Learning Module 2
Forward Commitment and Contingent Claim Features and Instruments

LOS: Define forward contracts, futures contracts, swaps, options (calls and puts), and credit derivatives and compare their basic characteristics.

LOS: Determine the value at expiration and profit from a long or a short position in a call or put option.

LOS: Contrast forward commitments with contingent claims.

Forwards, Futures, and Swaps

LOS: Define forward contracts, futures contracts, swaps, options (calls and puts), and credit derivatives and compare their basic characteristics.

Exhibit 1 Derivative contract comparison

	Forward commitments	Contingent claims
Contract	Exchange of obligations	Conveyance of rights
Counterparts	Both obligated to perform	Buyer has the right, but no obligation, to exercise; seller's obligation is contingent on exercise
Cost at initiation	Usually no cost to either party	Buyer pays premium to seller
Examples	Futures, forwards, most swaps	Options, credit default swaps, total return swaps

Derivative contracts are designated as either forward commitment contracts or contingent claims.

A forward commitment contract is an exchange of obligations between the counterparties. Examples of forward commitment contracts include:

- Forward or futures contracts: Counterparties commit to exchange an asset for a specified price at a specified time in the future. A bond futures contract is a forward commitment.
- Fixed-for-floating interest rate swaps: Counterparties commit to exchange a stream of fixed interest payments from the fixed-rate payer for a stream of floating interest payments from the fixed-rate receiver.

Contingent claims are derivatives that give holders the right to trade the underlying asset at a specified price at a future date. Contract holders do not have to exercise that right, but if they do, the original contract seller is obligated to take the other side of the trade that results from the exercise. For contingent claims, sellers must fulfill their obligations contingent on the contract holders exercising their rights.

Forwards

Exhibit 2 Forward commitment derivatives

	Futures	Forward	Swaps
Trading venue	Exchange-traded	Over-the-counter	Over-the-counter
Legal counterparty	Exchange clearinghouse	Contract counterparty	Contract counterparty
Contract terms	Standardized	Negotiated	Negotiated
Gain/loss realization	Daily settlement	At expiration	Periodically (eg, semiannual)

Forwards, futures, and swaps are the most common derivative contracts that represent a firm commitment for both counterparties.

A forward contract is an over-the-counter (OTC) derivative: two counterparties agree that the buyer will purchase an underlying from the seller at a prearranged fixed price. As OTC derivatives, forwards offer greater flexibility and customization than exchange-traded derivatives, but they usually involve more counterparty risk. Forwards are useful for importers and exporters to manage the currency risk in their accounts receivable and accounts payable.

At delivery, the payoff for the buyer is $S_T - F_0(T)$, and the payoff for the seller is $F_0(T) - S_T$.

- If $S_T > F_0(T)$, then the buyer has a positive payoff since she is paying less for the asset than its price on that date.
- If $S_T < F_0(T)$, then the seller has a positive payoff since she has sold the asset for more than its price on that date.

Example 1 Forward Market Settlement

An investor enters a cash-settled forward contract to purchase 100 ounces of gold at a forward price [$F_0(T)$] of $1,877 in 9 months. Today's spot price for gold is $1,840.20, and at maturity, the spot price (S_T) is $1,890.

The payoff is $S_T - F_0(T)$, or 1890 − 1877 = $13 per ounce.

The investor would receive $1,300 ($13 × 100) from the financial intermediary.

Futures

Futures contracts are similar to forward contracts, but with standardized sizes, dates, and underlyings. Futures are traded on an exchange with a central clearing facility, and therefore futures markets have higher liquidity and less counterparty risk.

The most important distinction between forward contracts and futures contracts is the daily settlement of gains and losses through the clearinghouse. At the end of each day, the clearinghouse engages in a practice called mark-to-market (MTM), also known as daily settlement, where the clearinghouse determines the end-of-day settlement price to which all contracts are said to be marked to market. Each counterparty deposits a required minimum sum (or initial margin) into a futures margin account held at the exchange, and that account is used to settle daily. If the amount in the margin account falls below the minimum balance or maintenance margin, the participant will receive a margin call or request to immediately deposit funds to return to the initial margin. The amount required to replenish the futures margin account is known as the variation margin.

To the buyer, the value of the futures contract at settlement is $S_T - f_0(T)$.

To the seller, the value of the futures contract at settlement is $f_0(T) - S_T$.

