

PART I

Overview of Financial Derivatives

Part One consists of four introductory chapters intended to open the world of financial derivatives to the reader. In Chapter 1, “Derivative Instruments: Forwards, Futures, Options, Swaps, and Structured Products,” Gary D. Koppenhaver takes a generalist approach to forwards, futures, swaps, and options. He approaches these instruments from the point of view of their suitability to address a single problem: managing financial risk. Through this approach, he shows that these instruments obey common principles and are closely related from a conceptual point of view. Koppenhaver strives to emphasize the connections among these different types of derivatives in order to demystify derivatives in general.

One of the largest differences among derivatives turns on the manner in which they are traded—on exchanges or in the more informal and less structured over-the-counter market? Sharon Brown-Hruska contrasts these two models for trading derivatives in Chapter 2, “The Derivatives Marketplace: Exchanges and the Over-the-Counter Market.” In light of the financial crisis, many legislators are pressing to reduce or eliminate the over-the-counter market, which is actually much larger than the market for exchange-traded derivatives. However, many believe that trading derivatives on exchanges make them more transparent, easier to regulate, and less likely to lead to derivatives disasters.

From the point of view of derivatives, we might think of *speculation* as trading derivatives in a manner that increases the investor’s risk in order to pursue profit. *Hedging* by contrast is trading derivatives in order to reduce a preexisting risk. In Chapter 3, “Speculation and Hedging,” Gregory Kuserk shows how hedging and speculation differ but also explains how one might think of hedging and speculating as two sides of the same coin, with the relationship between the two activities being much closer than is generally recognized.

The editors of this volume believe that Chapter 4 by Christopher L. Culp, “The Social Function of Financial Derivatives,” is one of the most important in the entire volume. As discussed in the introduction to this book, there is a recurring impulse to eliminate derivatives markets through legislative action. Culp shows how derivatives markets serve society in a variety of ways, some of which are quite obvious and others of which are more sophisticated.

CHAPTER 1

Derivative Instruments

Forwards, Futures, Options, Swaps, and Structured Products

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INTRODUCTION

The evolution of ideas in finance usually is driven by circumstances in financial markets. In the early 1980s, at the inception of cash-settled financial futures contracts, the term *derivatives* was most often associated with financial rocket science. Esoteric derivative contracts, especially on financial instruments, faced a public relations problem on Main Street. By the mid-1990s, the term *derivatives* carried a negative connotation that conservative firms avoided. High-profile derivative market losses by nonfinancial firms, such as Metallgesellschaft AG, Procter & Gamble Co., and Orange County, California, caused boards of directors to look askance at derivatives positions.¹ In the early 2000s, however, derivatives and their use are a real part of a discussion of business tactics. While it is still the case that derivatives contracts are a powerful tool that could damage profitability if used incorrectly, the discussion today does not focus on why derivative contracts are used but how and which derivative contracts to use.

The goal of this chapter is to take a generalist approach to closely related instruments designed to deal with a single problem: managing financial risk.² In the chapter, forwards, futures, swaps, and options are not treated as unique instruments that require specialized expertise. Rather the connection between each class of derivative contracts is emphasized to demystify derivatives in general. As off-balance sheet items, each is an unfunded contingent obligation of contract counterparties. Later in the chapter, the discussion returns full circle to consider the creation of funded obligations with derivative contracts, called structured products. Structured products are financial instruments that combine cash assets and/or derivative contracts to offer a risk/reward profile that is not otherwise available or is already offered but at a relatively high cost. The repackaging of off-balance sheet credit derivatives into an on-balance sheet claim is shown through a structured investment vehicle example.

Uncertainty is a hallmark of today's global financial marketplace. Unexpected movements in exchange rates, commodity prices, and interest rates affect

earnings and the ability to repay claims on assets. Great cost efficiency, state-of-the-art production techniques, and superior management are not enough to ensure firm profitability over the long run in an uncertain environment. Risk management is based on the idea that financial price and quantity risks are an ever-increasing challenge to decision making. In responding to uncertainty, decision makers can act to avoid, mitigate, transfer, or retain a commercial risk. Because entities are in business to bear some commercial risk to reap the expected rewards, the mitigation or transfer of unwanted risk and the retention of acceptable risk is usually the outcome of decision making. Examples of risk mitigation activities include forecasting uncertain events and making decisions that affect on-balance sheet transactions to manage risk. The transfer of unwanted risk with derivative contracts, however, is a nonintrusive, inexpensive alternative, which helps explain the popularity of derivatives contracting.

Consider Exhibits 1.1 through 1.4 as part of the historical record of volatility in financial markets. Exhibit 1.1 illustrates the monthly percentage change in the Japanese yen/U.S. dollar exchange rate following the breakdown of the Bretton Woods Agreement in the early 1970s. The subsequent exchange rate volatility helped create a successful Japanese yen futures contract in Chicago. In Exhibit 1.2, the monthly percentage change in a measure of the spot market in petroleum is illustrated. While significant spikes in price occur around embargos or conflict in the Middle East, price volatility has not lessened over time for this important input to world economies. U.S. interest rates are also a source of uncertainty. The change in Federal Reserve operating procedures in the late 1970s temporarily increased volatility, but significant uncertainty in Treasury yields has remained over time.

