Learning Module 2: Forward Commitment and Contingent Claim Features and Instruments

LOS 2a: define forward contracts, futures contracts, swaps, options (calls and puts), and credit derivatives and compare their basic characteristics

A forward contract is an **over-the-counter (OTC) derivative** contract. In this contract, two parties agree that one party, the buyer (long), will purchase an underlying asset from the other party, the seller (short), at a later date at a fixed price (the **forward price**) agreed upon when the contract is initiated.

A forward contract is suitable for hedging an existing or expected underlying exposure based on specified terms. For example, an importer may use a forward contract to hedge against foreign exchange by entering a forward contract to buy foreign currency to fulfill a future goods delivery contract.

Payoff Profile of a Forward Contract

Assume that we are currently at time $t = 0$, where the price of the underlying is S_0. The forward contract expires at a future date $t = T$, where the underlying price is now S_T. The price S_T is unknown at the initiation of the contract.

At time $t = 0$, the **long (buyer)** and **the short (seller)** agree that the seller will deliver the underlying asset for the price of $F_0(T)$, the **forward price**, at time $t = T$, the expiration date.

However, an important element of a forward contract is that no money is exchanged when the contract is initiated. Thus, forward contracts can be considered to have zero value at the start and are neither assets nor liabilities. The value deviates from zero as the price of the underlying moves. The ability to “lock in” a future price for an asset has important practical benefits and is used as an instrument for financial speculation.

Outcomes of a Forward Contract at Maturity

If, at the expiration date, the current spot price is greater than the forward price [$S_T > F_0(T)$], the buyer (long) receives a payoff of

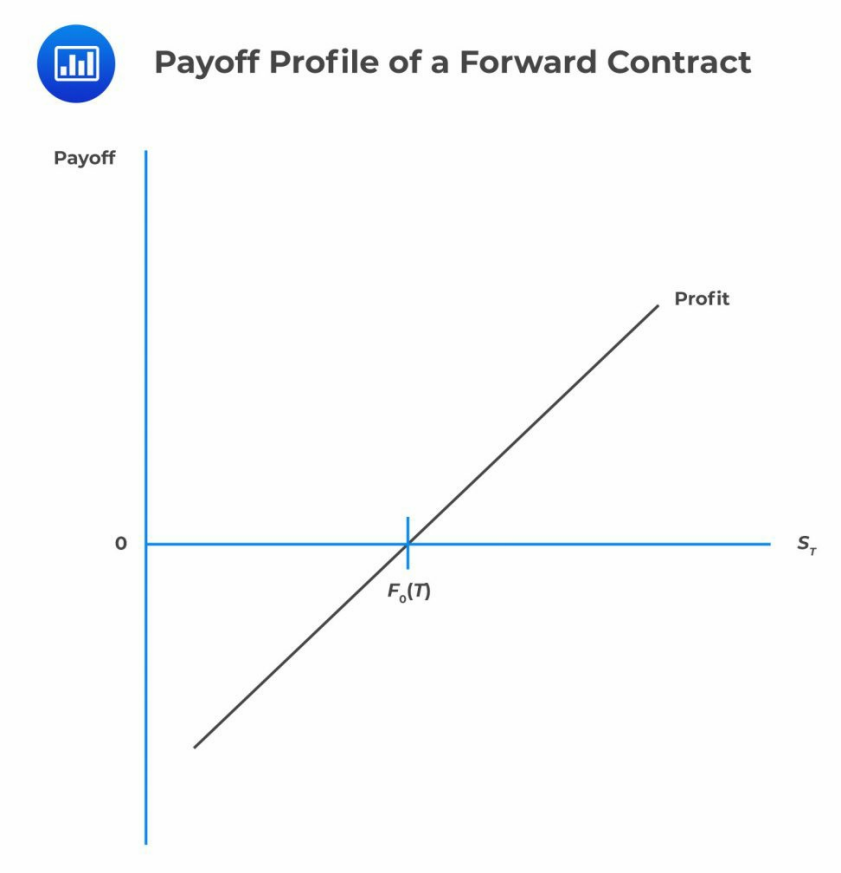
$$\text{Payoff} = S_T - F_0(T)$$

Intuitively, the short incurs a loss of $-(S_T - F_0(T))$ because the seller must deliver an asset at S_T and receive less amount $F_0(T)$.

