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DERIVATIVE INSTRUMENTS: CONCEPTS AND DEFINITIONS

1.1 KEY DERIVATIVE INSTRUMENTS DEFINITIONS

Forwards and Futures A forward contract is a contract between two parties. It states that one of the two parties is to buy something from the other at a later date at a price agreed upon today.

A futures contract is also a contract between two parties. One party is bound to buy something from the other at a later date at a price agreed upon today, subject to a daily settlement of gains and losses and guaranteed against the risk that either party might default.

Swaps A swap is a contract in which two parties agree to exchange a series of cash flows at predetermined dates over a period of time.

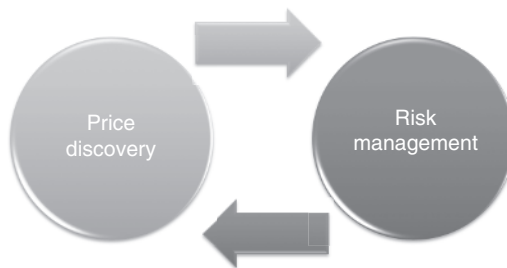
Options Options are contracts made between two parties that give one party, the buyer, the right to buy or sell an asset from or to the other party, the seller, at a later date and price agreed upon today.

Positions All derivative contracts have essentially two basic positions: long and short. Long position refers to buying, whereas short position refers to selling. The exact positions, rights, and obligations stemming from them differ for different types of financial derivatives.

1.2 THE ROLE, RISKS, AND BENEFITS OF DERIVATIVES MARKETS

Derivative instruments are securities that derive their value from an underlying asset. They offer investors global diversification in financial instruments and currencies, and promise to generate returns that are superior to traditional investments. Investors in derivatives can profit from changes in interest rates and equity markets around the world, currency exchange rate shifts, and changes in global supply and demand for various types of commodities such as precious and industrial metals, oil, and grains.

There are two widely recognized benefits of derivative instruments: price discovery and risk management.



Price Discovery How do we determine prices? Prices depend on a continuous flow of information from around the world and require the highest possible degree of transparency. A broad range of various elements constantly have an impact on supply and demand for assets. Information flow concerning political situations, climatic and environmental conditions, debt situation, and societal behavioral patterns constantly impacts the price of a commodity, such as wheat, soybeans, and oil. This process is known as price discovery.

Futures markets in particular are a useful tool to help discover prices. Futures markets are considered a primary means for determining the spot price of an asset. The futures market is more active than the spot market; hence, information taken from it is often considered more reliable. Futures markets'

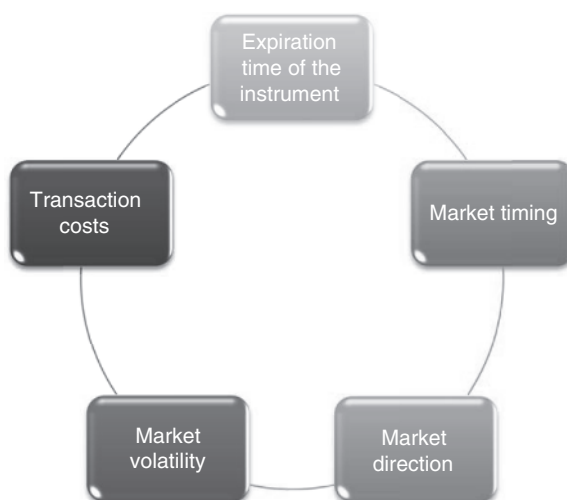
underlying assets can be geographically quite dispersed and hence have more than one spot price in existence. The price of the contract with the shortest time to expiration often serves as a proxy for the underlying spot price of an asset.

Options are also relevant in price discovery, mostly in the way the market participants view markets' volatility. If investors think that the markets will be volatile, the option premiums (i.e., their purchase prices) will spike higher.

