architecture.
- Adapt proven data access architecture and development patterns.
- Understand the business entities and relationship thoroughly prior to designing an entity and data model. Not understanding them is a common pitfall of the data model failures.

- Consider potential changes and enhancements to design easily scalable data models. Design the data model with options to enhance and accommodate additional entity attributes easily. Encapsulate data entities naturally, mapping to business entities that provide a proper hierarchical relationship. Derivatives data structures are hierarchical with multiple levels.
- Design and choose a solution that needs the least amount of coding and development time. Think of using standard patterns that require the least amount of code and promote automation with the flexibility of easier data model enhancements.
- Avoid direct access to the database. This will provide database agnostic solutions. Most components will remain independent from the database.
- The service layer should provide translator components that translate data formats between the business layer entities and data contracts.
- Consider *object-relational mapping* (ORM) solutions for reducing the amount of coding. Evaluate open source ORM frameworks such as Hibernate for Java and NHibernate for .Net. Such frameworks may provide higher flexibility but have adverse performance impacts. It is critical to perform performance tests during the design phase to make sure performance requirements are satisfied.
- Other common concerns to be considered are transaction management, data caching, batching, *binary large objects* (BLOB), and exception management.

In addition, during the design process, there are two key decisions to be made in reference to the use of *stored procedures* versus *dynamic SQL* and use of *XML*.

Stored procedures and dynamic SQL both have their advantages and disadvantages. However, the choice is based on the requirements of abstraction, maintainability, and environment constraints. It is also common that most platforms combine both approaches as needed. Just make sure that each approach is evaluated before making a final decision.

Extensible Markup Language (XML) is the most popular and widely used data format. It is critical to decide when to use XML. The XML format is quite flexible and useful for interoperability. If the XML format is used for data storage, it will provide the ability to maintain data structure outside of the database. That means XML is saved in a database as text instead of individual fields of the table. If the XML format is used for data transfer, XML text must be created before sending and must be parsed after it is received. This approach has an impact on the performance, as additional time is required for creating and parsing. So, the architecture process must thoroughly evaluate the use of XML in order to avoid any impact on the overall performance.

Data Sources

A DIP requires a robust and flexible data infrastructure to store a large amount of data that also provides a faster access. The common functions—such as pricing, analytics, and simulations—access and process large volumes of data. So the use of high-performance databases is the key for successful architecture. Most of the popular RDBMS systems deliver the performance, scalability, and other architectural qualities required for DIP. In addition to RDBMS databases, many started to use other types of databases such as OLAP, XML-based databases, and no-SQL databases that have unique advantages for certain operations such as reporting, analytics, and other nontransactional activities.

Furthermore, *Microsoft Access* has been a longtime companion of traders and risk management teams. It is still being used for small scale tasks such as research and testing activities. It is a simple, desktop database with support for VBA (programming script). Access database can also be accessed by most Windows-based programming tools, allowing it to be embedded into the DIP.

Key design principles for the data model include the following:

- Thoroughly map a data entity model to a physical data model (database tables). Remember one entity object may be mapped to multiple data tables.
- Develop or use existing data model standards for data modeling. Strictly adhere to standards.
- Adapt the use of good data modeling and administration tools.
- Design and adhere to a change management process.
- Consider historical data needs while estimating data volumes.
- Try to segregate data into multiple physical databases using criteria that can improve overall performance. For instance, transaction data, historical data, and warehouse data can reside in different physical databases.
- Document and publish the data model frequently to all related teams during implementation.

Crosscutting Functions

Functions such as security, operational management, logging, exception management, caching, and validation are common to all layers. Most components from these require some or all of these common functions. These common functions are known as *crosscutting concerns*. Key considerations for designing these functions include the following:

- Identify all functions that span two or more layers and categorize them as cross-cutting functions.
- Implement (build and deploy) them as reusable independent libraries or components that can easily be reusable by all components across the platform.
- Avoid mixing the code of crosscutting functions and layer specific components.

SOA Services

Service components are part of the business layer. As discussed in the previous section, SOA-based services are technology-agnostic, which means the underlying technology of service is transparent to its clients (consumers). For instance, a client built using .Net technologies can access a service built using Java, or vice versa.

In DIP, for instance, many independent functions such as market data access, pricing, and some other functions can be implemented as SOA services. In general, each service should closely map to the item under functional requirements.

Service components are essentially two types—*service interfaces* and *messages*. An interface component provides the access to service. The message component is the encapsulation of data and operations that are used to exchange data between a service and its consumer.

Some common considerations for designing services include the following:

- Use the *contract first design* approach, whereby the first step is the definition of the service interface that is exposed.
- Always define fault contracts that return error information to the consumers of the service.
- Decide whether to use the REST model or the SOAP model (explained in the next section).
- Design service contracts that can be extended in the future without affecting the consumer.

- Define the service scope clearly and limit implementation to the scope.
- Design services to be pure implementation-only application functions without including any infrastructure concerns such as authentication.
- Consider other common issues such as authentication, authorization, communication, exception management, message construction, message transformation, service interface, and validation.

REST versus SOAP

There are two popular models used for the implementation of services: *representational state transfer* (REST) and *Simple Object Access Protocol* (SOAP). The main difference between these two approaches is the way that the service state is maintained. REST is an architectural pattern that works mostly in conjunction with HTTP, so the REST model is more suitable for services used in web-based applications.

SOAP is an XML-based messaging protocol that can be used with any communication protocol, including HTTP. It is a better choice to implement a range of procedural interactions, such as the interaction between layers of an application. Unlike REST, SOAP is not restricted to HTTP alone, making it the preferred model for DIP services.

Consider using *grid-enabled SOA*, an advanced SOA architecture that alleviates many of the challenges in adopting a standard SOA.

Workflow Design

Workflow components play a critical role in the business layer of the DIP platform. As discussed in the previous chapter, workflows are the best tools that provide automation of operations and processing as various events occur and data changes happen. Workflow management is also known as *business process management* (BPM).

A workflow model can be used to define and coordinate long-running, multi-step business operations (tasks), such as order processing, pre- and post-trade processing, contract life cycle management, settlements, collateral management, and many other operations.