The table below gives a summary of the outcomes:

Outcome at Expiry	Buyer (long) Payoff	Seller (Short) Payoff
$S_T > F_0(T)$	$[S_T - F_0(T)] > 0$	$[F_0(T) - S_T] < 0$
$S_T < F_0(T)$	$[S_T - F_0(T)] < 0$	$[F_0(T) - S_T] > 0$

We can represent the above results in a graph:



From the graph above, it is easy to see that the price of the forward contract is a linear function of the underlying. As such, forward commitments are also called **linear derivatives**.

Example: Calculating the Forward Contract

Minners Inc. enters a forward contract with a financial intermediary to buy 80 kilos of gold at USD 53,000 per kilo. The spot price of gold is USD 52,780 per kilo.

How much will Minners Inc. pay (receive) to (from) the financial intermediary?

Solution

$$\begin{aligned}\text{Payoff at maturity} &= S_T - F_0(T) \\ &= 52,780 - 53,000 \\ &= -\text{USD } 220\end{aligned}$$

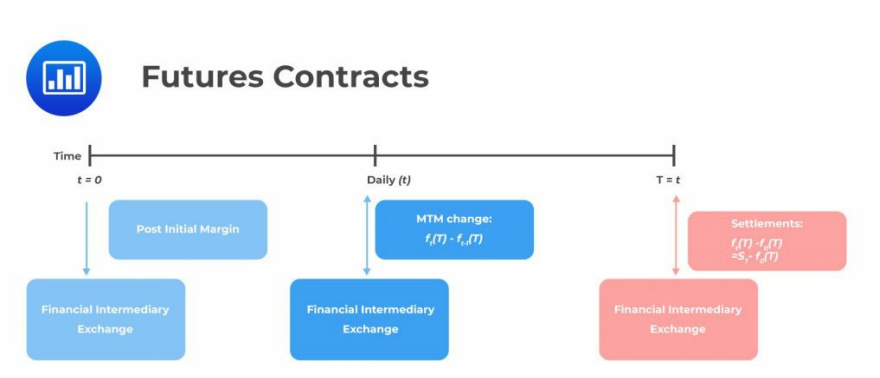
Therefore, Minners Inc. (buyer) must pay USD 17,600 ($= 80 \times 220$) to the financial intermediary (seller).

Futures Contracts

Futures contracts are a standardized variation of forward contracts. The buyer of the futures contracts agrees to buy the underlying in the future at a pre-agreed price (futures price). On the other hand, the seller agrees today to sell the underlying asset in the future at a price agreed upon at the initiation of the contract.

The exchange determines expiration dates, underlying assets, the size of the contracts, and other details.

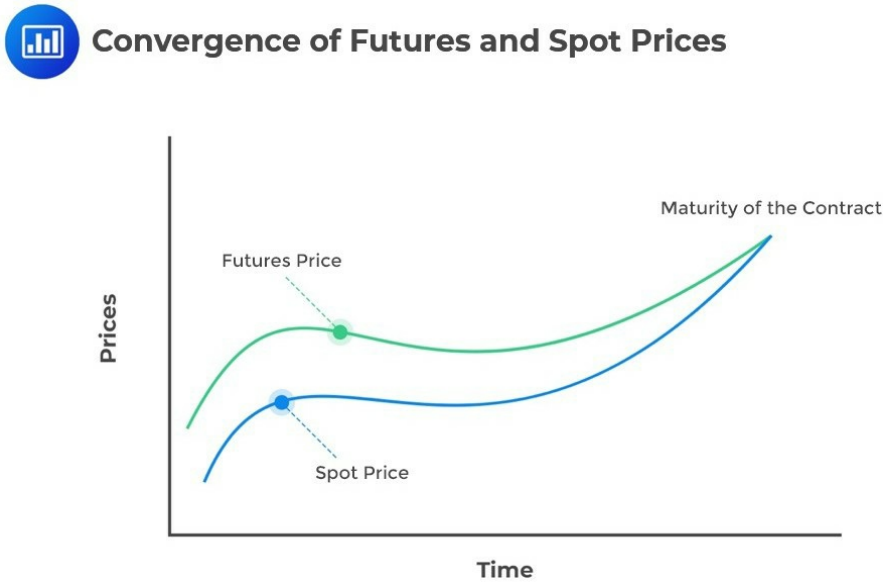
A distinguishing element of futures contracts compared to forward contracts is the **mark-to-market** feature (also called **daily settlement**), where the exchange determines an average of the final futures trades of the day (**settlement price**). Each party's account in the transaction will be debited or credited with the losses or gains for the day.



