

## 6. Futures, Options, and Derivatives

### Forward Contracts

A forward contract is a personalized contract between two parties buying or selling an asset on a future date at a defined price. For hedging or speculation, a forward contract might be used, although its unstandardized nature makes it particularly suitable for hedging.

#### Positions in forward contracts

Forward contracts may be used to lock in a future price to avoid market fluctuations and volatility. The party that purchases a forward contract is in a long position and the party that sells a forward contract is in a short position. The long position gains if the price of the underlying asset rises. The short position gains if the underlying asset price declines.

### Futures contracts

A futures contract is a legal arrangement in the future to buy or sell a certain commodity asset, or security at a fixed price at a given date. In order to promote trading on a futures market, future contracts are structured for quantity and quality. Once the futures contract expires, the holder of a futures contract takes on the responsibility to purchase and receive the underlying asset. At the expiry date, the seller of the futures contract assumes the obligation to provide and deliver the underlying asset.

### OTC versus Exchange

The over-the-counter/exchange-based distinction is often applied to the market as a whole, meaning the notion of 'a commodity market' is discarded in favor of typifying the forward market as an OTC market and the futures market as an exchange-based market. The demand for futures is much more structured and practical than the demand forwards. It is composed of the different exchanges selling futures contracts, and also the participants and potential participants dealt with by the exchange. While the forward market is a network of distributed counter - parties and potential market participants.

So, what are the consequences of not communicating directly with a counterparty, and interacting instead with the exchange that actually binds you to a counterparty? We've already seen a negative assumption is that one can't expect the exchange to give and of its counter - parties customized contracts (especially because it wants it to cancel long and short positions exactly). Two important consequences of traded futures, nevertheless, are that they have stronger credit risk and liquidity characteristics than before, although we are not quite prepared to clarify the specifics of those features.

## Vanilla Option

A vanilla option is a financial instrument that offers the ability to buy or sell an underlying asset at a predetermined price within a given timeframe, but not the obligation. A Vanilla choice is an alternative to call or place with no special or uncommon features. When exchanged on an exchange such as the Chicago Board Options Exchange, these options are standardized.

## The Functions and Risks of Derivatives

### Hedging and speculation through options

Speculators and hedgers are words that define both traders and investors. Speculation involves attempting to make a profit from the price change of a security, while hedging aims to reduce the amount of risk, or uncertainty, associated with a price change of a security.

Hedging means taking a position in a derivative to cover any gains and losses to the investment product. Hedging seeks to remove the uncertainty associated with an asset's price by taking offset positions against what the investor already has. On the other hand, the main purpose of speculation is to profit from betting on the direction an asset is going to move in.

### Risk in derivatives markets

#### Credit risk

Credit risk is basically a perception by the public of a company's default likelihood. Investors who own a company's debt are exposed to credit risk.

'Credit default swaps' (CDS) provide protection against financial default by allowing creditors to take a bet on a corporate bond issuer's default risk.

An investor may own a CDS which refers to a single bond or a multiple bond index. Consider an investment scheme which owns a large portfolio of corporate investment grade bonds. The fund manager expects financial conditions will deteriorate and corporate-default risk will rise in the short term.

#### Liquidity risk

Liquidity risk is the potential that an asset cannot be quickly transformed to cash – and this can also be important for derivatives, in particular long-term derivative pay-off contracts. Over-the-counter derivatives are hard to liquidate since they require a deal with a particular counterparty — you can't simply terminate a contract unless the counterparty agrees to.

### Valuing Derivatives

Derivative valuations are defined by three components: future cash flows, current value and the valuation model used. "The first element you need to determine is what you know, and what you do not know," said Wiggins. "Derivatives are typically a mixture of defined cash flows, and what still needs to be calculated."

"Before the credit crisis, expectations we had in valuation do not really hold," Wiggins said. In spite of the global financial crisis, valuation models have made progress. It is a result of changes in the way the institutions think about risk. As ingredients of valuation, Wiggins listed market data, contract terms, counterparty information and legal agreements.

Particular focus is now placed on counterparty credit risk. Entities will attempt to quantify the probability and effect of defaulting counterparties. This has led to an increase collateralization by utilizing margins as a way of alleviating risk. Bilateral annexes to credit support and central counterparty cleaning up are two types of collateralization that provide protection against counterparty defaults, but these can affect liquidity. Unsecured interbank loans are now heavily limited and what's left comes at even higher rates. Wiggins suggested thinking of the value as risk-free and instead putting the risk back in when assessing valuation. Overnight index swap discounting is used for risk-free rate calculation.

Consider a long way forward at the time of maturity, which provides a payoff

$$S_T - K$$

## The Black Scholes Model

The Black Scholes model, also referred to as the Black-Scholes-Merton (BSM) model, is a mathematical model for contracting an option. Particularly the model calculates the variability of financial instruments over time. It means that certain instruments (such as futures or stocks) will have a lognormal price distribution. The equation derives the price of an option call using this assumption and factoring in other important variables.

$$C = S_t N(d_1) - K e^{-rt} N(d_2)$$

$$d_1 = \frac{\ln \frac{S_t}{K} + (r + \frac{\sigma_s^2}{2})t}{\sigma_s \sqrt{t}} \text{ and}$$

$$d_2 = d_1 - \sigma_s \sqrt{t}$$

where:

- $C$ =Call option price
- $S$ =Current stock (or other underlying) price
- $K$ =Strike price
- $r$ =Risk-free interest rate
- $t$ =Time to maturity
- $N$ =A normal distribution

The Black-Scholes-Merton model is a statistical model of financial derivative markets from which the Black-Scholes formula could be derived, often simply called the Black-Scholes model. The formula measures call rates and put options. It originally priced European options and became the first commonly supported mathematical valuation options formula. Others credit this model for the large rise in trading options, and call it a big influence in modern financial valuation.

The formula for a call option is:

$$S_t \Phi \left( \frac{\ln \left( \frac{S_t}{K} \right) + \left( r + \frac{\sigma^2}{2} \right) (T - t)}{\sigma \sqrt{(T - t)}} \right) - X e^{-r(T-t)} \Phi \left( \frac{\ln \left( \frac{S_t}{K} \right) + \left( r - \frac{\sigma^2}{2} \right) (T - t)}{\sigma \sqrt{(T - t)}} \right)$$

The formula for a put option is:

$$X e^{-r(T-t)} \Phi \left( - \frac{\ln \left( \frac{S_t}{K} \right) + \left( r - \frac{\sigma^2}{2} \right) (T - t)}{\sigma \sqrt{(T - t)}} \right) - S_t \Phi \left( - \frac{\ln \left( \frac{S_t}{K} \right) + \left( r + \frac{\sigma^2}{2} \right) (T - t)}{\sigma \sqrt{(T - t)}} \right)$$

To sum up, it is a critical point to know the general meanings and uses of derivatives, as well as the distinctions among them. As we have shown when such derivatives are used correctly may help minimize risk, but when used incorrectly you can be exposed to unnecessary risk. Thus, it is crucial to understand the specific features of the assets as well as instruments, as well as how such features relate to the risks involved and methods of assessment of each.

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