Workflows can provide automated end-to-end processing, seamless STP, improved productivity, reduced operational failures, increased compliance, process optimization, and reduced transaction costs. In addition, advanced workflow tools provide the flexibility to customize and manage the change quickly without involving software development. There are three basic types of workflow models that can be mapped to real business scenarios: the *sequential model,* the *state machine model,* and the *data-driven model.*

In a sequential workflow model, a task moves through a specific set of steps until it is completed. This sequence can be defined and controlled. With the state machine workflow model, a task can be defined as a set of states and events that cause a transition from one state to another. As events occur, the resulting tasks are executed. With a data-driven workflow, tasks are executed based on information associated with data. As data changes occur, related tasks are executed. Using these three models, most of the business operations can be designed into workflows.

Developing workflow components is more of a software engineering task than a typical application development. Using an existing foundation will save initial time for ongoing maintenance costs. Consider using one of the solutions that are available either from a vendor or an open source. There are many good solutions available in the form of APIs as well as customizable products both in commercial and open-source spaces.

Consider the following common guidelines when designing workflows:

- Identify the appropriate workflow model required for each business scenario.
- Thoroughly evaluate technologies and tools available. Identify an appropriate implementation model to choose the overall solution.
- Choose the suitable workflow authoring tool and develop standards to author workflows.
- Develop and maintain the documentation.

Communication Design

A DIP architecture is a multi-layer distributed application with many components. DIPs are multi-layer and relatively large distributed systems with complex processing logic, workflows, and services, voluminous data exchange, and communication of some kind among components. DIPs demand high performance, scalability, and robust data processing qualities. In achieving these requirements, communication between components of the same layer, different layers, and external systems plays a critical role.

A communication solution describes the way various components of the system communicate with each other and with external systems. Furthermore, the method of communication decides interdependency (coupling and cohesion) between layers. The communication infrastructure is generally known as *middleware.*

There are many integration patterns that provide architectural solutions to various scenarios. There are two main categories - *synchronous (direct and blocking) and asynchronous (message-based).*

In a synchronous (direct) model, a caller will establish a connection with the target component and makes direct method calls. This mode is generally used for short-living calls, ordered messaging, and sequential operations. Communication protocols such as RMI (*Remote Method Invocation*), HTTP (*Hypertext Transfer Protocol*), service calls, and FIX (*Financial Information eXchange*) use synchronous communication.

In an asynchronous model, a caller sends the message to the target over some channel without establishing a direct connection. It is generally known as a *message-based communication model, message-oriented-middleware* (MoM), a *message bus*, or a *nonblocking call*. There are various types of message-based communication models, such as *message-queue, broadcast, publish-subscribe, point-to-point,* and *certified messaging*.

Data Format

The most common data formats for passing data across layers are scalar values, XML, tabular data stream, and custom objects. Carefully study the requirements and decide the data formats. The use of fewer data formats will be easier to manage. Try to build and use generic APIs that are used to deal with data formats. Application level protocols such as FIX, FpML, and SWIFT define their own message formats.

External System Communication

As discussed earlier, DIP systems communicate with several external systems such as trading platforms, sell-side platforms, post-trading processing platforms, CCPs, FCMs, market data vendors, application hosting services, and custodians. Consequently, establishing communication (integration) of these systems is critical.

Standard and open messaging protocols will help to achieve efficiency and cost-effective communication. Various communication methods and protocols are in use: FTP, HTTP, MoM, FIX, FIXML, FpML, SWIFT, and other nonstandard proprietary formats. Figure 19-9 shows common communication protocols between buy-side institutions and other market participants.

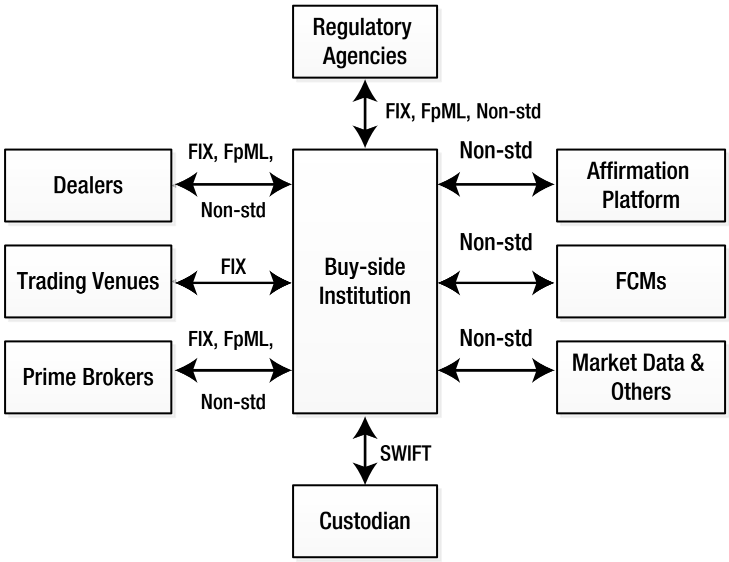

Figure 19-9. Communication between buy-side and external entities

Figure 19-10 shows common communication protocols between the sell-side institution and other market participants.

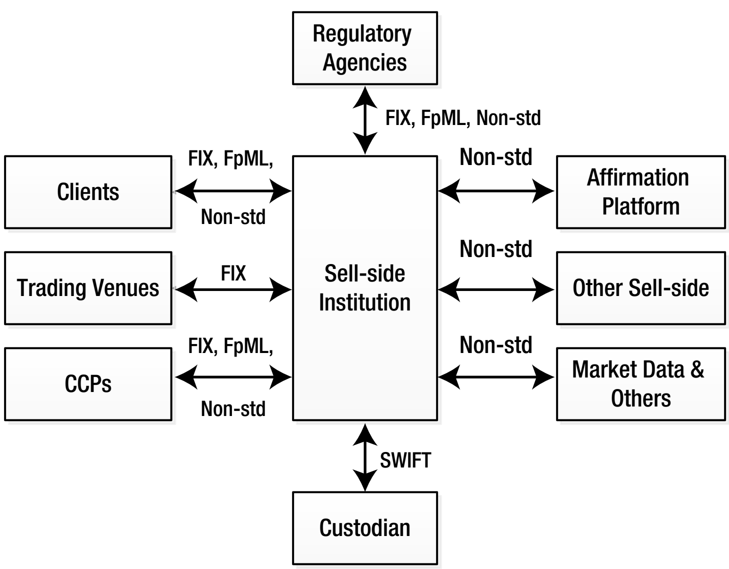

Figure 19-10. Communication between sell-side and external institutions

FIX protocol. Mostly used between trading platforms and its clients. (See the "FIX protocol" section below.)