Like forward contracts, the payoff is based on the difference between the futures price and the underlying price at the expiration date. For example, from the buyer's perspective, the payoff is given by:

$$\text{Payoff} - S_T - F_0(T)$$

Additionally, the futures price converges towards the spot price at expiration. In cash-settled transactions, there is a final mark-to-market at expiration, with the futures price set to the spot price to ensure convergence:



Futures Margin and Settlement Process

Denote the futures price by $f_0(T)$ and the current spot price at expiry by S_T. Note that, like forward contracts, no cash changes hands at the initiation of the futures contract. However, both

counterparties must deposit the **initial margin** into a **futures margin account** at the exchange.

The exchange uses the futures margin account to settle daily market changes. Special financial intermediaries usually execute futures contracts on behalf of the counterparties.

When the futures margin account funds fall below the initial margin, the seller receives a **margin call** to top up the account back to the initial amount. The added sum is called the **variation margin**.

If a counterparty cannot replenish the margin account, it must close out the contract as soon as possible and incur additional costs in the process. In extreme cases where a counterparty cannot meet the obligations, the exchange covers the losses through an **insurance fund**.

At maturity, the outstanding contracts (collectively called open interest) are settled through cash or physical delivery (whichever is stated in the contract). However, a counterparty may elect to enter an offsetting future contract before expiration to close out a position.

How Exchanges Limit Losses Due to Defaults in Futures Contracts

An exchange might impose additional requirements to limit potential default-occasioned losses. These include:

- **Increasing required margins**: Due to an increase in price volatility.
- **Price limits**: Establishing a band relative to the previous day's settlement price in which all trades take place.
- **Circuit breaker**: Stopping intraday trading for a short period if the price limit has been reached.

Futures Contracts Accounts (Summary)

Futures Margin Accounts

Futures margin accounts are transactional accounts of buyer and seller held by the exchange. If the end-of-day settlement price decreases, the buyer (long) loses money, which is charged from the margin account and transferred to the seller's account (short). The opposite is true.

Let's assume that at maturity, the futures price is greater than the underlying price. In that case, the profit is transferred to the buyer's account (short) from the seller's (short) account, which equals total settlements.

Initial Margin

This is the minimum amount of money (typically less than 10% of the futures price) that is deposited by both parties to cover possible future losses.

Maintenance Margin

This refers to the sum of money (lower than the initial margin) that each party must maintain in the margin account from the initiation to the maturity of the trade.

Margin Call

This is the request to deposit additional funds (variation margin) into the account if it falls below the maintenance margin.

Example: Margin Call

Minners Inc. enters a 3-month futures contract on an exchange through a financial intermediary to buy 80 kilos of gold with an opening price of USD 53,000 per kilo.

The exchange requires an initial margin of USD 127,200 and a maintenance margin of USD 115,750.

Below is an excerpt of mark-to-market (MTM) details:

Day	Futures Price	Day Gain/Loss	Net Gain/Loss	Margin Balance	Margin Call Variation Margin
T_{90}	$\$53,000$			$\$127,200$	
T_{89}	$\$53,124$	$\$9,920$	$\$9.920$	$\$137,120$	
T_{88}	$\$53,080$	$(\$3,520)$	$\$6,400$	$\$133,600$	
T_{87}	$\$52,600$	$(\$38,400)$	$(\$32,000)$	$\$95,200$	$\$32,000$
T_{88}	$\$53,024$	$\$33,920$	$\$1,920$	$\$161,120$	
T	$\$53,129$	$\$10,020$	$(\$2,020)$	$\$134,125$	

Day 89:

- The gold futures price increases by USD 124, so the gain is USD 9,920($= 80 \times 124$).
- Margin balance = $\$127,200 + \$9,920 = \$137,120$
- No margin call since the margin balance is higher than the maintenance margin.

Day 87

- The gold futures price decreases by USD 480, so the loss is USD 38,400($= 80 \times 480$).
- Margin balance = $\$133,600?\$38,400 = \$95,200$ (**below the maintenance margin**).
- Margin call amount (variation margin) = $\$127,200?\$95,200 = \$32,000$

Swaps

A swap is an over-the-counter derivative contract in which two parties agree to **exchange a series of cash flows** whereby one party pays a variable (floating) series that an underlying asset or rate will determine. The other party either pays (1) a variable series determined by a different underlying asset or rate or (2) a fixed rate.