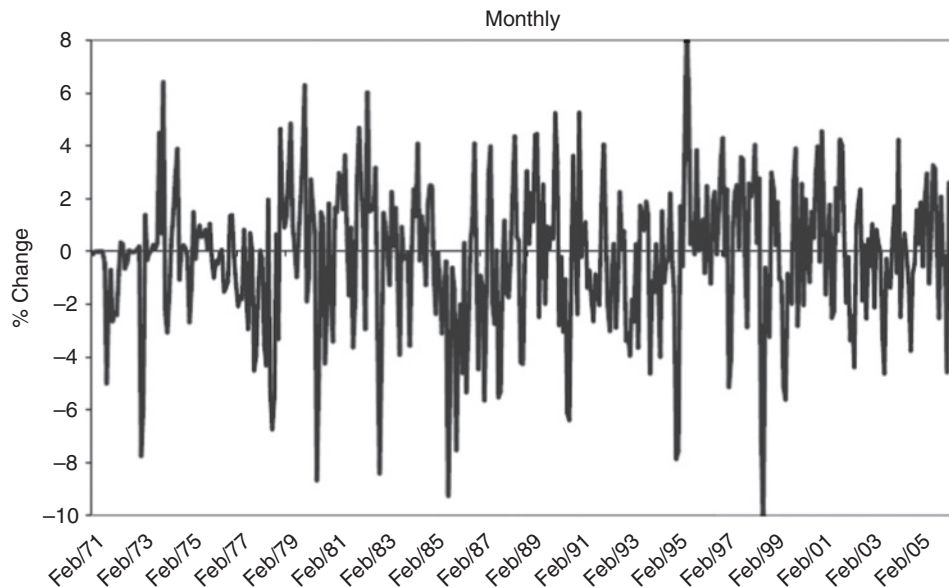


Exhibit 1.1 Percent Change in Yen/U.S. \$ Exchange Rate

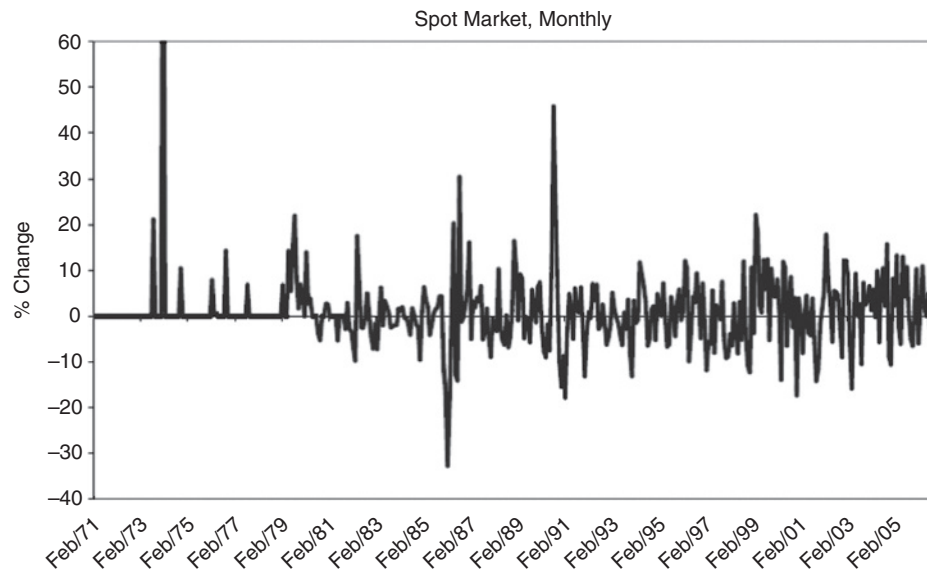


Exhibit 1.2 Percent Change in West Texas Oil Prices

Exhibit 1.4 illustrates the past history of default risk premiums. Most recently, a sharp spike in default risk premiums occurred at the end of the stock market technology bubble in the early 2000s. Across all graphs, it should be clear that uncertainty in economically important markets is not decreasing over time and that the effectiveness of forecasting changes in prices, rates, or spreads as a method to mitigate the uncertainty is not likely to be high.