FIXML. XML version of FIX protocol.

FpML. FpML (financial products markup language) is an XML-based message format that is mainly used in the OTC market. (See the "FpML" section below.)

SWIFT. Secured infrastructure that is used between financial institutions and their clients to exchange messages and process various transactions.

Proprietary nonstandard protocols. Some service institutions such as sell-side firms and post-trade processing firms use their own messaging formats to communicate with their clients. Typically, they are comma-separated data files transferred over FTP. However, this trend is slackening as standard protocols such as FIX and FpML are becoming more popular.

Message-based interface. Some service providers use MoM (queue-based) (message bus) or simple email protocol to communicate with market participants asynchronously.

FTP (file transfer protocol). It is another asynchronous or off-line model in which data files are transferred between market participants over FTP.

Proprietary APIs. Some service firms, such as market data vendors, provide an API (application program interface) to access their services through client applications.

Web-based interface. Some noncritical functions, such as reconciliations and reports, are provided through web interfaces by some service providers.

General guidelines to be considered during the design of communication architecture include the following:

- The key issues to consider are asynchronous versus synchronous communication, security and reliability, data format, performance, security, interoperability, coupling and cohesion, and state management.
- Develop guidelines for asynchronous and synchronous communication, and apply them across the platform.

- Consider the communication overheads between different layers or tiers. Design communication to reduce round trips in such scenarios. For instance, communication between components on the same layer can use simple and direct calls, whereas communication between the layers may use some standard service-based interface to achieve efficiency and reliability of both.
- Identify inter-system and external communication scenarios and design an appropriate communication model to achieve the best performance.
- Develop a preference using a coarse-grained, message-based communication method with an asynchronous model in case of cross-layer communication and long-running operations. These function as nonblocking calls and provide offline support.
- Consider using message-based communications when crossing process boundaries or physical boundaries.
- In the case of large data transfers, consider using a serialization technique, either using XML serialization or binary serialization.
- Consider using standard application level communicating protocols, such as FIX, FIXML, and FpML, that have built-in features that provider orderly and robust communication.
- Identify audit, replay, messaging order, and other requirements, and define a strategy to provide these features as needed.
- Identify data security requirements and adapt methods such as encryption, digital certificates, and channel security features.

Component Development

In general, the term *component* refers to software that encapsulates a specific set of functions, either small or large, for the software module, service, or any software that is relatively independent. It is a generic and commonly used term both in architecture and programming.

The preferred architecture style for component development is an *object-oriented (OO)* style. There are many widely used OO patterns that resolve various programming challenges. The use of well-known patterns is highly recommended in programming. Programs are the fundamental element of any software systems. This makes it critical to adapt standard and proven methodologies.

Each DIP system or business function must be divided into OO objects. This will promote independent components or objects. The OO style reduces the overall cost of software development and produces functional components. For instance, most critical components, such as analytics, can be developed as reusable objects by a single group and used by different departments. Similarly, complex as well as simple functions must be developed as reusable object libraries.

Big Data and DIP

Big data refers to a collection of large-volume, structured, and unstructured data collected by an organization. It can be analyzed to benefit the business in different ways. In recent years, several new technologies have evolved to deal with big data. Unlike traditional database technologies, these new technologies are extremely powerful and process a very large size of data much faster. They can bring dramatic cost reductions and substantial improvements in the time required to perform a computing task. Big data technologies can enable corporations to gain a strategic advantage over the competition through predictive analysis and business intelligence.

The derivatives business can definitely benefit from big data technologies, especially in the risk management area. The challenges such as increased regulation, product complexity, and market volatility require complex calculations and processing of large volumes of data. Risk measures such as *potential future exposure* (PFE), *credit value adjustment* (CVA), and stress tests and simulations can be performed in real time using these powerful technologies.

Standard Protocols

As processes evolved, the financial industry has adopted standard protocols. Today, most trading-related communication uses the FIX protocol while post-trade processing uses FpML and FIX/FIXML, and financial transactions occur over SWIFT.

Standard protocols are the key drivers in automating trading and operations across the board. This directly leads to STP, resulting in high efficiency and reduced transaction costs. Moreover, it reduces the operations risk and addresses regulatory concerns.

Currently, much of the trading happens on electronic platforms including electronic systems of exchanges and ECNs. Most of these platforms are using the FIX protocol. As a result, market participants are able to capture trade data directly in their internal systems, enabling the automation of post-trade processing and STP.

FIX Protocol

The *Financial Information eXchange* (FIX) protocol is one of the most used protocols in financial markets today. It is an industry-driven electronic messaging and communication standards for the exchange of trading and trading-related information between market players. Today, most financial institutions—including exchanges, broker-dealers, buy-side institutions, and servicing firms—use the FIX protocol.

The FIX protocol was introduced in 1992 and is managed by the *FIX Trading Community, originally known as FIX Protocol Limited (*`www.fixtradingcommunity.org`*)*. It is a nonprofit, industry-driven, member-managed standards body formed by major market participants.

The latest FIX version is 5.0. Other popular FIX versions are 4.1 to 4.4, which are still in use by some users. FIX is the open protocol that streamlines and increases the efficiency of communication among industry players. It is widely accepted because it is simple, easily extensible, platform-independent, and easy to implement.

FIX protocol supports two message formats: a traditional *text format* and an XML format known as *FIXML*. XML is the standard meta-language for describing the data that is shared between applications.

The FIX message is a collection of fields and each field is a tag-value pair. For instance, the field "*55=ABC*" represents the *trading symbol of a financial instrument* whose value is *ABC*. Each field is terminated by a delimiter character. All tags (FIX dictionary) and message formats are defined by FIX protocol specifications with provisions to extend the dictionary as well as the message format. This format is widely used due to its simplicity and performance in creation and processing.

FIXML is used mostly in the post-trade world for trade processing and other communications.

FIX Software *QuickFix* is a popular, free, open source FIX engine. It is available online at `quickfixj.org` in Java, `quickfixengine.org` in C++, and `quickfixn.org` in C#.

FpML

In the derivatives industry, the *Financial Products Markup Language (FpML)* has become an increasingly popular means for representing and exchanging derivatives—especially OTC contracts—data between systems and entities. FpML is an open source, platform-independent electronic messaging, and the processing standard for financial derivatives instruments. Most post-trade processing and servicing firms use FpML to receive trade data from their clients.