Risk Management Companies and investors today use derivatives as tools in their strategies designed to enable them to manage risk exposures more effectively. Risk management is about both hedging and speculation. At times, investors want to increase their risk exposure to gain greater expected return. At other times, investors will want to protect themselves from undesirable risk exposure. Risk management has a very important purpose for the derivatives market. It is essentially the process of recognizing the desired level of risk, detecting the actual level of risk, and altering the actual to equal the desired.

Derivative securities represent additional risks to investors. Many of those risks are heightened by investors perhaps not fully understanding the proper use of said instruments. For example, options offer the potential for vast gains and losses. While the potential for gain is appealing, their complexity makes them suitable for only sophisticated investors with a high degree of risk tolerance.

Professional traders and money managers can use derivatives effectively. They are aware and trained to work with risk exposures stemming from (1) expiration time of the instrument, (2) market timing, (3) market direction, (4) market volatility, and (5) transaction costs.



Derivative instruments have expiration dates. As each day passes, the expiration date approaches and investors lose more and more “time value”. In the case of options, that alone makes an option’s value decrease. In order to make money with most derivatives, investors need to accurately predict the direction in which the market will move. It is also very beneficial if they can predict the extent of the move within a specific amount of time.

Operational Advantages Derivative securities are associated with a number of operational advantages. They offer lower transaction costs and greater liquidity. They are generally easier to sell short and contribute to increasing market efficiency.

Criticisms It probably comes as no surprise that derivative instruments have been linked with periods of financial distress. Unlike financial markets, derivatives markets neither create nor destroy wealth—they merely provide means to transfer risk. Additionally, they enable speculation and as a result are often compared with gambling. They also enable greater leverage, which we’ll see more clearly in the following chapters.

1.3 ARBITRAGE

Spot prices for the exact same commodities may vary around the world according to the place of trading. This represents an arbitrage opportunity. It exists whenever similar assets are sold at different price levels. This opportunity allows an investor to realize a profit with zero risk and, at times, limited funds, by selling the asset in the high-priced market and simultaneously buying it in the inexpensive market. Investors will continue buying and selling until the asset price reaches an equilibrium in both markets. This process of achieving equilibrium through buying and selling is referred to as the *Law of One Price*. In reality, fairly efficient markets have very little to no arbitrage opportunities. If they do, market participants quickly eliminate them.

Case Study 1.3-1

Suppose that on NYMEX crude oil is trading at \$65/barrel and on another exchange (B) oil is trading at \$70/barrel.

If you buy crude oil on NYMEX and simultaneously sell it on another exchange, you can net a profit of \$5 without any risk or any outlay of cash. As

people continue to buy on NYMEX, the price of crude will increase and all of the selling of oil on exchange B will force the price down. This will continue until equilibrium is reached. At equilibrium, the market is efficient. Thus, this is how arbitrage works to make the marketplace more efficient.

Problems

- 1.3-1.** How can market participants eliminate arbitrage opportunities? Discuss the effect of arbitrage on market efficiency.

1.4 MISCELLANEOUS

Short Selling Short selling refers to a strategy where an investor is selling an asset that he/she doesn't own. The investor anticipates the asset price falling and wants to take an advantage of the price difference. In order to sell something we don't own, we have to temporarily borrow it. Thus, we borrow the asset from a broker, with a promise to deliver the shares back to him at a later date. When we decide to close out the position, we buy back the underlying asset, hopefully for less than what we sold it for. That way we can unwind the debt to the broker and realize a gain.

Repos In repurchase agreements (repos), the seller agrees to sell an asset to a buyer and repurchase the asset sometime in the future for an agreed upon price (higher than the sell price). Repos are used as a way to borrow (usually short term) at a relatively low cost. The underlying asset serves as collateral.