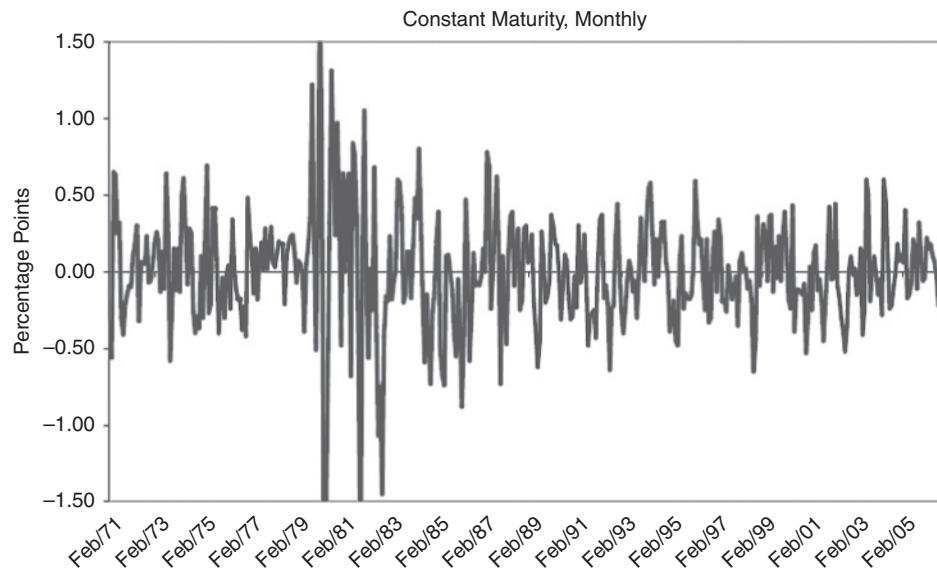


Exhibit 1.3 Change in 5-Year Treasury Yield

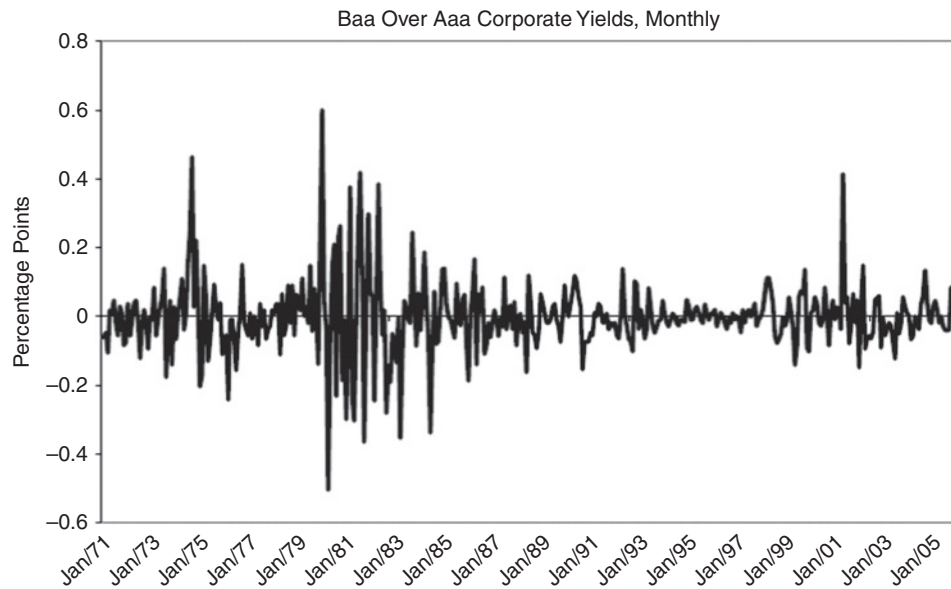


Exhibit 1.4 Credit Risk Premium Change

A GENERALIST'S APPROACH TO DERIVATIVE CONTRACTS

What are derivative contracts? A derivative contract is a delayed delivery agreement whose value depends on or is derived from the value of another, underlying transaction. The underlying transaction may be from a market for immediate delivery (spot or cash market) or from another derivative market. A key point of the definition is that delivery of the underlying is delayed until sometime in the future. Economic conditions will not remain static over time; changing economic conditions can make the delayed delivery contract more or less valuable to the initial contract counterparties. Because the contract obligations do not become real until a future date, derivative contract positions are unfunded today, are carried off the balance sheet, and the financial requirements for initiating a derivative contract are just sufficient for a future performance guarantee of counterparty obligations.

Before beginning a discussion of contract types, it is helpful to depict the profiles of the commercial risks being managed with derivative contracts. The first step in any risk management plan is to accurately assess the exposure facing the decision maker. Consider Exhibit 1.5, which plots the expected change in the value of a firm, ΔV , as a function of the unexpected change in a financial price, ΔP . The price could be for a firm output or for a firm input. The dashed line indicates that as the price increases ($\Delta P > 0$) unexpectedly, the value of the firm falls. The specific relationship is consistent with many conditions, such as an unexpected rise in input cost, a loss of significant market share as output prices unexpectedly rise, or even a rise in the price of a fixed income asset due to an unexpected decline in yields. The key is simply that the unexpected price rise causes the expected value of the enterprise to fall.

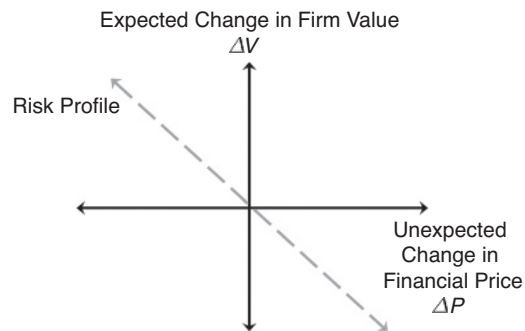


Exhibit 1.5 A Commercial Risk Profile

It is also instructive to ask whether there are alternatives to derivative contracts in managing commercial risks. Significant, low-frequency commercial risks are transferred through insurance contracts, for example. While virtually any risk can be insured, negotiation costs and hefty premiums may prevent insurance from being a cost effective mechanism for risk transfer. On-balance sheet transactions such as the restructuring of asset and/or liability accounts to correct an unwanted exposure are another alternative to derivative contracts. Customer resistance to restructuring may affect profitability as, say, a squeeze on net interest income results when a bank offers discounts on loans or premium deposit rates to accomplish the restructuring. Finally, firms can exercise their ability to set rates and prices to transfer risk to customers and stakeholders. Such exercise of market power as an alternative to derivative contracting depends on the degree of competition in output and input markets. Firms facing different competitive pressures may have different preferences for derivatives relative to other risk transfer methods.

Forward Contracts

The most straightforward type of derivative contract is a contract that transfers ownership obligations on the spot but delivery obligations at some future date, called a forward contract. One party agrees to purchase the underlying instrument in the future from a second party at a price negotiated and set today. Forward contracts are settled once—at contract maturity—at the forward price agreed on initially. Industry practice is that no money changes hands between the buyer and seller when the contract is first negotiated. That is, the initial value of a forward contract is zero. As the price of the deliverable instrument changes in the underlying spot market, the value of a forward contract initiated in the past can change.

To illustrate the value change in a forward contract, consider Exhibit 1.6. All other things equal and for every unexpected dollar increase in the financial price, ΔP , an agreement to purchase (long forward) the underlying instrument at the lower forward price increases expected firm value, ΔV . Alternatively, Exhibit 1.6 shows that an agreement to sell (short forward) the underlying instrument at the lower forward price decreases expected firm value. The forward contract long (short) benefits from the contract if the underlying instrument price rises (falls) before the contract matures. The exhibit also shows that both buying and selling

Overview of Financial Derivatives

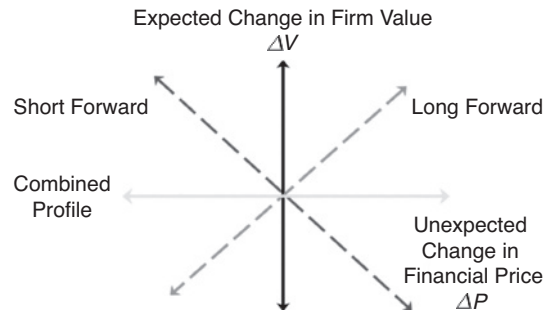


Exhibit 1.6 Risk Profiles for Forward Contracts

exactly the same forward contract create a combined position that makes the firm value insensitive to unexpected changes in the underlying price (the horizontal axis). Comparing Exhibits 1.5 and 1.6, the commercial risk profile in Exhibit 1.5 is the same as the risk profile for a short forward contract. To hedge away the risk or make the firm insensitive to unexpected changes in the underlying price, the firm should enter into a long forward contract (Exhibit 1.6).

A feature of a forward contract is that the credit or default risk implicit in delayed delivery performance is two-sided. The default risk is real because most forward contracts are settled by physical delivery. Recall the forward contract buyer can either make a gain or take a loss depending on the forward price set initially and the price of the underlying at contract maturity. If the underlying instrument price rises (falls), the contract buyer gains (loses) on the forward contract. Because the value of the contract is settled only at contract maturity and no payments are made at origination or during the term of the contract, a forward contract buyer is exposed to the credit risk that the seller will default on forward contract delivery obligations when the underlying asset can be sold for more in the spot market. Likewise, a forward contract seller is exposed to the credit risk that the buyer will default on forward contract payment obligations when the underlying asset can be purchased for less in the spot market.