FpML specifications are managed by ISDA and available online from www.fpml.org. The objective of these protocols is to automate the flow of information among all firms involved in the derivatives business. It was originally designed to cover OTC derivative products including swaps and structured products.

FpML is modular and uses extensibility schema. It defines product descriptions and sets of business processes. It uses an XML format for product descriptions. XML format is quite suitable for representing complex hierarchical structures involved in derivatives, especially OTC products.

It defines the format for a wide range of products, including various interest rate derivatives, FX derivatives, credit derivatives, equity derivatives, and commodity derivatives. In addition, it also defines a broad group of underlying assets that are used in derivatives, including loans and deposits.

It also defines processes, including the request for quotes, confirmation, affirmation, novation, terminations, increases, amendments, credit event notice, allocations, cash flow matching, and portfolio reconciliation. FpML is used by most participants, including dealers, asset managers, hedge funds, service providers, and technology companies.

FIX versus FpML

FIX and FpML are two different protocols introduced with very different objectives. FIX is a complete communication protocol with application and transport message standards. Furthermore, in the last decade, the FIX protocol has been heavily adopted and has become the standard in financial markets for trading related electronic communications.

FIX was originally designed for securities transactions and was later extended to support derivatives, as well as pre- and post-trade messaging. Today, it is widely used in listed derivatives market by exchanges and other participants. FIX, along with FIXML, has been continuously evolving to support complex derivative products.

In the case of OTC products, FpML holds up quite well because it was originally designed for this purpose. OTC products are complex and need a flexible and hierarchical format such as XML. FpML was originally designed to transfer OTC contract information among market participants for contract processing. Later, FpML was enhanced to support trading and other features. The latest version of FpML (5.X) includes a transport protocol and many other features.

FIXML focuses on standardized products while FpML focuses on complex customized products. FpML uses a complex XML structure that FIXML doesn't support.

In conclusion, FIX may gain ground in all trading and inter-organization communication purposes including the derivatives area. FpML is likely to continue to be used in an OTC derivatives area for post-trade processing.

SWIFT

The *Society for Worldwide Interbank Financial Telecommunications* (SWIFT) is an organization that runs a worldwide network *(SWIFTNet),* which is used by its members to exchange electronic messages. The SWIFT network is highly reliable and secure. Its members are banks, financial institutions, and large corporations. This network (SWIFTNet) is typically used for transferring financial transactions and related messages between its members.

SWIFT is a member-owned, not-for-profit cooperative founded in 1973. It was originally created by global banks to automate cross-border payments and reporting as a replacement for the fax and telex. Later, SWIFT added automating securities, treasury, and trade operations to help different segments of financial markets.

Note that SWIFT does not facilitate funds transfers; rather, it sends payment orders (instructions), which must be settled by institutions. SWIFT defines the standards used for communication over its network. These standards are known as the *SWIFT protocol.* The protocol defines how transaction messages should be structured, what data they need to contain, how they should be formatted, and the rules on how and when each message should be used.

SWIFT messages use the standard *ISO 20022 format (*`www.iso20022.org`*)*. The SWIFT protocol supports two types of formats for message transmissions:

> **MT or FIN.** This is an old, traditional SWIFT proprietary message standard. It is a plain text message with a proprietary format.
>
> **MX (XML).** This is relatively new message standard using an XML format.

RIXML

The *Research Information Markup Language* (RIXML) is an open standard designed for categorizing, tagging, and distributing global investment research data to market participants. RIXML utilizes XML and supports various types of data elements, including media. It is quite useful, but it has yet to be fully accepted by a wider range of market participants.

Market Data Integration

Various market data and reference data elements used in derivatives business were discussed in Chapter 8. Designing and managing the market data flow is one of the critical tasks. As explained earlier, it is critical for pricing, valuation, and analytics. Timing and data accuracy is the key to understanding the economic perspective as well as the legal perspective.

In practice, market data is collected from multiple sources in different formats. The collection, conversion, storage, and access are the key aspects of design. From a technical standpoint, the market and reference data is one of two types: the *live data* that is streamed during trading hours and the *on-demand data* that is retrieved from data vendors when needed. Figure 19-11 shows market data flow and components.

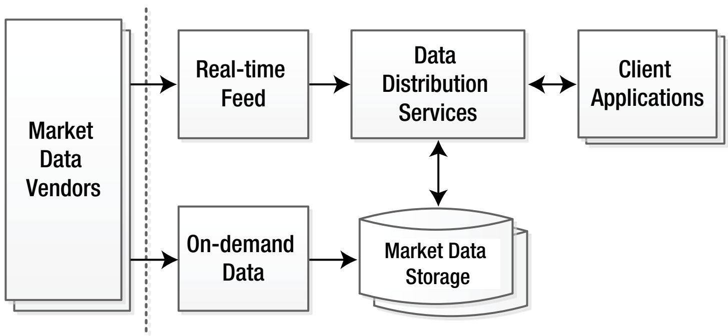

Figure 19-11. Market data integration

Integration Models

The following are the integration models in use.

Real-time live data (streaming data). Live data is streamed from exchanges, electronic platforms, and data aggregators. This data is accessed by consumers in the following ways:

> **API.** Client applications use the data vendor provided by API to receive data directly onto the client platform.
>
> **Desktop or server applications.** Clients use vendor applications installed on the client desktop to access and view market data. In addition, some vendors also provide services that can be installed directly and integrated into the system platform.

Message queues (message bus). Data is transmitted through an asynchronous model over the queue from which client applications read continuously.

On-demand data. Live, historical, and reference data that is accessed when and as it is needed. It includes closing prices, securities information, market events, and other data. Typically, this type of data is retrieved by batch jobs on scheduled intervals. Common data retrieval models include the following:

API. Client applications use data vendor APIs to retrieve data.

FTP. Clients download data from vendor's data servers using FTP.

Web-based interface. Clients download data from the vendor's data servers via the Internet using the web interface.

Market Data Storage

Typically, separate sets of market data are required by the front office, middle office, risk, and others on-demand. The architecture must incorporate the features to maintain multiple sets and reference those that set a link to them back for audit purposes.

Furthermore, managing market data is a resource intensive process. Consider space usage, process power, memory, network, licensing costs, and other factors during the design.

Platform Development Approaches

After the architecture, the next major step is the implementation of various systems of the platform. Competent development alone cannot deliver an effective IT platform. Rather, it depends more on execution of the design and strategy. There is no single specific approach to building a perfect IT platform; it can result only from the combined efforts of business management, IT management, and the development team.