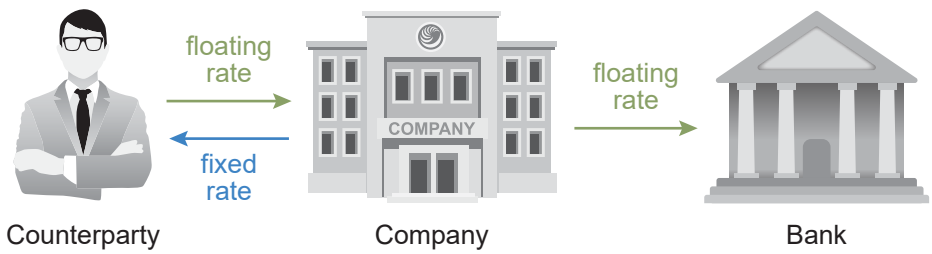
Forwards and futures involve the same net loss or gain, but while the forward is fully settled at maturity, the future is settled daily through the futures margin account. Although the total settlement is the same for each, the present value of their cash flows will differ since payments occur at different times.

At maturity, the open interest (number of outstanding contracts) can be settled with either cash or physical delivery. Instead of waiting until maturity, a counterparty may also choose to enter an offsetting contract to close out a position.

Swaps

A swap is a firm commitment under which two counterparties agree to exchange a series of cash flows in the future. Under the most common type of swap—an interest rate swap—one set of cash flows is variable or floating (determined by a market reference rate), while the other is fixed. The counterparty paying the variable cash flows is the floating-rate payer (fixed-rate receiver); the counterparty paying fixed cash flows is the fixed-rate payer (floating-rate receiver).

Exhibit 3 Using a plain vanilla swap to convert floating to fixed rate



In interest rate swaps, the notional principal is not exchanged but is instead used to calculate the amounts of the fixed- and floating-rate payments.

The swap's fixed payment is calculated to make the present value of the floating-rate payments (given the yield curve at initiation of the contract) equal to the present value of the fixed-rate payments so that the value of the swap at initiation is zero.

- If the yield curve rises, the present value of the floating-rate payments will increase, making the contract positive for the fixed-rate payer (floating-rate receiver).
- If the yield curve falls, the present value of the variable-rate payments will be less than the present value of the fixed-rate payments, and the swap will have a positive value for the fixed-rate receiver (floating-rate payer).

Options

LOS: Determine the value at expiration and profit from a long or a short position in a call or put option.

Contingent claims are derivative contracts in which one of the counterparties has the right to determine whether the trade will be settled. The most common contingent claim contract is an option. The main difference between option contracts and other derivatives is that the option buyer has the right, but not the obligation, to transact the trade. The option seller has the obligation to fulfill the transaction if the buyer chooses to transact the underlying.

The right to buy the underlying is a call option, whereas the right to sell the underlying is a put option. The decision to transact the underlying is referred to as exercising the option, and the prearranged price is the exercise price (also called *strike price*). The right to exercise the option in the future has a value that is paid upfront; this payment is the option premium.

European options can be exercised only at maturity, while American options can be exercised at any time from contract inception until maturity. This learning module will focus primarily on European options.

Example 2

A European call option with an exercise price of $45 is selling for $4 (the option premium). Assume that at maturity the underlying is trading for $52. If exercised, the option buyer would have a payoff ($S_T - X$) of $7 (52 − 45). Because the asymmetric right (the right without the obligation) to exercise the transaction had a cost (option premium) of $4, the profit (Payoff − Premium) would be $3 ($7 − $4).

If the underlying had been trading at $46 when the option expired, the buyer would still choose to exercise the transaction with a positive payoff ($S_T - X$) of $1 (46 − 45). Even though the profit (Payoff − Premium) in this case would be negative at −$3 ($1 − $4), this would be the correct decision as not exercising would have resulted in a loss of $4.

In contrast, if the underlying had been below the strike price at expiration, for example at $32, the option buyer would allow the option to expire without exercising. In this case the payoff would be zero [max(0, $S_T - X$)], and the profit would be a loss of $4.

Example 3

A European put option with an exercise price of $76 is purchased at an option premium of $5.

If, at maturity, the underlying price is below the strike price, the option would be in the money. If the underlying were trading at $60 at expiration, the buyer would have the right to sell an asset worth $60 for $76, which would represent a payoff ($X - S_T$) of $76 − 60 = $16. Given that the buyer paid $5 for this right, the profit (Payoff − Premium) would be $16 − $5 = $11.