Consider a forward rate agreement as an example of a forward contract on interest rates. A forward rate agreement is an agreement to pay a fixed interest rate on a pre-determined, notional principal amount and receive a floating rate cash flow on the same notional principal amount at contract maturity. Note that only the interest cash flows are intended to change hands at contract maturity. If the floating rate return is higher than the fixed rate cost agreed to at contract initiation, the forward rate long gains the difference in cash. If the floating rate return is lower than the fixed rate cost agreed to at contract initiation, the forward rate short gains the difference in cash. The forward rate long gains if interest rates rise or fixed income prices fall over the life of the contract. A map of the forward rate agreement cash flows is illustrated in Exhibit 1.7, where $\bar{R}$ is the fixed rate set at contract origination, time 0, and $\hat{R}$ is the actual rate realized at time t , the maturity of the contract.

Suppose three months in the future Ford Motor Acceptance Corporation (FMAC) plans to borrow \$100 million for three months at the U.S. dollar

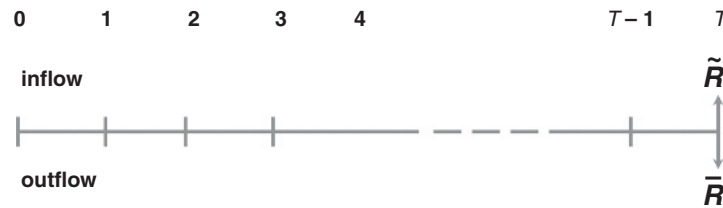


Exhibit 1.7 Forward Rate Agreement Cash Flows

London Interbank Offered Rate (LIBOR). FMAC is exposed to the risk that borrowing costs (rates) will rise unexpectedly over the three months. If so, the \$100 million amount borrowed will raise less cash for use by FMAC. The commercial risk facing FMAC is illustrated in Exhibit 1.8, which is similar to Exhibit 1.6 except that the unexpected change affecting firm value is a change in interest rates instead of prices. FMAC decides to manage the interest rate risk by making a long forward rate agreement with an investment bank as seller. What should the fixed rate be on FMAC's forward rate agreement if LIBOR 3-month is 4.9507 percent and LIBOR 6-month is 5.1097 percent? A "fair" forward rate would be one that does not favor either the buyer or the seller of the forward rate agreement nor create an opportunity for interest rate arbitrage. The three-month rate three months in the future from the LIBOR yield curve is 5.2036 percent annualized ($=\{[1 + (.051097 \times 182/360)/(1 + (.049507 \times 91/360))] - 1\} \times (360/91)$). That is, LIBOR rates must rise from 4.9507 percent to 5.2036 percent for investors to be indifferent between a sequence of two three-month LIBOR investments and one six-month LIBOR investment yielding 5.1097 percent. Let the forward rate agreement specify 5.2036 percent as the fixed rate. If the three-month LIBOR rate in three months is greater than 5.2036 percent, FMAC receives a net payment on the forward rate agreement from the investment bank to offset the greater liability issuance costs associated with the increase in LIBOR rates.

Futures Contracts

Because of unique, negotiated features in forward derivative contracts, the contracts can be difficult to reverse or terminate early once created. Futures contracts

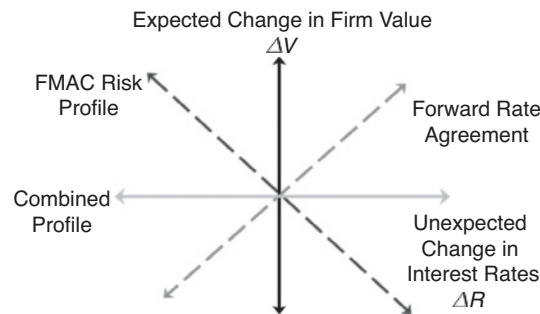


Exhibit 1.8 Risk Management with a Forward Rate Agreement

are delayed delivery contracts that permit the frequent transfer of ownership and delivery obligations until some future date. Once created, a futures contract can be settled in one of two ways: delivery of the underlying at contract maturity (less than 2 percent of contracts) or, more commonly, liquidation of a prior position by an offsetting transaction. A centralized marketplace allows investors to trade contracts with each other, providing immediacy in the execution of transactions, and the regulation of trade practices. Because contract sellers are obligated to perform only in the future, there are no restrictions on short selling as in the cash markets for equity, for example.

Futures contract trading has many unique institutional features compared to trading the underlying spot instruments or forward contracts. As a financial safeguard, earnest money deposits are made by both futures contract buyer and futures contract seller to ensure performance of future obligations. As unfunded positions, the funds required to trade futures contracts are a performance bond, not an amount borrowed from the broker to make up the entire contract value. The earnest monies are usually less than 10 percent of futures contract value. Futures contract positions are marked to market at least daily, which means position value changes are conveyed from losers to gainers through performance bond adjustments when prices change. The constant transfer of funds and removal of financial claims between traders effectively reduces the trader's performance period.

Default risk is further reduced by a clearinghouse for all transactions; the clearinghouse is organized to provide a third-party guarantee of financial performance for all cleared trades. In effect, the clearinghouse becomes the seller to every buyer and buyer to every seller, standing behind or guaranteeing each transaction. Most important, futures contracts are standardized, not customized, to apply to certain underlying commercial risks. The contracts specify the quantity or par value of the underlying instrument and whether the contract is settled by cash or physical delivery at contract maturity, among other things. Contract standardization and clearinghouse operation make taking a futures position that offsets or eliminates a previous position a low-cost alternative to holding an open contract until maturity. In total, these institutional features decrease the cost of contract origination and early termination.

In comparing futures to forward contracts, note that the risk profiles are the same (see Exhibit 1.9). That is, long and short futures positions have the same effect on firm value change as long and short forward positions, respectively. The success of futures markets as a risk-transfer device is largely due to their cost advantage compared to forward contracts. Importantly, futures contracts involve less credit risk exposure for traders. Marking futures contracts to market prices at least daily removes debt from the marketplace in risk transfer, which makes default less likely.