The DIP platform can be implemented using four different approaches: the *vendor product-based platform,* the *developed-in-house platform,* the *hosted solution,* and the *hybrid platform*. The following sections explain each of these approaches.

Vendor Product-Based Platform

A *vendor product-based platform* is a platform built using one or more vendor products but hosted and managed by the firm's IT team. There are many vendor products that provide simple, out-of-the-box business functions, as well as products with complex and highly customizable features. Also, there are products that provide features serving a single functional area and products that provide features serving multiple functional areas. The selection of a product depends on the size of the firm's derivative operations and the range of the contracts they use.

There are many out-of-the-box vendor products that serve widely traded listed and standard OTC products. Unfortunately, there is no perfect vendor product that provides a full set of functions required by a broader DIP platform. In practice, most mid- to large-size firms implement their platforms with multiple vendor products.

The major benefits of using a vendor product to build a platform are the following:

Time-to-market. Vendor products are relatively easy and quick to set up and use.

Cost effective. Total cost of ownership is relatively less than the cost of development.

Product enhancements. Most vendors stay on top of market trends and enhance their products as the client requirements change.

Flexibility. A multi-vendor product platform that is built using flexible standard interfaces. It is easy to replace one vendor product with another. This enables the firms to quickly implement change when needed.

Quality products. These allow one to build a platform with the best-of-the-breed products from multiple vendors who are experts in different areas such as market risk, credit risk, or collateral management.

Limited in-house expertise. Firms don't have to employ functional and technical expertise, and instead only need limited technical and operational staff.

Customizability. Many vendors realize that there are no solutions that can satisfy the requirements of all clients. So, most products will allow for clients to customize functions to accommodate their needs. This type of customization provides for greater flexibility. In theory, customization is quicker than development. Most high-end products can be completely tailored to suit the firm's unique requirements.

Scalable platform. The use of the latest integration patterns and technology can lead to a platform that is scalable with plug-and-play architecture. It may allow for adding or replacing any specific functional product or module of the platform quickly and easily.

This approach may be suitable for small- to mid-size corporations that have limited budgets but still need some control over their technology platforms. Even large firms can adapt this approach with products that provide for better customization features. Besides this, an increasing number of improved vendor products are being introduced as the derivative markets are becoming standardized.

Developed-In-House Platform

The *developed-in-house platform* is built with systems mostly developed in house by a firm's IT team. The platform may include some vendor APIs, libraries, and other tools, but most functional modules are developed by in-house teams.

Developing an in-house DIP is a complex, expensive, and risky undertaking. Functions such as OTC derivatives pricing and risk analytics require exceptional expertise. In addition, managing an in-house built platform is an expensive task. However, a large corporation with a sufficient budget can accomplish this. For instance, most sell-side firms build their own systems. It may not be a viable option for many buy-side firms.

The in-house development approach provides the flexibility to build the most closely tailored applications. Moreover, it may provide a competitive advantage, especially for sell-side firms. On the downside, there are many challenges with in-house development. A firm must consider these issues while making their decision. Some points to consider are the availability of strong IT resources with derivatives expertise, the complexity of products in scope, realistic project time lines, higher costs of development and maintenance, project management resources with derivatives business expertise, availability and willingness of the business team, and the firm's long-term goals. However, as markets are being reformed and are heading toward product standardization, developing a platform in-house is becoming easier than ever before.

Sell-side business is all about product and service innovation. Since most vendor products are designed to serve a wider audience, they are not suitable for sell-side firms in many cases. So, sell-side firms tend to build their own products to gain a competitive advantage and also to fit their business models.

SaaS or Managed Services

Software as a service (SaaS) is a software leasing model in which customers use fully functional software applications for a fee. It is also known as *on-demand software, hosted solutions,* and *managed services*.

SaaS customers have no hardware or software to buy, install, maintain, or update. Customers are typically charged a fixed fee—per user, per transaction, per annum, or in some other form. Software applications are developed, hosted, and managed by an external entity—the *application service provider* (ASP).

SaaS is typically accessed by users through a thin client such as a web browser. It also provides standardized software service components that are easy to integrate with internal applications. This allows firms to use a specific function through SaaS and also integrate that with internal applications.

SaaS is becoming an increasingly popular model on account of its potential for reducing costs and regulatory and operations risks. This model provides greater flexibility, allowing business professionals to focus on other tangible business operations, problems, and issues. It is a solution well suited to many small to mid-size corporations involved with standard derivative products.

Nonetheless, SaaS is a relatively new concept in the derivatives market, and not all business functions are available through this model. As such, SaaS often figures in the hybrid models discussed in the next section.

Hybrid Platform

A *hybrid model* is a combination of all the above approaches. A hybrid platform is a platform that brings together in-house builds, vendor products, and SaaS systems in such a way as to provide seamless access to all business functions.

A hybrid approach enables corporations to build a platform with best-of-all components or with the products of their choice. However, it does not follow that a hybrid platform is necessarily the best choice. The quality of a hybrid solution depends implicitly on how the products are chosen and how well they are integrated. There is a besetting risk of building a rigid platform hobbled with system limitations.

In practice, most corporations have hybrid platforms, whether intentionally or not. Owing to the challenges in building a derivatives platform, most firms start with vendor products and subsequently build in-house systems to customize certain business functions.

The general trend is for firms to periodically replace installed vendor products and in-house systems with other vendors' products or new in-house systems as corporate strategy changes, business needs evolve, technology expands, or regulatory requirements take effect.

Choosing an Approach

Only large firms with reasonably large IT departments can build and maintain their own platforms. Firms planning to build their own platforms must thoroughly study the challenges of each approach and decide whether to build, buy, or outsource each function. Most sell-side firms are large and favor building in-house applications that precisely fit their business models' unique requirements, so conferring strategic advantages and superior capabilities for generating pricing models, risk analytics, and portfolio analytics. Furthermore, sell-side operational models and organizational structures vary by firm such that it is often easier to develop in-house builds than to customize a vendor product.

For most buy-side firms (mid- to large-size), the hybrid approach is preferred because it provides them the flexibility to choose different products and still have control over the final platform. It allows them to build and integrate functions they may need on top of vendor products.

For small buy-side firms, the total vendor solution or SaaS model may work better because of the lower cost of ownership and quick setup time.

