

Derivative Markets

RECOMMENDED READING:

FINANCIAL MARKETS & INSTITUTIONS BY JEFF MADURA (CH#13-16)

Derivatives – Definition

- A derivative is a financial instrument whose value depends on (or derives from) the values of other, more basic, underlying variables.

-----John C. Hull, Options, Futures, and Other Derivatives

- A derivative is a financial instrument (or more simply, an agreement between two people) that has a value determined by the price of something else.

-----Robert L. McDonald, Derivatives Markets

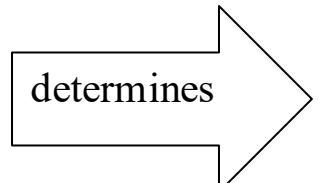
- A derivative is a financial instrument that offers a return based on the return of some other underlying asset. The return of a derivative is derived from another instrument.

-----CFA Institute

Value of Underlying Asset



Value of Derivatives



Derivatives – Types

- Forwards
 - A *private agreement* between two parties to buy or sell an asset at a specific price and date in the future.
 - Contracts are *not standardized or traded on an exchange*.
- Futures
 - A *standardized agreement* to buy or sell an asset at a specified price and date in the future.
 - Futures contracts are *traded on organized exchanges* – prices are publicly available.
- Options
 - A type of derivative contract that gives the holder the right (not the obligation) to buy (i.e., call options) or sell (i.e., put options) an underlying asset at a predetermined price and time in the future.
- Swaps
 - A financial agreement or derivative contract between two parties to exchange cash flows based on different financial instruments or rates.

Derivatives – Functions & Uses [1/3]

Crude Oil Producer – selling the oil



Oil User (manufacturer) – buying the oil



Make a contract at fixed price for future delivery in one year (say, \$100/barrel)

It's a risk if the price goes down in one year

It's a risk if the price goes up in one year

Derivatives – Functions & Uses [2/3]

After one year,

If the oil prices goes up (say, \$110/barrel):

The contract, which has a fixed price set one year before (\$100/barrel), has a value for the manufacturer (buyer) since they can buy oil at the fixed price lower than the current market price

If the oil price goes down (say, \$90/barrel):

The contract has a value for the oil producer (seller) since they can sell oil at the fixed price higher than the current market price

Therefore, the value of the oil contract depends on

- the price of underlying asset (oil) at the time the contract matures and
- position in a derivative contract (i.e., buy or sell).

Derivatives – Functions & Uses [3/3]

- Hedging
 - Often used by investors to hedge against potential losses in their portfolio.
 - ✓ For example, an investor may use a futures contract to hedge against a decline in the value of a foreign currency.
- Speculation
 - Also be used for speculation – an investor seeks to profit from changes in the value of the underlying asset.
 - ✓ For example, an investor may enter into an interest rate swap to speculate on changes in interest rates. If the investor expects interest rates to rise, he/she may pay a fixed rate in exchange for receiving a variable rate.
- Arbitrage
 - Derivative contracts can also be used for arbitrage, where an investor seeks to profit from price discrepancies between different markets.
 - ✓ For example, an investor may buy a forward contract on a commodity in one market and sell it in another market where the price is higher.

Forwards/Futures Positions and Value of the Contract [1/3]

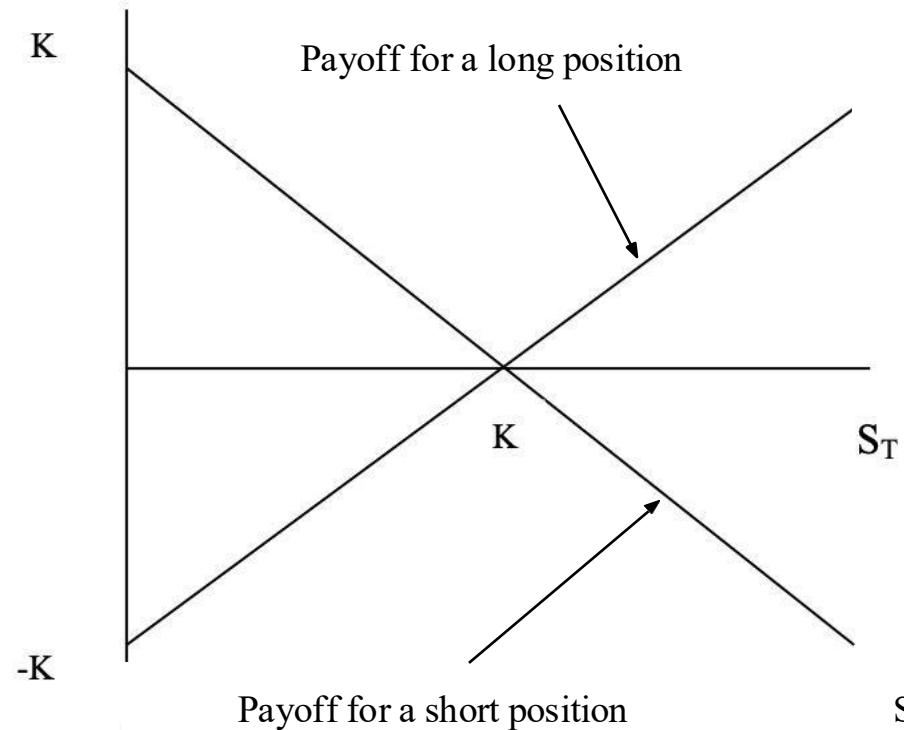
- Long position
 - Agree to buy the underlying asset
- Short position
 - Agree to sell the underlying asset
- Most often, participants are large firms, financial institutions, and governments.
- No cash flow at the beginning
- At maturity, settlement can be made through either delivery of asset or *cash settlement*.
 - NDF (Non-deliverable forward)