Futures contracts can also be considered an extension of forward contracts on the same underlying instrument. Suppose two counterparties enter into a sequence of one-day forward contracts. The forward contract is negotiated first on day 0 and settled on day 1. For simplicity, assume the forward contract buyer pays the difference between the forward price and the day 1 spot market price if the forward price is larger than the spot price. If the forward price is less than the spot price at day 1, the seller pays the difference to the buyer. A new forward contract is then written on day 1 reflecting the day 1 spot price, again maturing in a single day. If the

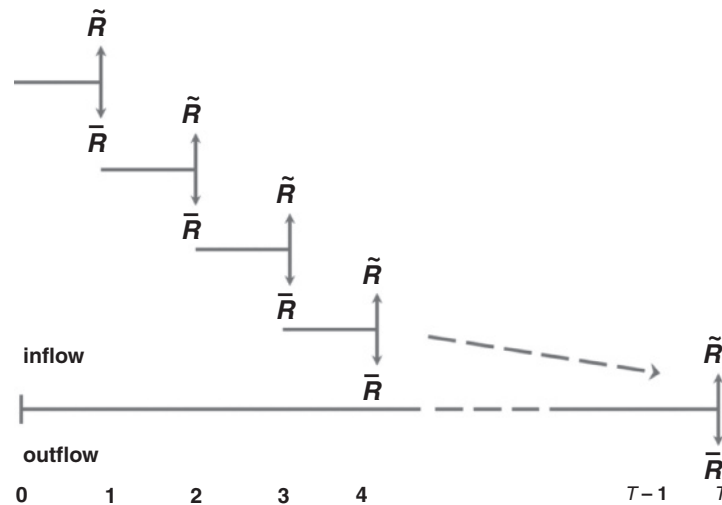


Exhibit 1.9 A Futures Contract as a Portfolio of One-Day Forward Contracts

sequence of forward contracting (forwards are negotiated, mature, are renegotiated and repriced daily) is repeated until some future time t (futures contract maturity), the result is a futures contract on the same underlying instrument. The entire “portfolio” of one-day forward contracts captures the institutional safeguard of marking all futures positions to market at least daily, removing the financial claims that can be built up over the life of a single forward contract. Futures contracts can be viewed as just a sequence of forward contracts.

Swap Contracts

A swap contract is a contract in which two counterparties agree to make periodic payments that differ in a fundamental way from each other until some future date. The terms of a swap contract, besides the maturity and notional value of the contract, can include the currencies to be exchanged (foreign currency swap), the rate of interest applicable to each counterparty (interest rate swap), and the timetable by which payments are made. Swap contracts are an over-the-counter, negotiated derivative contract like a forward contract rather than an exchange-traded instrument like a futures contract. The swap contract counterparties must be classified as Eligible Contract Participants, as defined by the Commodity Exchange Act.³ Although foreign currency swaps predate interest rate swaps, interest rate swaps are economically most important today.

Consider the uses for an interest rate swap. Suppose the swap contract specifies the exchange of floating rate cash flows for fixed rate cash flows. That is, a counterparty agrees to pay a fixed cash flow (based on a fixed rate) to another counterparty and in return receive a variable cash flow (based on a floating rate). The exchange of cash flows occurs periodically, say every six months; the cash flows are netted against each other so that whichever counterparty’s cash flow is larger, that counterparty pays the difference to the other. A swap of fixed rate

for floating rate cash flows reduces the fixed rate payer's exposure to unexpected rate increases, which is an important commercial risk for the holder of existing fixed-income securities or firms that anticipate the issuance of debt in the future. If rates rise during the contract's life, the fixed rate payer will receive cash flows that offset the loss of value in existing securities or the increase in debt issuance cost. Similarly, the swap of floating rate for fixed rate cash flows reduces the floating-rate payer's exposure to unexpected rate decreases.

Suppose in 1999, Maytag issues a three-year, \$100 million par floating rate note with semiannual interest payments at 80 basis points over the London Interbank Offered Rate (LIBOR), which is at 3.2 percent per annum. Maytag's interest expense floats with LIBOR but at the current rate, Maytag will pay \$2.0 million as interest to the debt holders every six months, in March and September. Maytag is exposed to the commercial risk of unexpected increases in LIBOR. To transfer the risk, Maytag enters into a swap agreement with a U.S. commercial bank to pay a fixed 5 percent per annum on the \$100 million until maturity. In return, the bank agrees to pay Maytag a variable amount based on LIBOR plus 80 basis points. Only the cash flow differential is exchanged in the agreement. Exhibit 1.10 is a table of the swap cash flows as LIBOR rises. Maytag makes increasing cash payments to debt holders as the rate floats higher; completely offsetting the interest expense are equivalent cash inflows from the U.S. commercial bank. Maytag still pays a fixed rate cash flow to the U.S. commercial bank of \$2.5 million every six months. Note that Maytag has credit risk exposure from the bank only when the value of the interest rate swap is positive (last column of Exhibit 1.10).

Because the performance period for swaps (six months in the above example) is generally less than for forward contracts (only at contract maturity) but greater than for futures contracts (at least daily), the default risk characteristics of swap contracts are intermediate between forward and futures contracts. At each time when cash flows are exchanged between counterparties, the value of the interest rate swap is effectively marked-to-market and reset to zero. Between interest rate reset dates (again, a six month period in the above example), the obligation to pay a known fixed rate and receive an unknown variable rate depends on the movement

-----Millions of Dollars-----				
		<i>FLOATING</i>	<i>FIXED</i>	Net
Date	Rate	Cash Flow	Cash Flow	Cash Flow
Mar. 1, 1999	4.2%			
Sept. 1, 1999	4.8%	+2.10	-2.50	-0.40
Mar. 1, 2000	5.3%	+2.40	-2.50	-0.10
Sept. 1, 2000	5.5%	+2.65	-2.50	+0.15
Mar. 1, 2001	5.6%	+2.75	-2.50	+0.25
Sept. 1, 2001	5.9%	+2.80	-2.50	+0.30
Mar. 1, 2002	6.4%	+2.95	-2.50	+0.45