Although there are many vendor products available, both out-of-the-box and customizable, it is hard to find a single product or suite of products that will create the ideal platform to serve end-to-end business functions. In practice, most mid- to large-size firms have at least some functions built by their IT departments and contractors.

Decision Making

The process of building a platform starts with certain key decisions being made, such as keeping business functions in-house versus outsourcing them, in-house builds versus external buys, and a given vendor product versus a rival vendor product. These strategic decisions draw on research, study, evaluation by management, specialists, and consultants at various organization levels.

In-House versus Outsourcing Business Functions

Outsourcing certain business functions is common practice in small- to mid-size firms. Even larger firms these days have started to outsource or use the SaaS model to reduce costs and stay on par with continuous changes in the competitive environment. The decision is a complex one based on the size of the firm's derivatives business, budget, long-term goals, and strategic direction.

Build versus Buy

In deciding whether to build in-house functions, firms must weigh such considerations as in-house IT capabilities, total cost of ownership, development time, and long-term strategic goals. Every firm will reckon the pros and cons and cost-benefit analysis of build-versus-buy differently.

In-house development projects that deal with complex business processes commonly fail and are scrapped before they are complete. A firm's IT organization's capabilities must be fully ascertained before choosing an in-house solution over a vendor product.

In listed markets, many products are available to buy-side firms in the various functional areas that are mature.

Product Selection Process

The next major decision is to decide which vendor product to choose. Comprehensive evaluation is the key to making the right decision. The key steps in the product selection process are the following:

> **Form a committee.** Form a committee with members charged and authorized to make the final decision. In addition to senior management, choose at least one member from each group affected by the final product.
>
> **Identify valuating criteria (requirements).** Choose platform requirements that are critical and add other requirements that are specific to your firm. In addition, consider aspects such as the installation or implementation time required, total cost of ownership, in-house skills required to set up and support the product, portability of the product, customizability, vendor background, and vendor viability in the long term. Prepare a list of these criteria (requirements).

Set up rating process. Define the process and criteria for rating each requirement during the evaluation.

Add weightage. Add weightage to each criterion based on its importance to your firm.

Make a short list. Compile a list of products, together with feature comparisons features. When it is not practical to evaluate all products, produce an initial score to shortlist products for evaluation.

Evaluate. Thoroughly evaluate selected products and rate each criterion. The evaluation must be done by the team that has the requisite functional and technical knowledge. Firms often fail to perform a fair evaluation. Use external consultants, if fair evaluation cannot be objectively undertaken by internal resources.

Report. Prepare thorough documentation of the whole process and of the final scores. Score each criterion, including the product rating and weightage.

Make the final decision. Critically review the reports and make a final decision based on the total scores and strategic goals of the firm.

Pricing and Analytics Tools

Microsoft Excel, Access, and similar tools have been long-time companions for many traders, analysts, and other teams in the derivatives area. Most firms used Excel, Excel-based products (with add-ins), or similar simple products before the wider acceptance of full-featured products. These traditional tools are still occasionally used for certain activities such as pricing, valuations, model building, testing, and research. In most cases, however, full-range software products, vendor add-ins, and in-house-built libraries have long since replaced the traditional tools.

Nonetheless, Excel-based add-ins, APIs, libraries, and quantitative research products are available to perform most front-office and risk management functions for a wide range of derivatives contracts. Many small-size firms use these tools as their key tools. Even larger firms use these tools for roughing out the building and testing of models, doing quick analyses, and presenting reports in familiar formats.

Excel-based solutions can also access enterprise databases and market data from vendors and provide connectivity to other sources. They remain popular on account of their familiarity, their ease of use and access, and their ability to manipulate the data as required.

In summary, Excel in tandem with add-ins and APIs is capable of most activities, including pricing, valuation, risk analytics, risk calculation, cash flows, curve building, performance analysis, charting, scenario analytics, stress testing, structuring new deals, model building, portfolio management functions, and routine operations.

Summary

A derivative systems platform might be a single consolidated technology platform, a seamlessly integrated multi-vendor, multi-technology platform, or a family of various, loosely coupled independent systems platforms. A corporation looks for a platform that can grow with the business, adapt to changing business conditions, and support new initiatives.

An effective platform provides improved efficiencies, reduced costs, and optimized operations across the derivatives business. Technologically, a good platform provides a solid, well-constructed foundation upon which other business applications can easily be built. It must be a modular collection of reusable, flexible, and customizable services. Developing such a platform is a complex task and requires great expertise and effort.

This chapter provided insights into platform architecture and the process of building a platform. It presented the key challenges that firms must confront and the various styles preferred for DIP architecture.

At the highest abstract level, the layered architecture style was chosen to illustrate DIP architecture because it provides technology-agnostic flexibility. Other architecture styles were discussed in connection with the different levels to which they are appropriate, and best practices and guidelines were noted for each.

This chapter described the alternative approaches to implementing a DIP, including a vendor product-based approach, an in-house development approach, an SaaS approach, and a hybrid combination of these three pure approaches.

Finally, this chapter compared the suitability of the different approaches to different types of companies and discussed the criteria and processes for evaluating and selecting vendor products.

You have reached the end of this book. My hope is that it has educated you in how to navigate your way through the derivatives world.

Further Readings

Microsoft Application Architecture Guide on MSDN: http://msdn.microsoft.com/en-us/library/ff650706.aspx

Java Enterprise Systems and Architecture Guide on Oracle: http://docs.oracle.com/cd/E19396-01/819-0061/index.html

Patterns of Enterprise Application Architecture (P of EAA): http://martinfowler.com/eaaCatalog/

Enterprise Integration Patterns: www.eaipatterns.com/

Patterns Catalog by Category: http://msdn.microsoft.com/en-us/library/ee658089.aspx

The Patterns Home Page: www.hillside.net/patterns (information about various patterns and more)

TOGAF—The Open Group Architecture Framework: www.opengroup.org/subjectareas/enterprise/togaf

UML Design Standard: www.uml.org

Software Engineering Institute (SEI): www.sei.cmu.edu

I

Index

D

E

H

I, J, K

L

P

Q

R

S

T, U

V, W, X, Y, Z

MANAGING DERIVATIVES CONTRACTS

A GUIDE TO DERIVATIVES MARKET STRUCTURE, CONTRACT LIFE CYCLE, OPERATIONS, AND SYSTEMS

Khader Shaik

Apress®

Managing Derivatives Contracts: A Guide to Derivatives Market Structure, Contract Life Cycle, Operations, and Systems

ISBN-13 (pbk): 978-1-4302-6274-9

ISBN-13 (electronic): 978-1-4302-6275-6

Publisher: Heinz Weinheimer
Acquisitions Editor: Robert Hutchinson
Editorial Board: Steve Anglin, Ewan Buckingham, Gary Cornell, Louise Corrigan, James DeWolf, Jonathan Gennick, Robert Hutchinson, Michelle Lowman, James Markham, Matthew Moodie, Jeff Olson, Jeffrey Pepper, Douglas Pundick, Ben Renow-Clarke, Dominic Shakeshaft, Gwenan Spearing, Steve Weiss, Tom Welsh
Coordinating Editor: Rita Fernando
Copy Editor: Ann Dickson
Compositor: SPi Global
Indexer: SPi Global
Cover Designer: Anna Ishchenko

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a Delaware corporation.