If the underlying were above the strike price at expiration, for example at $82, the option buyer would choose not to exercise the right to sell an asset at $76 that could be sold in the market at $82, and the payoff would be $0 (the profit would be a loss of $5, the option premium).

Having the right, but no obligation, to buy or sell is advantageous. Option contract holders realize increasing gains as the underlying asset's price moves in their favor. However, since there is no obligation to exercise the contract, the minimum payoff is zero if the option is out of the money, no matter how far out of the money it is. As a result, contingent claims have asymmetric payoffs relative to the underlying asset's price movements. Due to the advantageous tradeoff, contingent claims always have a positive nonzero initial value.

Moneyness Concepts

A call option is in the money at time T if the spot price $S_T > X$: intrinsic value = $S_T - X$.

A call option is out of the money when $X > S_T$.

The intrinsic value of an out-of-the-money option is zero since it would not be exercised.

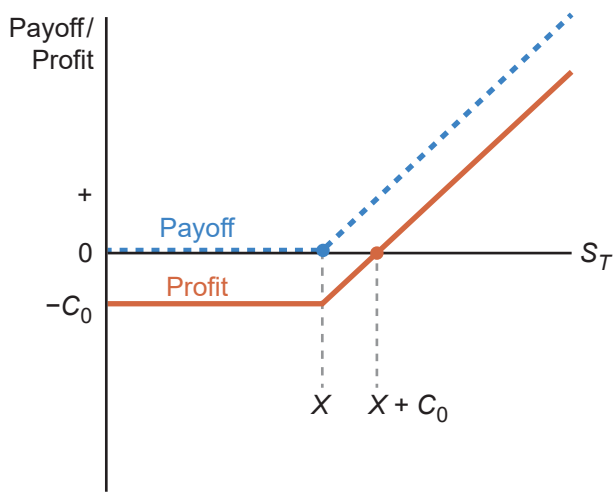
A put option is in the money when $X > S_T$: intrinsic value = $X - S_T$.

A put option is out of the money when $S_T > X$, and it also has an intrinsic value of zero.

Both call and put options are at the money when $S_T = X$, and their intrinsic values = 0.

Call Option Payoff Profiles

Exhibit 4 Long call payoff/profit profile



The call option value at maturity C_T is:

$$C_T = \max(0, S_T - X)$$

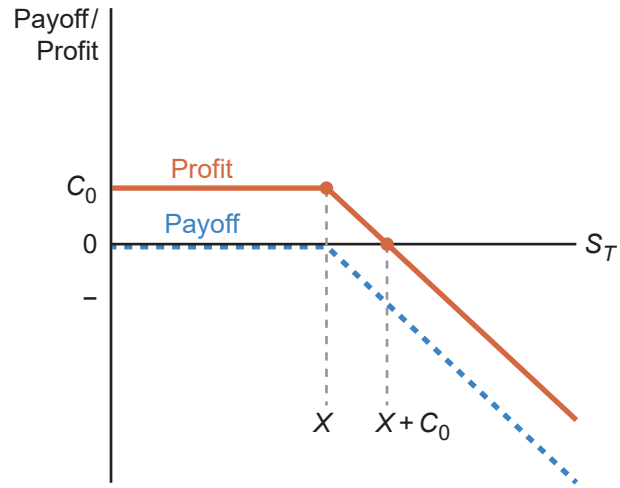
And the call option buyer's profit is:

$$\text{Profit} = C_T - C_0 = \max(0, S_T - X) - C_0$$

The longer the time to maturity, the greater the likelihood that a favorable change in the underlying will increase the call position's profitability. The ***time value*** of an option is always positive and declines to zero as an option reaches maturity.

Given that the call option buyer and the call option seller are on opposite sides of the same trade, their payoff/profit diagrams are basically mirror images.