Exhibit 1.10 Swap Contract Cash Flows for Maytag

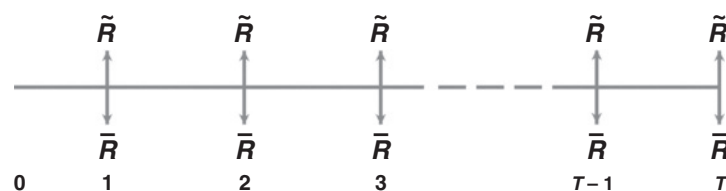


Exhibit 1.11 A Swap Contract as a Portfolio of Different Maturity Forward Contracts

in rates. The swap contract builds a financial claim by one counterparty against the other between reset dates, creating either a positive or negative swap value, as interest rates change. This is similar to a forward contract once it is negotiated but not yet settled. To carry the connection to forward contracts further, a swap contract can be viewed as a portfolio of different maturity forward contracts, each maturing at a different swap interest reset date (see Exhibit 1.11). The Maytag interest rate swap in our example then consists of six forward rate agreements, the first maturing and settled in six months, the last maturing and settled in three years.

Viewing a swap as a portfolio of different maturity forward contracts has two important implications. First, a swap contract has a risk profile similar to a forward contract or a futures contract on the same underlying instrument. That is, the fixed rate payer in the typical interest rate swap has a position that protects against an unexpected rise in interest rates, like the forward rate agreement in Exhibit 1.8 or a short futures position in Eurodollar time deposits. If rates rise and prices fall unexpectedly, the additional cash inflow in the swap contract or a forward rate agreement or a Eurodollar futures contract offsets the increased interest expense. The floating rate payer has the opposite risk profile. The second implication is that a portfolio of forward contracts with different maturities (a swap contract) can be valued on the assumption that today's forward interest rates are realized. The value of the swap is just the sum of the values of the forward contract elements of the swap. Knowing how to price forward contracts and value forward contract positions is all that is needed to price swap contracts and value swap positions between rate reset dates.

Option Contracts

Option contracts fall into one of two basic categories: calls or puts. In a call (put) option contract the contract buyer has the right but not the obligation to purchase (sell) a fixed quantity from (to) the seller at a fixed price before a certain date. Every option contract has both a buyer and a seller. The contract buyer has a right but not an obligation to initiate an exchange; the seller is obligated to perform, however, should the buyer exercise the contract rights. The fixed price in an option contract is the exercise or strike price—the price at which the contract buyer either purchases from the contract seller (call option) or sells to the contract seller (put option). The contract maturity date is also called the contract expiration date. Finally, the option buyer makes a nonrefundable payment to the option seller, called the option premium, to obtain the rights of the option contract. The purpose

of an option pricing model, such as the Black-Scholes model or the binomial model, is to estimate a “fair” option contract premium.

In general, a call option buyer (seller) expects the price of the underlying security to increase (decrease or stay steady) above the option exercise price. If not, the call option seller keeps the nonrefundable payment, the call option premium. A put option buyer (seller) expects the price of the underlying security to decrease (increase or stay steady) below the option exercise price. If so, the put option buyer can exercise the right to sell the underlying instrument to the put option seller at the relatively high exercise price. If an option contract is held to expiration, the option may expire worthless, be exercised by the contract buyer, or be sold for the difference between the contract exercise price and the market price of the underlying.

Consider the call option risk profile in Exhibit 1.12. The buyer of an option contract, call or put option, is called the option long; the option seller is called the option short. In Exhibit 1.12, if the unexpected change in the underlying instrument’s price, ΔP , at option expiration is negative (or prices fall), the long call position is worthless and the call option buyer forfeits the call premium. At the same time, the short call option position is profitable by the amount of the premium. The horizontal, dashed lines to the left of the vertical axis illustrate the returns. If the unexpected change in the underlying instrument’s price, ΔP , at option expiration is positive (or prices rise), the long call position increases the value of the option buyer, ΔV . Before the option buyer can break even, however, the price must rise sufficiently to cover the nonrefundable option premium paid to the option short. At the same time, the short call position keeps part of the premium paid by the call long until prices rise sufficiently. The sloping, dashed lines to the right of the vertical axis illustrate the returns. Exhibit 1.12 shows that the risk profile of a long call position is similar to a long forward or long futures contract position. The risk profile of a short call option position is similar to a short forward or futures contract position but only if underlying prices rise.

In Exhibit 1.13, the risk profiles for a put option are illustrated. Because a put is an option to sell the underlying instrument, unexpected price increases, $\Delta P > 0$, result in a constant return equal to the put option premium for the option short or loss of the same for the option long. That is, the option to sell at a relatively low price is worthless if prices rise unexpectedly. The horizontal, dashed lines to the right of the vertical axis illustrate the returns. To the left of the vertical axis,

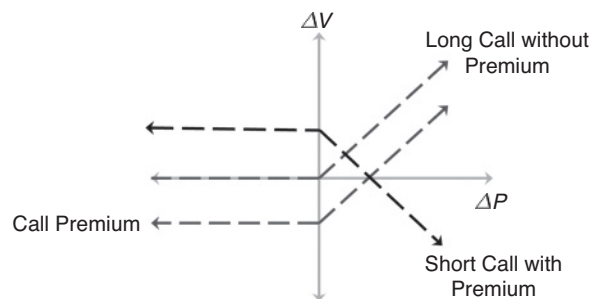


Exhibit 1.12 Risk Profiles for Call Options

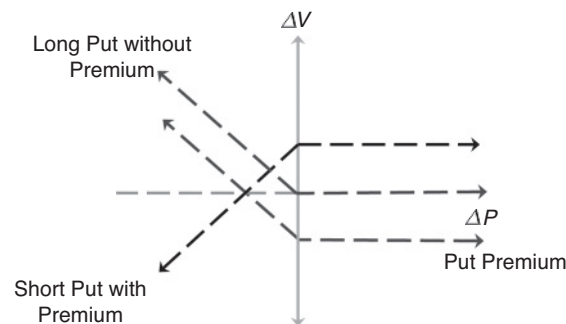


Exhibit 1.13 Risk Profiles for Put Options

the put long gains and the put short loses dollar for dollar as the underlying price falls unexpectedly. Exhibit 1.13 shows that the risk profile of a long put position is similar to a short forward or short futures contract position. Note that although the put option buyer is long the option, the position is effectively short the underlying instrument. The risk profile of a short put option position is similar to a long forward or long contract position but only if underlying prices fall.