For instance, in interest rate swaps, the floating rate payer pays a market reference rate (MRR) which resets every period, and the fixed rate payer pays a fixed-rate (swap rate), which is constant, as shown below.

As is the case in forwards and futures, no money changes hands at the initiation of the contract. However, as time passes and market conditions vary, the MTM value of the swap contract changes. Note that counterparties exchange a net payment on fixed-and floating payments. The counterparties privately negotiate the credit terms of a swap rate. The credit terms may range from uncollateralized exposure to margining like the futures contract. Swaps may be centrally settled between financial intermediaries by a central counterparty (CCP), where they involve margins like those of futures contracts. The **notional amount** is a sum of money that is used to calculate fixed and floating interest payments.

Example: Calculating Swap Contract Net Cashflow

FinnLay LTD has entered a 10-year interest rate swap with a financial institution with a notional amount of USD 100 million.

The contract states that FinnLay signed to receive a semiannual USD fixed rate of 5% and, in turn, pay a semiannual market reference rate (MRR). For the first six months, MRR is 2%.

Calculate the first swap cash flow.

Solution

The amount owed to FinnLay by the financial intermediary: $\frac{5\%}{2} \times 100\text{m} = 2.5\text{m}$

Amount paid by FinnLay to the Financial intermediary: $\frac{2\%}{2} \times 100\,\text{m} = 1.0\text{m}$

Therefore, the netting is: $2.5\text{m} - 1.0\text{m} = 1.5\text{m}$

Net Result: Financial intermediary pays FinnLays USD 1.5 million after six months.

Common Features among Forwards, Futures, and Swaps

- Defined contract size.
- Defined underlying.
- There is one or more exchanges of cash flows or underlying on a given date or dates.
- The exchanges are based on pre-agreed prices.

Option Contracts

Options are derivative instruments that give the option buyer the right, but not the obligation, to buy (call) or sell (put) an asset from (or to) the option seller at a fixed price on or before expiration.

In other words, options are contingent claims that give the option buyer the right but not the obligation to transact the underlying, and the option seller is obligated to meet the obligation chosen by the buyer. As such, the **payoff** of an option is positive or zero.

However, the **profit** can be negative since it takes into account the payoff plus (minus) the **premium** received (paid) by (to) the option buyer (seller). If the option expires out-of-the-money, the seller of the option receives the full amount of the premium.

More on Options

When the option buyer decides to transact the underlying, it is referred to as **exercising the option**. The pre-agreed price at which the option buyer exercises the underlying is called the **exercise price**. It is the fixed price at which the underlying asset can be bought or sold at expiry.

The option buyer pays the seller an **option premium** for the right to exercise the option in the future. It is the **fair price** of an option in a **well-functioning** market. The option buyer (long) is not obligated to exercise the option beyond the initial payment of the premium.

Options can be traded on over-the-counter (OTC) markets or exchanges based on standardized

terms.

Options can be American options or European options. European-style options can only be **exercised at expiry**, while American-style options are exercisable **before expiry**. This reading primarily dwells on European options.

There are two types of options: call option and put option. A put option is a financial contract that gives the buyer the right, but not the obligation, to sell an underlying asset at a predetermined price within a specified period of time to the seller of the option while a call option is a financial contract that gives the buyer the right, but not the obligation, to buy a specified amount of an underlying asset at a predetermined price within a specified period of time from the seller of the option.

Consequently, the option will only be exercised if the payoff is positive; otherwise, the option expires worthless, and the buyer incurs a loss equal to the option premium.

More information on payoff profile options is given in the next reading.

Credit Derivatives

Credit derivative contracts, like credit default swaps (CDS), manage default risk from single or multiple debt issuers. CDS contracts trade based on credit spreads, influenced by default probability and loss severity. Unlike standard options, exercise timing and payment vary in CDS contracts, which resemble firm commitments.

The buyer pays the seller to assume default risk, with the seller paying in the event of an issuer credit event. CDS can hedge existing credit exposure or speculate on credit spreads, with buyers seeking protection and sellers receiving fixed payments. An issuer credit event triggers termination, with the seller compensating the buyer based on the loss severity.

Question

Which statement is *most* accurate when the stock price is above the exercise price ($S_T > X$) on a put option at expiration?