Forwards/Futures Positions and Value of the Contract [2/3]

- Suppose an investor enters a futures contract to buy (i.e., long position) 100 shares of a company's stock at a delivery price of \$50 per share (K), with a delivery date of 3 months from now (T).
 - If the market price of the stock rises to \$55 per share (S_T) by the delivery date (T), the investor can buy the shares at the lower delivery price of \$50 per share, and immediately sell them in the market at the higher market price of \$55 per share, resulting in a profit of \$5 per share. For 100 shares, the total profit for long position would be \$500.
- On the other hand, an investor enters a futures contract to sell (i.e., short position) 100 shares of a company's stock at a delivery price of \$50 per share (K), with a delivery date of 3 months from now (T).
 - If the market price of the stock falls to \$40 per share (S_T) by the delivery date (T), the investor can buy the shares at a lower price from the spot market and sell it at a delivery price of \$50 per share. For 100 shares, the total gain would be \$1,000.

In this way, the value of the futures/forward contract is determined by the difference between the delivery price and the current market price of the underlying asset at the time of delivery.

Forwards/Futures Positions and Value of the Contract [3/3]



Long position for a forward/future contract

At time $t = 0$, the long and the short position holders agree that the short will deliver the asset to the long at time T for a price of K .

If the spot price of the underlying asset is S_T at time T .

Value of the contract to the Long at expiration = $S_T - K$.

Value of the contract to the Short at expiration = $K - S_T$.

Payoff diagram of long and short positions in a forward/future contract, where S_T is the spot price and K is the delivery price (forward/future price).

Options – Definition and Types

- A contract promising a right (not an obligation) to sell or buy specified asset(s) at a predetermined price (strike price/exercise price) and conditions.
 - A contract between an option writer (seller) and option buyer
 - A strike price is the fixed price at which the option holder can buy or sell the underlying asset when the option is exercised.
 - An option buyer pays option premium (price) for the right
 - This right will be effective until expiration date (maturity)

Option contracts are of two types –

- Call option
 - A right to buy an asset at the predetermined exercise (strike) price.
- Put option
 - A right to sell an asset at the predetermined exercise (strike) price.

Options vs. Futures/Forwards

Two major differences between purchasing an option and purchasing a future/forward contract –

1. To obtain an option, the purchaser must pay a premium in addition to the price of the financial instrument.
2. Unlike Futures/ Forwards, the owner of an option can choose to let the option expire on the expiration date without exercising it.

Payoff calculation of different options

Net profit of Long position in Call option = $\max(S - K, 0) - p$

Net profit of Short position in Call option = $p - \max(S - K, 0)$

Net profit of Long position in Put option = $\max(K - S, 0) - p$

Net profit of Short position in Put option = $p - \max(K - S, 0)$

Practice problems on Option profit

1. Jia has decided to buy some call options. He made a contact with Ayesha to purchase Square Pharma stock at 1000tk per share within next three months. He paid 30Tk per share for this contact. Sometime before next three months, the price of Square Pharma became 1050Tk per share. How much will be the payoff of Jia?

Answer: $\max(S-K, 0) - p = \max(1050-1000, 0) - 30 = 50 - 30 = 20$

1. In the above scenario, if the price of Square Pharma became 950Tk per share. How much will be the payoff of Ayesha?

Answer: $p - \max(S-K) = 30 - \max(950 - 1000, 0) = 30 - 50 = -20$

Practice problems on Option profit

3. Kailee has bought 1000 put options for 4Tk each. The dealing is that she will sell rice at 50Tk per kg to Philip in next three months. Meantime, by three months the price of rice fell to 45Tk per kg in the market. How much will be the payoff of Kailee?

Answer: Net profit per put option(long position) = $\max(K-S, 0) - p = \max(50-45, 0) - 4 = 5-4 = 1\text{ Tk}$

Total profit = $1000 * 1 = 1000\text{ Tk}$

4. In the above scenario, how much will be the payoff of Kailee?

Answer: Net profit per put option(short position)= $p - \max(K-S, 0) = 4 - \max(50-45, 0) = 4-5 = -1$

Total profit of Kailee = $-1 * 1000 = -1000$

Options – Terms

- American/ European options
 - American option can be exercised at any time up to the expiration date
 - European option can be exercised **only on the expiration date**
- Intrinsic value (Exercise value)
 - The value that could be generated by exercising the option.

Derivatives – Advantages

- Risk management
 - Allows investors to manage various types of risks such as price risk, interest rate risk, currency risk, and more.
- Leverage
 - Can provide higher returns on investment due to their leverage factor – allows investors to control a larger position with a smaller amount of capital. i.e., purchasing options.
- Liquidity
 - Usually, a highly liquid market available – can be easily bought and sold in the market, providing investors with quick access to their funds.
- Hedging
 - Can be used to hedge against adverse market movements, protecting investors from potential losses. i.e., managing risk of rising/declining interest rates through swaps etc.
- Price discovery
 - Can provide valuable information about market expectations and help determine the fair value of underlying assets. i.e., expected changes in foreign currency prices in the future.

Derivatives – Disadvantages

- Complexity
 - Derivative contracts can be complex and difficult to understand, which may lead to confusion and higher risk of losses for inexperienced investors.
- Counterparty risk
 - Derivatives contracts involve counterparty risk, which is the risk that one party may default on their obligation to the other party, leading to potential losses.
- Volatility
 - Derivative contracts can be highly volatile, leading to rapid changes in the value of the contract and potentially significant losses for investors.
- Regulatory risk
 - Derivative contracts are subject to regulatory changes, which can impact the availability and cost of these contracts, as well as the liquidity of the market.
- Market risk
 - Derivative contracts are subject to market risk, which is the risk that the market may move in an unexpected direction, leading to potential losses for investors.

Thanks