Next consider the risk profile of positions that combine a commercial risk with a call option. Suppose we return to Maytag's problem in 1999. Recall Maytag issued floating rate debt tied to LIBOR and so is exposed to the risk that interest rates rise unexpectedly. Maytag's commercial risk profile is the same as the risk profile illustrated in Exhibit 1.14. That is, as interest rates increase the additional interest expense of funding at LIBOR plus 80 basis points decreases the value of the firm. To manage the risk, Maytag purchases a call option on LIBOR interest rates from an investment bank. If rates fall in the future, Maytag will not exercise its right to issue debt at the exercise rate and will forgo the option premium. If rates rise in the future, Maytag will gain from the call option by issuing debt at below-market rates. The call option gain offsets the higher interest expense to ensure that the most that can be lost is the option premium. The combined risk profile in Exhibit 1.14 shows how Maytag's commercial risk is transformed after the purchase of a call option on LIBOR. Most important, note that the combined profile in this exhibit is the same

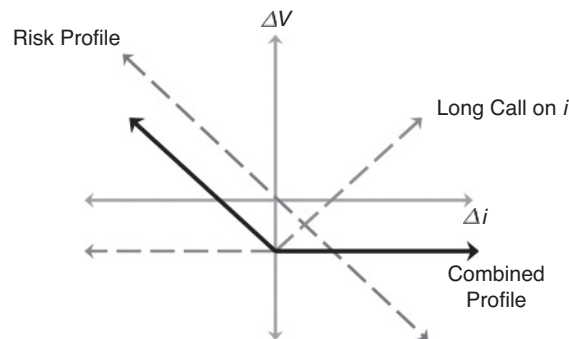


Exhibit 1.14 Risk Management with Call Option Contracts

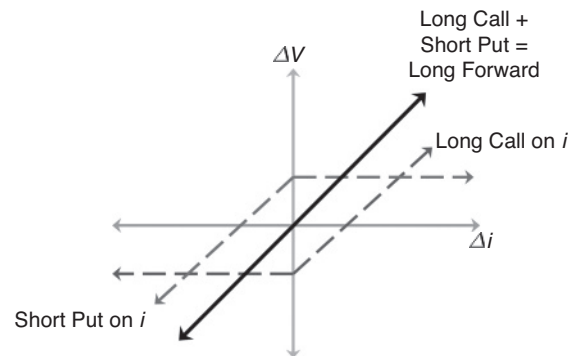


Exhibit 1.15 Relationship between Options and Forward Contracts

risk profile for a long put option position (Exhibit 1.13), suggesting a relationship between call options, put options, and the underlying instrument. The relationship is termed put-call parity.

Let us generalize the relationship of option contracts to forward contracts. For an increase in financial value, a call option contract has a risk profile like a forward contract on the same underlying instrument. For a decrease in financial value, however, a call option has a risk profile like a Treasury bill with the same maturity as the option, yielding a constant return if held to maturity. A call option risk profile can then be replicated by adjusting the composition of a portfolio of a forward (or futures or swap) contract on the underlying instrument and a riskless security. An analogous relationship holds for a put option contract and a short forward (or futures or swap) contract for a decrease in financial value. A put option risk profile can also be replicated by adjusting the composition of a portfolio of a forward (or futures or swap) contract on the underlying instrument and a riskless security. To carry the relationship a step further, suppose a portfolio combines a long call contract and a short put contract on the same underlying instrument with the same exercise prices and expiration date. The resulting risk profile is depicted in Exhibit 1.15. As shown, the risk profile of a long forward contract position is replicated by the portfolio of a long call contract and a short put contract on the same underlying instrument with the same exercise prices and expiration date.

STRUCTURED PRODUCTS AND AN APPLICATION TO DERIVATIVE CONTRACTS

Given a basic understanding of derivative contracts and how derivative contracts are related, consider structured products with an application to derivative securities. Structured products are financial instruments that combine cash assets and/or derivatives to provide a risk/reward profile not otherwise available or only available at high cost in the cash market.

Structured products are often the securities that result from the securitization process and have been successfully created with portfolios of mortgage, automobile, and boat loans as well as credit derivatives. Securitization is the process by

which mortgages issued by a financial institution are converted into mortgage-backed securities sold to investors or a firm's accounts receivable portfolio is converted into asset-backed notes, for example. Investors in securitized loans face default and prepayment risk, among other risks, passed through by original loan issuer. Usually investors are offered multiple classes—called tranches—of notes that differ in their priority of payment rights to best match the investor's risk-bearing preferences. Depending on the securitization structure, investors may choose between super-senior notes (first to be repaid, last to default), mezzanine notes (second to be repaid, second to default), and equity or capital notes (last to be repaid, first to default). Each tranche earns a different return based on the structured risk.

Of course, the correspondence of corporate securities and option contracts is familiar to students of derivatives.⁴ A zero-coupon bond issued by a firm without other debt can be viewed by the bondholder as a riskless bond plus a written put option (default premium) on the value of the firm's assets. The put option is owned by shareholders and the firm can be "put" to the bondholders in exchange for a release of indebtedness. With multiple tranches in a structured product, junior debt claims are paid only after senior debt claims. The super-senior tranche, for example, can still be viewed as a riskless bond plus a written put option. The mezzanine and capital note claims can be viewed as bullish spreads (put options both purchased and sold) on the value of the issuing firm's assets. Note that the correspondence between option contracts and corporate securities applies to all default-risky debt instruments.

To apply the ideas behind structured products to derivative contracts, consider an example using a recently developed credit derivative building block: a credit default swap. That is, these derivative contracts have the credit quality (or default risk) characteristics of a single company (called a single-name credit default swap) or a portfolio of debt instruments from different companies (called a portfolio default swap) as the underlying instrument. A change in the reference entity's default risk characteristics causes the value of the credit derivative to change. The International Swaps and Derivatives Association (ISDA), a trade group for the swaps industry, sponsors master agreements that define the situations under which a payoff is triggered by a reference entity default.⁵ Because debt instruments underlie a credit derivative, borrowers (firms, governments) and lenders (financial intermediaries, investors) might use a credit derivative to manage the risk of an unexpected change in a reference entity's default risk. The risk of issuing or holding any fixed income security includes interest rate risk as well as credit risk. In essence, a credit derivative contract represents a low-cost way to separate credit risk from interest rate risk. There are and have been well-accepted "credit derivatives" like variable-rate loan commitments, standby letters of credit, revolving loan facilities, and floating rate loans (floaters), which are all affected by changes in the credit quality of the funding beneficiary. As always, the key to the successful acceptance of credit default swaps is their low transaction costs.