Discount Factor Calculations in Different Markets

Notation

$B(t, T)$	Discount factor
T	Maturity time
t	Any time prior to maturity time
r	Interest rate (i.e., yield)

1. Bond equivalent yield (U.S. bond markets)

Equation 1.1 : Discount factor calculation in the U.S. bond market

$$B(t, T) = \frac{1}{(1 + r)^{(T-t)/360}}$$

2. Money market yield (money markets)

Equation 1.2 : Discount factor calculation in the money market:
add-on method

$$B(t, T) = \frac{1}{\left(1 + r \left(\frac{T-t}{360}\right)\right)}$$

3. Discount rates (commercial paper and treasury bill markets)

Equation 1.3 : Discount factor calculation for the T-bill market:
discount method

$$B(t, T) = 1 - r \left(\frac{T-t}{360}\right)$$

Eurodollar Time Deposits Eurodollar time deposits are deposits held outside of the United States but denominated in U.S. dollars. They are time deposits denominated in USD held either with a foreign bank or with a subsidiary of a U.S. bank.

They have the “Euro” part in the name because they refer to deposits that were in the past held mostly by European banks, and thus became known as “Eurodollars.” Now they are part of the enormous global foreign exchange market. In 2006, China became the largest holder of foreign exchange reserves and most of those reserves are denominated in U.S. currency. Today, such deposits continue to be referred to as “Eurodollars,” regardless of the location.

Thus, Eurodollars are short-term obligations to pay dollars and they are obligations of banking offices located outside the United States. Eurodollar time deposits are designed for corporate, commercial, institutional, and high-net-worth investors who want a short-term, high-yield money market investment.

The interest paid for these dollar deposits is generally higher than that for funds deposited in U.S. banks because the foreign banks are riskier—they will not be supported by the U.S. government upon default. Furthermore, they may pay higher rates of interest because they are not regulated by the U.S. government. They are backed by the full faith and credit of the local domestic bank and are issued by its offshore branch.

Libor Libor, which stands for London Interbank Offered Rate, is the interest rate paid on interbank deposits in the international money markets (also called the Eurocurrency markets). Because Eurocurrency deposits priced at Libor are almost continually traded in highly liquid markets, Libor is commonly used as a benchmark for short-term interest rates in setting loan and deposit rates and as the floating rate on an interest rate swap. It's considered one of the most important barometers of the international cost of money. Libor is quoted on a one-month, three-month, six-month, or yearly basis.

Euribor Euribor (Euro Interbank Offered Rate) is similar to Libor, except it uses euros and euro deposits in the lending and borrowing between banks, instead of dollars. Euribor is the rate at which euro interbank term deposits are offered by one bank to another. It is compiled in Frankfurt, Germany, and published by the European Central Bank. Euribor is the benchmark rate of the large euro money market and is sponsored by the European Banking Federation, which represents the interests of 4500 banks in 24 Member States of the European Union and in Iceland, Norway, and Switzerland. The choice of banks quoting for Euribor is based on a number of market criteria, but all banks are selected to ensure that the diversity of the euro money market is adequately reflected, thereby making Euribor an efficient and representative benchmark.

Treasury Bond Contracts Treasury bond contract is a contract based on the delivery of a U.S. Treasury bond with any coupon and at least 15 years to maturity. There are many different bonds that fit the above description. To give some type of standardization, the markets use a conversion factor to achieve a hypothetical bond with a 6% coupon. Because bond prices do not move in a linear fashion, there is a chance to use arbitrage to capitalize on the deviance of a bond when compared with the 6% standardized bond. To do this, traders look for the cheapest to deliver bond (CTD). This is the least expensive underlying product that can be delivered upon expiry to satisfy the requirements of a derivative contract. The CTD bond is always changing because prices and yields are always changing.

Problems

- 1.4-1. Suppose $r = 2.5\%$, and there are 36 days left to maturity of an instrument. Please calculate the appropriate discount factor if this instrument is

- a.** Treasury bond;
- b.** money market instrument;
- c.** T-bill.

1.4-2. Please discuss the difference between Libor and Euribor.

1.4-3. What are repos?

1.4-4. How can you make gains short-selling assets? Please discuss.