A. The option seller will suffer a loss equivalent to the difference between the stock price and the exercise price.

B. The option buyer will suffer a loss equivalent to the difference between the stock price and the exercise price.

C. The option seller will show a profit equivalent to the option premium amount, the option buyer will show a loss equivalent to the option premium amount.

Solution

The correct answer is **C**.

If the stock price is above the exercise price at expiration, the put option expires out-the-money and is worthless. The option buyer has lost the premium paid while the option seller has made a gain equivalent to the premium received.

LOS 2b: determine the value at expiration and profit from a long or a short position in a call or put option

Define the following:

c_T = Value of the call at expiration.

p_T = Value of a put option at expiration.

S_T = Price of the underlying at time T.

X = Exercise price.

c_0 = Call option premium.

p_0 = Put option premium.

Π = Profit from an option strategy.

Payoff Profile of a Call Option

Recall that in call options, the buyer has the right but not the obligation to buy the underlying. Moreover, the call option will only be exercised if the payoff is positive; otherwise, the option expires worthless, and the option buyer incurs a loss equal to the option premium.

Intuitively for a call option, the buyer would only exercise the option if $S_T > X$. As such, the payoff to the buyer at expiration is given by:

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

Conversely, the payoff to the seller at expiration is:

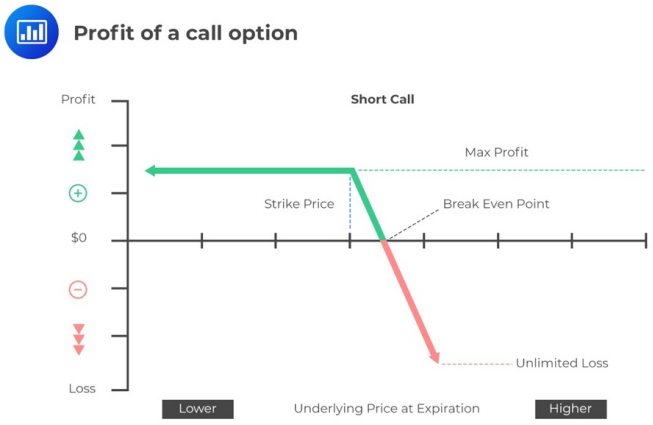
$$-C_T = -(\max(0, S_T - X))$$

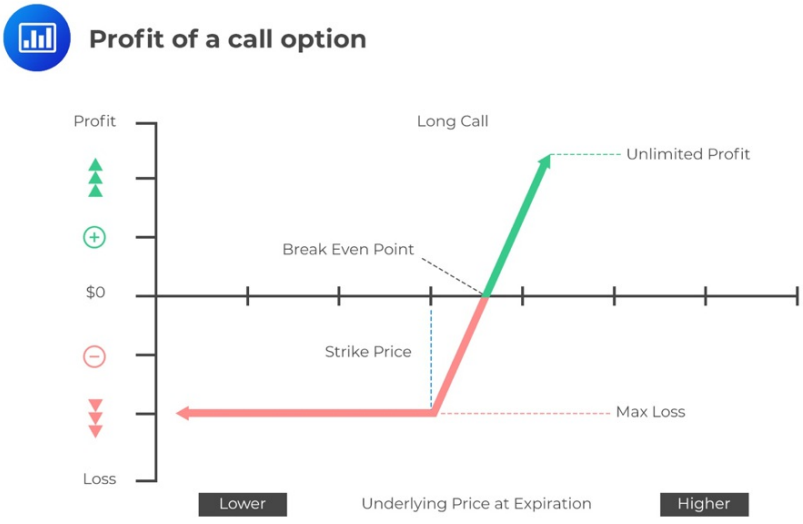
Note also that the option buyer pays the seller the call option premium (c_0) at time $t = 0$ for the right to buy the underlying S_T at an exercise price of X at time $t = T$. Therefore, the profit the buyer will earn is calculated as follows:

$$\Pi = \max(0, S_T - X) - C_0$$

For the call option seller's profit, it is given by:

$$\Pi = -\max(0, S_T - X) + C_0$$





From the above graphs, the following points can be deduced:

- **The maximum loss** for the long (buyer) of the call option is the **premium**, and the **profit** for the **buyer** is **unlimited**.
- **The maximum loss** for the short (seller) of the call option is **unlimited**, and the **greatest profit** the **seller** can make is the premium.