Specifically, a credit default swap is not so much a "swap" of cash flows as an "option" on credit quality. In a credit default swap, the contract buyer pays a periodic premium to the contract seller and the contract seller protects the buyer from unexpected changes in the credit risk of a reference asset. The buyer and seller agree to a definition of a credit event; if the credit event occurs, the protection seller

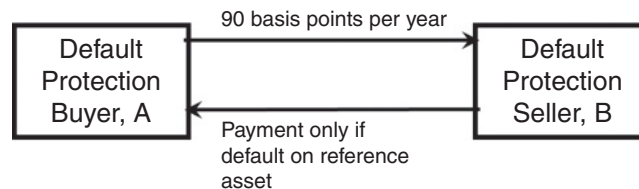


Exhibit 1.16 Cash Flows for a Credit Default Swap

pays the contract buyer a predetermined amount and the contract is terminated. If there is no credit event over the life of the derivative contract, the protection seller keeps the premium cash flow paid by the protection buyer. From a relatively simple arrangement with a single firm's debt as the reference entity, complicated agreements can be constructed, such as a total return swap and a portfolio default swap. A general illustration of the payments in a credit default swap is shown in Exhibit 1.16. The analogy between a credit default swap and an insurance policy against adverse changes in default risk should be clear.

To return to the topic of this section, a credit default swap is not a structured product per se. A credit default swap, however, can be the raw material behind a structured product.⁶ As with most derivative contracts, the value of a credit default swap is initially set to zero: Neither the protection buyer nor the protection seller is at an advantage over the other. That is, the buyer agrees to pay periodic premiums to the seller that reflects the current default risk of the reference entity. The credit default swap seller has an unfunded liability contingent on the occurrence of a credit event. Suppose that the protection seller in effect securitizes the unfunded liability by issuing debt instruments called credit-linked notes to investors in the cash market. Securitization means the protection seller repackages the payment rights to the protection buyer's premium and sells those rights to investors. Investors in the notes purchase cash market debt instruments that are linked to the default risk of the reference entity underlying the credit default swap. Investors receive the premium cash flow from the credit default swap, which typically is augmented with income from collateral purchased with the proceeds of the securitization, for the risk of a credit event. The credit-linked notes tied to the credit default swap and purchased by investors in the cash market are one example of a structured product.

Why securitize a derivative contract based solely on default risk? Certain institutional investors may be prohibited by policy or regulation from taking direct positions in credit derivative contracts yet have permission to invest in notes with traditional coupon payments, par values, and credit ratings. Credit-linked notes may have a transaction cost advantage over negotiated credit default swaps yet the same diversifying exposure to default risk. Finally, credit-linked notes are valuable as an instrument to hedge other credit derivatives positions.

In essence, the issuance of a structured note offsets the exposure of selling a credit default swap, which creates a funded rather than unfunded exposure. The investor in a credit-linked note pays for cash flows associated with selling the protection of a credit default swap. If no credit event occurs in the reference entity, the investor (indirectly, the protection seller) keeps the premium cash flow. If a credit event occurs, however, the investor's claim on the cash flow and collateral

investment income is junior to at least the protection buyer in the credit default swap. Structured products can repackage the cash flows of credit default swaps, broadening the market for credit derivatives in general. The credit-linked notes can be viewed generally as corresponding to options (default-risky securities) on credit default swaps (generating income passed through to note holders). Finally, the securitization process using the safest, super-senior notes, for example, could repeat itself, meaning the ultimate investors that provide the funding for the credit protection are several steps removed from the original seller of the credit default swap.

CONCLUSION

This chapter takes a generalist approach to instruments designed to deal with a single problem: managing financial risk. Forwards, futures, swaps, and options are not unique instruments that require specialized expertise. The connection between each class of derivative contracts helps demystify derivatives in general. Viewing forwards, futures, swaps, and options as interrelated tools for risk transfer may help further the application of integrated risk management. Interest rate, exchange rate, credit, prepayment, and price risks are often interrelated. Financial markets and commercial risks are not becoming simpler, more local, or less important than in the past. The goal of the chapter has been to provide a framework to make the connections clear. Finally, the creation of funded obligations with derivative contracts, one example of a structured product, also is an important application of the connection between derivative contracts. The repackaging of off-balance sheet credit derivatives into an on-balance sheet claim, illustrated with a structured investment vehicle that issues credit-linked notes, shows that derivative contracts are a flexible, essential part of the risk management landscape.

ENDNOTES

1. For an excellent discussion of the possible lessons learned by successful and unsuccessful uses of derivative contracts, see Marthinsen (2005).
2. The idea that derivative contracts are fundamentally interrelated was first detailed effectively in Smithson (1998). The approach here draws significantly from that treatment.
3. An eligible contract participant is an entity, such as a financial institution or investment trust, classified by the Commodity Exchange Act on the basis of assets or regulated status to engage in transactions not generally available to noneligible contract participants. Noneligible contract participants include retail customers and individual investors, for example.
4. The discussions in Chapter 7 of Cox and Rubinstein (1985) and Chapter 15 of MacDonald (2006) are excellent treatments of the options view of security design.
5. Credit default swap contracts sponsored by the ISDA specify rights and obligations of the counterparties and definitions of a reference entity credit event. Reference entity default is commonly triggered by bankruptcy filings, a failure to pay on notes, or a debt moratorium, restructuring, or repudiation. See Chapter 24 of Bomfim (2005) for detailed discussion of ISDA contracts.
6. Precisely speaking, the example of a structured product discussed here is called a synthetic collateralized debt obligation. The term *synthetic* is used because a derivative contract—a credit default swap—is being securitized instead of a portfolio of cash market debt instruments. See Bomfim (2005) and Rosen (2007).

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