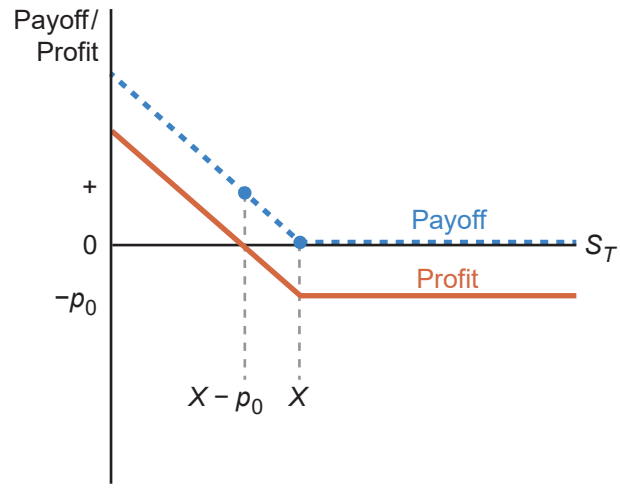
Exhibit 5 Short call payoff/profit profile



Put Option Payoff Profiles

By selling at the predetermined exercise price, the put option buyer benefits when the underlying price *declines*.

Exhibit 6 Long put payoff/profit profile



The put option *payoff* and *profit* are:

$$P_T = \max(0, X - S_T)$$

$$\text{Profit} = \text{Payoff} - \text{Premium} = \max(0, X - S_T) - p_0$$

Given that the put seller takes the opposite side of the same trade, the put seller's payoff and profit are the exact opposite of the put buyer's. The put option seller's maximum gain is the premium charged (as is also the case for the call options). With a call option, the seller has unlimited potential for loss; with a put option, the call seller's maximum loss is the strike price less the option premium.

The short put option *payoff* and *profit* are:

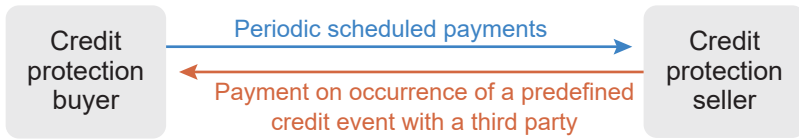
$$-P_T = -\max(0, X - S_T)$$

$$\text{Profit} = -\max(0, X - S_T) + p0$$

Credit Derivatives

The underlying in a credit derivative is default risk (either of a single debt issuer or a group of debt issuers in an index). The most common credit derivative contract is the credit default swap (CDS). CDS contracts trade on a credit spread and allow an investor to manage the risk of credit loss. The credit spread depends on the probability of default and the loss given default, where a *higher* credit spread (or higher likelihood of issuer financial distress) corresponds to a *lower* cash bond price (and vice versa).