For information on translations, please e-mail rights@apress.com, or visit www.apress.com.

Apress and friends of ED books may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Special Bulk Sales–eBook Licensing web page at www.apress.com/bulk-sales.

Any source code or other supplementary materials referenced by the author in this text is available to readers at www.apress.com. For detailed information about how to locate your book's source code, go to www.apress.com/source-code/.

Apress Business: The Unbiased Source of Business Information

Apress business books provide essential information and practical advice, each written for practitioners by recognized experts. Busy managers and professionals in all areas of the business world—and at all levels of technical sophistication—look to our books for the actionable ideas and tools they need to solve problems, update and enhance their professional skills, make their work lives easier, and capitalize on opportunity.

Whatever the topic on the business spectrum—entrepreneurship, finance, sales, marketing, management, regulation, information technology, among others—Apress has been praised for providing the objective information and unbiased advice you need to excel in your daily work life. Our authors have no axes to grind; they understand they have one job only—to deliver up-to-date, accurate information simply, concisely, and with deep insight that addresses the real needs of our readers.

It is increasingly hard to find information—whether in the news media, on the Internet, and now all too often in books—that is even-handed and has your best interests at heart. We therefore hope that you enjoy this book, which has been carefully crafted to meet our standards of quality and unbiased coverage.

We are always interested in your feedback or ideas for new titles. Perhaps you'd even like to write a book yourself. Whatever the case, reach out to us at editorial@apress.com and an editor will respond swiftly. Incidentally, at the back of this book, you will find a list of useful related titles. Please visit us at www.apress.com to sign up for newsletters and discounts on future purchases.

The Apress Business Team

To my parents, my wife Saira, and children Hafsah and Shayaan.

Foreword

More than once in my career I have been hailed on the trading floor inter-desk squawk box and engaged in the following conversation:

Trader:	Moorad, do you know if the bank has settled a [particular exotic derivative product] before?
Moorad:	I'm not sure. Let me check with Ops…
Trader:	Well, we better have—I've just traded it!

The above conversation is reported here without hype or embellishment. It speaks volumes about the approach to finance generally by practitioners and academics alike, in that—while product type, valuation principles, and advertised rates of return are the focus of considerable attention in the published literature—more supposedly mundane but vital nuts-and-bolts issues such as documentation, settlement processes, and clearing procedures are ignored. This is why Mr. Shaik's book is so welcome. While it is not unique in addressing clearing and middle-office issues associated with derivatives, it is certainly a rare beast.

Of course, transacting in a product without checking first that the bank can actually settle it is simply bad practice, as well as deplorable—but it's merely an extreme version of a culture that emphasises the front office and trading side of things first and foremost. This is a pity, because financial derivative contracts are without a doubt a "good thing" and it's unfortunate when they blow up because of incompetence on the part of the operators. Without derivatives we would not have a mass market in fixed-rate residential mortgages, and corporations all around the world would suffer greater volatility in earnings as they were unable to remove the impact of higher raw material costs. I name but two areas of commerce that have benefited from the availability of derivatives; there are very many others.

But as with all commercial transactions subject to a contract, it is vital that parties to the trade are able to address the documentation and clearing processes associated with it. This issue has, on numerous occasions, worried the regulatory authorities sufficiently that they have commented on it. Even prior to the banking crash of 2008, both the US Federal Reserve and the Bank of England had expressed concerns about the considerable time lag between front-office dealers transacting in credit default swaps and the dealers' middle offices executing the documentation associated with each trade. The crash had a profound impact on over-the-counter (OTC) derivative markets, on the pricing side with the introduction of the "XVAs"—including counterparty risk value adjustment (CVA) and the bank's funding cost value adjustment (FVA)—and also on the little matter of mandatory "centralized clearing counterparties."

The CCCP (my acronym adds an extra "C" because then it is reminiscent of another gargantuan beast that was ultimately definitely not best-practice!) makes sense from a systemic risk perspective, but arguably collateral requirements as expressed by the Credit Support Annex of the ISDA Agreement serve just as well. Having decided that too-big-to-fail banks were not desirable, it appears that the authorities have gone and created the biggest-ever TBTF institution in response!

But that is a separate debate. Whether one is involved in the OTC or exchange-traded derivative markets, it behoves all participants to be fully understanding of every aspect of the trade life cycle. Equally it is an imperative that banks and other institutions that transact in derivatives understand the middle- and back-office issues associated with the instruments and pay equal attention to them. It isn't only in the pricing of derivatives and in measuring the "Greeks" that banks can come unstuck; they have on numerous occasions reported large-scale P&L losses as a result of middle-office and back-office errors. These aspects of the market are a significant operational risk in banks and deserve more focus.

And yet I don't ever expect to see the bookshelves of university business school libraries or the articles of finance journals boasting a surfeit of content on derivatives clearing. Just as the head of operations will never become the CEO of an investment banking business. That's the nature of the game. Nevertheless this is a part of the whole, and the market would fall over without the associated operational side—and anything that increases knowledge transfer in this area is, like derivatives themselves, a "good thing."

Which brings us back to Mr. Shaik's book. I am sure practitioners, auditors, and regulators will find the content of value. The accessible style is also welcome. All in all, a worthwhile addition to the finance literature and one that hopefully helps plug the knowledge gap in this field.