- The **breakeven point** for both the long (buyer) and short (seller) is the strike **price plus the premium**.
- The sum of the profits between the long and the short equals zero since options trading is a **zero-sum game**.

Example: Calculating the Value (Payoff) of a Call Option at Expiration

Consider a one-year call option with a premium of $2 and a strike price of $30. If the price of the underlying at expiration is $40, the value at expiration is *closest* to:

Solution

At $40, the stock price is above the exercise price. Therefore, the option has a value of:

$$\begin{aligned} c_T &= \max(0, S_T - X) \\ &= \$40 - \$30 \\ &= \$10 \end{aligned}$$

Example: Calculating the Profit/Loss of a Call Option at Expiration

Consider a one-year call option with a premium of $2 and a strike price of $30. If the price of the underlying at expiration is $40, the value and profit/loss at expiration is *closest* to:

Solution

The buyer of the call option will exercise the option and make a profit of:

$$\begin{aligned} \Pi &= \max(0, S_T - X) - C_0 \\ &= \$10 - \$2 \\ &= \$8 \end{aligned}$$

Intuitively the seller is at a loss of:

$$\begin{aligned} \Pi &= -\max(0, S_T - X) + C_0 \\ &- 10 + 2 \\ &- \$8 \end{aligned}$$

Payoff Profile of a Put Option

For a put option, the buyer has the right but not an obligation to exercise the option at expiry. Exercising the option means that at expiration, the buyer sells the underlying S_T at the exercise price X. As such, the put option is only exercisable if $S_T < X$.

Therefore, the payoff to the buyer is given by:

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

Conversely, the payoff to the put option seller is:

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

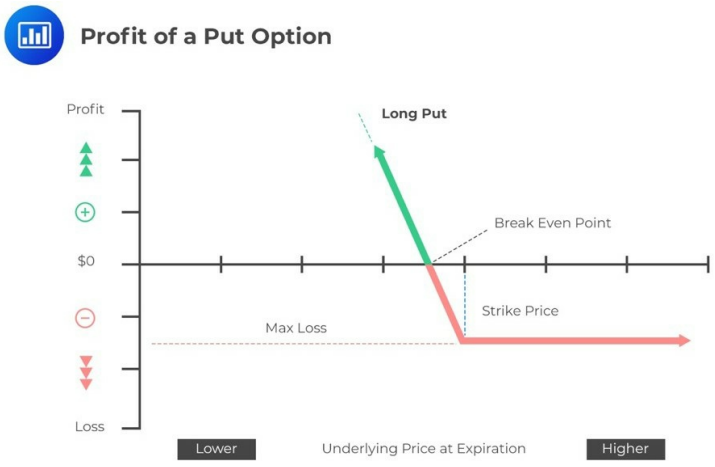
Recall that the put option buyer pays the seller a put option premium (p_0). Therefore, the profit to the option buyer is given by:

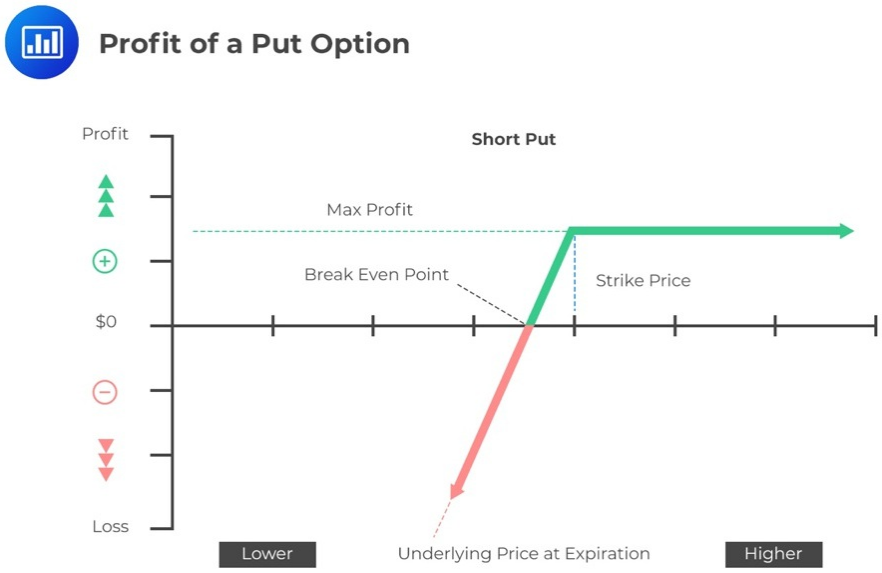
$$\Pi = \max(0, S_T - X) - p_0$$

Conversely, the profit to the options' seller is given by:

$$\Pi = -\max(0, S_T - X) + p_0$$

The following graphs can represent the profit of a put option to both buyer and the seller:





From the above graphs and formulas, the following can be deduced:

- The **maximum loss** for the long (buyer) of the put option is the **premium** paid, and the **profit** for the **buyer** is **limited** to the difference between the strike price and the underlying asset's price (or strike price if the underlying price falls to 0) at expiration. The price of the underlying asset cannot drop below zero, so the maximum profit for the buyer cannot be unlimited.
- The **maximum loss** for the short (seller) of the put option is **limited** to the strike price, and the **greatest profit** the **seller** can make is the premium.
- The **breakeven point** for both the long (buyer) and short (seller) is the strike **price minus the premium**.
- The sum of the profits between the long and the short party equals zero. Options trading is a **zero-sum game**.

Example: Calculating the Payoff (Value) and Profit/Loss of Put Options

Consider a one-year put option with a premium of $3 and a strike of $30. If the underlying price at expiration is $20, the value and profit/loss at expiration is *closest* to:

Solution

At $20, the stock price is below the exercise price. Therefore, the options have a value of:

$$\begin{aligned} p_T &= \max(0, X - S_T) \\ &= \$30 - \$20 \\ &= \$10 \end{aligned}$$

The buyer of the put option will exercise the option; therefore, he makes a profit of:

$$\begin{aligned} \Pi &= \max(0, X - S_T) - p_0 \\ &= \$10 - \$3 \\ &= \$7 \end{aligned}$$

The seller/writer makes a loss of:

$$\begin{aligned} \Pi &= -(\max(0, X - S_T)) + p_0 \\ &= -\$10 + \$3 \\ &= -\$7 \end{aligned}$$

Question

If a put option has a premium of $3 and the exercise price is $100, and the price of the underlying is $105, the value at expiration and the profit to the option seller are *closest to*:

A. Value = -$3; Profit = $0

B. Value = $0; Profit = $8

C. Value = $0; Profit = $3

Solution

The correct answer is **C**.

Note that the exercise price ($100) is less than the underlying price ($105), so we have a situation where $S_T \geq X$. Therefore, the option expires worthless, so the value (payoff) at maturity is zero ($p_T = 0$).

Intuitively, the profit to the seller is equal to the option premium paid by the option buyer ($\Pi = p_0$), which is $3. From the perspective of the put buyer (long put), $p_T = 0$ and $\Pi = -p_0$ or a loss of $3.

LOS 2c: contrast forward commitments with contingent claims

Derivatives typically fall into two classes: forward commitments or contingent claims. The primary difference between the two is based on rights and obligations. Forward commitments carry an obligation to transact, whereas contingent claims confer the right to transact **but not the obligation**.

Forward Commitments

Forward commitments are derivative contracts between two parties that require both parties to transact in the future at a pre-specified price. The parties are obligated to transact, and a legal remedy may be enforced in the event of non-performance.

The payoff profiles of forward commitments are linear. That is, the payoff moves upwards or downwards in direct relation to the underlying asset's price. In other words, the payoff of forward commitments is a linear function of the underlying price.

Forward commitments include forward contracts, futures contracts, and swaps.

Contingent Claims

A contingent claim is a type of derivative where the payoff profile is dependent on the outcome of the underlying asset or **conditional** on the occurrence of some events. With a contingent claim, there is the right to transact but not the obligation. As such, contingent claims have become synonymous with the term "option."

The payoff profile of a contingent claim is non-linear. That is, the payoff of an option is asymmetric (limits losses in one direction).

Contingent claims include options, credit derivatives, and asset-backed securities.

Question

Which statement *best* describes the key difference between a forward commitment and a contingent claim?

A. A forward commitment creates an obligation to transact, whereas a contingent claim allows a transaction to be optional.

B. A forward commitment allows the holder to choose whether to transact, whereas a contingent claim is always enforceable.

C. A forward commitment is enforceable, and a party must transact, whereas a contingent claim allows the seller to choose whether to enforce the transaction.

Solution

The correct answer is **A.**

A forward commitment creates an obligation between the transacting parties, whereas a contingent claim creates the right but not the obligation to transact at a future date.