

Lecture Note 2: A Brief Summary of Some Common Derivatives

Financial derivatives are contracts with various terms included, and they have uncertain payoffs depending on the outcome of certain specific underlying factors. Central to each derivative are the expiration of the contract (T) and the specified underlying. In contrast to other general contracts, financial derivatives are openly traded either on the exchange, or over-the-counter, and the main drive for investors is the fact that they allow investors to bet, or express opinions, on various factors, since the value of the derivative depends on the specified uncertain factor.

Each derivative contract consists of the following components: the underlying, which must be one or several random variables, the expiration of the contract, and the payoff function that describes how the payoff is calculated based on the underlying value at various times when payments are made, such as the expiration of the derivative.

In the following, we briefly summarize the most common derivatives we discussed so far.

- European call option: the final payoff equals $(S_T - K)^+$ where S_T is the underlying stock price at T , and the strike price K is predetermined when the contract is entered.
- European put option: the final payoff equals $(K - S_T)^+$.
- American call or put: similar to the European version, except that they can be exercised any time before expiration. Most US stock options fall into this category. However, the difference in prices between European and American options is limited and corrections are often available to make up the difference.
- Forward contract: the payoff function is $S_T - K$, where K is the delivery price of the underlying and S_T is the market price of the underlying at time T . The delivery price K is usually chosen such that the value of the contract is zero when it was just entered, to make the contract look "fair" to both parties. This quote of K is called the forward or the futures price for the particular expiration, and it will fluctuate as market conditions change. As the forward/futures price moves up and down, the value of your existing contract is no longer zero, since you would have obtained a new quote for K if you had started a new contract on the same underlying with the same expiration. It is very important to watch for both the spot (market) price and futures price moves if you have an interest in certain commodity, such as oil.
- CDS: this is quite different from the above examples, with exchanges of payments between the counter parties depending on whether the default event has been actually triggered. However, the contract can have fluctuating values, depending on the market's outlook concerning the financial health of the underlying entity in question. The valuation, as we see, is rather determined by a series of changing default

probabilities, which are also random. CDS contracts can be viewed as derivatives on the random default probabilities to the point that actual default events play a secondary role.