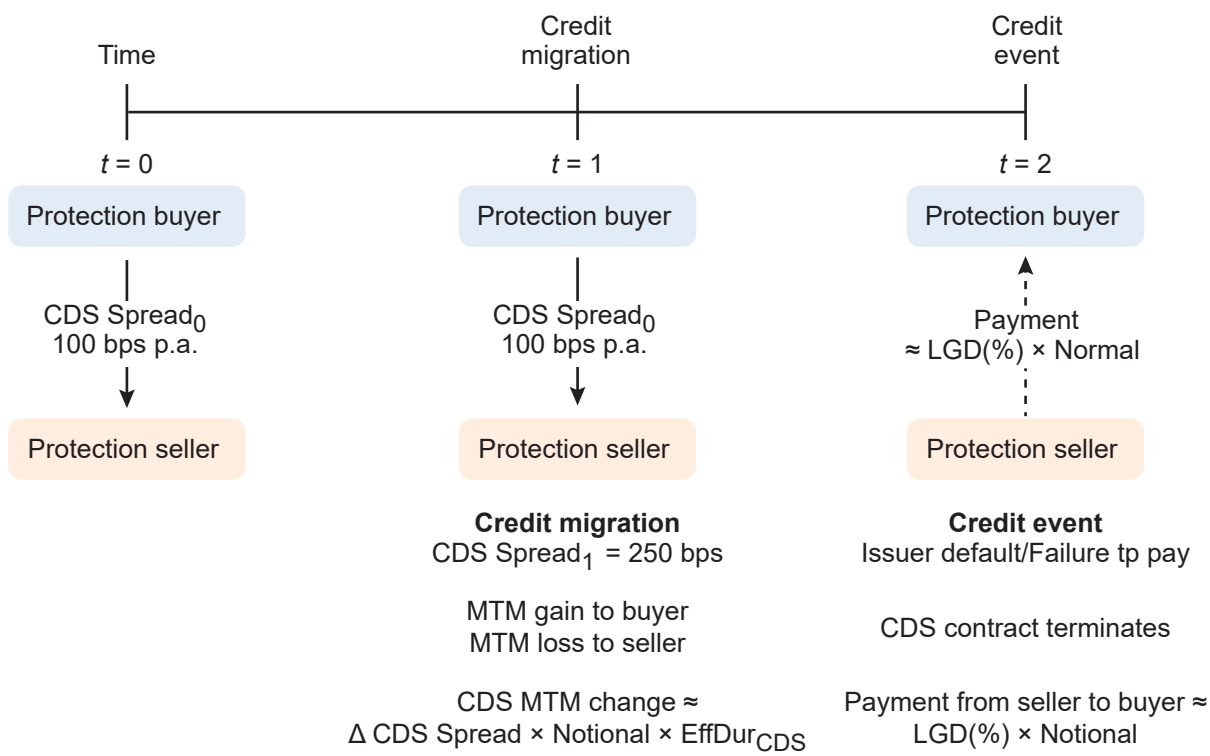
Exhibit 7 Credit default swap



CDS contracts are contingent claims with some features of firm commitments. In a CDS contract, the credit protection buyer pays the credit protection seller to assume the risk of loss from the default of an underlying (third-party) issuer. If the case of a credit event (eg, bankruptcy, failure to pay, involuntary debt restructuring) the credit seller pays the credit protection buyer. Even though the name includes the word "swap," the contract structure is more similar to insurance. The premium that will be paid over the life of the contract is established upfront, while the timing and size of the loss under the credit event are unknown. The seller's position is similar to that of a long risk position in the underlying issuer's bond.

In the following example, the protection buyer agrees to pay a fixed spread of 100 bps (basis points) p.a. (per annum) at $t = 0$. As the issuer's credit spread widens to 250 bps at $t = 1$, the protection buyer gains, as she is paying a lower spread than the current spread, while the seller loses. An effective duration can be used to approximate any mark-to-market change in the instrument. At $t = 2$, an issuer credit event causes the contract to terminate, and the seller must make a payment equal to the loss given default multiplied by the notional principal.

Exhibit 8 CDS contract with credit migration and credit event



Forward Commitments versus Contingent Claims

LOS: Contrast forward commitments with contingent claims.

As previously established, a firm commitment requires both counterparties to perform, whereas in an option contract the buyer can decide whether to execute the contract. Both a long position in a forward and a long position in a call option will gain from an increase in the price of the underlying.

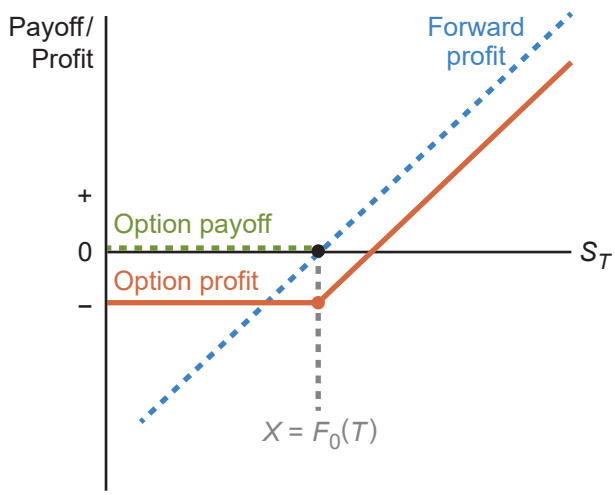
In the case of a forward, the relationship is linear and can be expressed by the formula $[S_T - F_0(T)]$. As no upfront premium has been paid, the payoff is equal to the profit. If the strike price in a call option were equal to the predetermined price in a forward contract, then for the buyer of a call option, the profit would be:

$$\text{Profit} = \max[0, S_T - F_0(T)] - c_0.$$

With the exercise price equal to the forward price, the following relationships emerge:

- $S_T - F_0(T) > -c_0$, forward profit exceeds call option profit.
- $S_T - F_0(T) = -c_0$, forward profit equals call option profit.
- $S_T - F_0(T) < -c_0$, call option profit exceeds forward profit.

Exhibit 9 Long forward and long call option payoff/profit profile



Another option position that benefits from a rise in the price of the underlying is a short position in a put option. Because the premium is received instead of paid, the option profit exceeds the forward profit at lower prices; however, the maximum short put option profit is limited by the premium received.

Exhibit 10 Long forward and short put option payoff/profit profile