Professor Moorad Choudhry
Surrey, England
10 September 2014

About the Author

Khader Shaik is a senior consultant in the derivatives systems group of a large buy-side firm in New York, building a derivatives collateral management system and enhancing systems to support compliance with Dodd-Frank regulations. He has more than 15 years of experience building systems for managing securities and derivatives life cycle, order management, trading, and risk for investment banks and buy-side firms, including Citigroup, JPMorgan Chase, Merrill Lynch, SalomonSmithBarney, Bank of Tokyo-Mitsubishi UFJ, and AEGON. He developed commercial software products for financial startups and cofounded a consulting firm specializing in derivatives technology solutions and training services. Shaik holds a bachelor's degree in computer science and engineering from Bangalore University and a certificate in quantitative finance (CGF) from Fitch Learning and is pursuing an MBA in finance at Norwich University.

About the Technical Reviewer

Keith R. Fevurly is an investment advisor with Integra Financial, Inc., Greenwood Village, Colorado, and a Senior Lecturer in Finance at Metropolitan State University of Denver. He is also an Adjunct Associate Professor of Finance at Webster University, St. Louis, Missouri. He served as the Vice President of Education at the College for Financial Planning, Denver, and as the Executive Director of Kaplan University's financial planning education program. Dr. Fevurly has assisted in the education of over 50,000 financial planners and investment advisors and authored over 20 refereed articles on financial and investment planning. He is the author of *Plan Your Financial Future* (Apress, 2013) and *The Handbook of Professionally Managed Assets* (Apress, 2013). He is a member of the Editorial Review Board of the *Journal of Financial Planning* and a former member of the CFP Board's Board of Examiners. He holds an MBA in Finance and Accounting from Regis University of Denver, a JD from Washburn University of Topeka, an LLM degree in Taxation from the University of Denver Graduate Tax Program, and the Certified Financial Planner (CFP) certification.

Acknowledgments

Writing simply is hard. For that reason, writing simply is a humbling and enlightening experience for the author. As Albert Einstein said, "If you can't explain it simply, you don't understand it well enough." Without the help of many, I could never have understood all the topics in this book well enough to write about them simply.

First, I would like to extend my gratitude to the reviewers who unstintingly provided their valuable time and invaluable feedback: David Burns, Satyam Kancherla, Amir Sadr, Sriram Thiruvenkadam, Jamurud Shaik, Brian McGurn, Shreya Deb, Gulshan Advani, Marc Adler, Rehan Qureshi, Syed Ahmad, Amit Rao, Prem Makhijani, David Guyton, Imadad Shaik, Mahaveer Prashaad, Shakeel Akhtar, and Hakeem Mohammad.

Transforming a concept and draft into a book is no different from any complex project. I am amazed at the individual and collective contributions of everyone at Apress. Thanks to Robert Hutchinson, my chief editor, for his support throughout the writing process and to Rita Fernando, my coordinating editor, for her help at each and every step of the process. Also thanks to my copy editor, Ann Dickson, my cover designer, Anna Ishchenko, and the team at SPi Global.

Thanks to my technical editor, Keith Fevurly, for his thorough review of the content and valuable feedback. Also, thanks to Morgan Ertel for believing in me and giving the opportunity to write this book.

I also would like to thank Lee Ann Murray, Rajesh Dhingra, Michael Leach, Chander Bansal, Elisabeth Bedore, William Mehman, Kevin Anderson, Rahamathullah Shaik, Saif Ahmad, Santhosh Aravindakshan, Azmathullah Mohammad, Xiao Fand Shen, Feifei Wu, Taj Haslani, Linda McCormick, and all the others too many to name who directly or indirectly contributed to this book.

A special thanks to Professor Moorad Choudhry for writing the foreword and his valuable feedback while writing the book. Also, special thanks to Amir Sadr, who gave the courage to pursue this project.

I cannot omit this opportunity to extend my lifelong gratitude to two of my teachers, Naga Raja and Hema Sekhar Raju, who inspired me at critical junctures in my school days.

I am deeply grateful to my parents, Abdul Rahim and Zahidunnisa Shaik, who made many sacrifices to give me the best, and for the continuous support of my brother, Jamurud, and sister, Sanjida.

Above all, a special thanks to my family for their patience and unwavering support—most especially to my children, who continually inspire me to learn new things in my life.

Preface

When I first started working on derivatives, I reviewed all the books I could find on the subject. Many of them did an excellent job explaining how derivatives work. But I could find none that did an adequate job of explaining how derivatives contracts are managed and the operations behind the business. Over the years of working on various systems, I made copious notes on these underserved topics, which I eventually organized and posted on my blog. These formed the rump of this book.

The objective of this book is to provide a structured and focused study of the derivatives market on both the buy and sell sides, the life cycle of various types of derivatives contracts, and the underlying technology platforms. I describe all of these in the simplest and most practical manner possible, without mathematics and without presuming prior knowledge of the industry.

The book is designed to provide an overview of how derivatives contracts, complex financial instruments, are managed end-to-end for all who are involved in derivatives business—whether they are in operations, systems, or the front office, and whether they are new entrants to the field or seasoned veterans. To cover coherently the multifarious aspects of the derivatives world, I organize the book into the following four parts.

Part I—"The Big Picture of Derivatives"—is a flyover of the world of derivatives and charts the essential landmarks needed to navigate the derivatives market. Chapters 1 through 4 outline the broad lineaments of derivatives market structure, product categories, contract characteristics, and risk management functions.

Part II—"Derivatives Market Structure"—drills down into the structural elements of the derivatives market. Chapters 5 through 9 detail the market players and their roles, sketch the typical organization structures of buy-side and sell-side firms, enumerate the critical market and reference data elements, and describe the profound effects of the ongoing implementation of the Dodd-Frank Act on the derivatives market.

Part III—"The Derivatives Contract Life Cycle"—unspools the contract life cycle of each of the various product categories. Chapters 10 through 16 begins with a conceptual exposition of the general life cycle of a derivatives contract from origination to expiration before detailing the particular life cycles in the various product categories.

Part IV—"Derivatives Platforms and Systems"—focuses on the underlying information technology systems on which the derivatives business runs. Chapters 17 and 18 explain the importance of software systems to the overall business process and describe the functions and contributions of each system. Geared to IT managers, architects and developers, Chapter 19 delves into systems architecture and compares different approaches to building platforms for different requirements.

I have endeavored to present up-to-date information as simply as possible for the benefit of readers at all levels and in all areas of the derivatives business. I invite constructive comments, suggestions, and corrections at khaderv@yahoo.com and thank you in advance for your input.