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# Hedging with Financial Derivatives

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# Hedging

- Financial derivatives are so effective in reducing risk because they enable financial institutions to **hedge**
  - Engage, in financial transaction that reduces or eliminates risk
- If a financial institution has bought an asset, it is said to have taken a **long position**
  - And this exposes the institution to risk if the returns on the asset are uncertain
- On the other hand, if it sold an asset that it has agreed to deliver to another party at a future date, it is said to have taken a **short position**
  - and this can also expose the institution to risk

# Hedging

- Financial derivatives can be used to reduce risk by invoking the following basic principle of hedging
  - Hedging risk involves engaging in a financial transaction that **offsets a long position** by taking an additional **short position**, or **offsets a short position** by taking an additional **long position**
    - If a financial institution **has bought a security** and has therefore **taken a long position**, it conducts a hedge by **contracting to sell that security** – take a short position at some future date
    - Alternatively, if it has **taken a short position** by **selling a security that it needs to deliver** at a future date, then it conducts a hedge by **contracting to buy that security** – take a long position at a future date

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# Forward Markets

- Forward contracts are agreements by two parties to engage in a financial transaction at a future – forward point in time
    - Interest-rate forward contracts
    - Forward contracts for foreign currencies
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# Interest-Rate Forward Contracts

- Interest-rate forward contracts involve the **future sale or purchase of a debt instrument** and have several dimensions
    - **Specification** of the actual debt instrument that will be delivered at the future date
    - **Amount** of the debt instrument to be delivered
    - **Price** – interest rate on the debt instrument when it is delivered
    - **Date** on which delivery will take place
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# Interest-Rate Forward Contracts

- An example of an interest-rate forward contract
  - Agreement for the First National Bank to sell to the Rock Solid Insurance Company, one year from today, \$5 million face value of the 6s of 2029 Treasury bonds
    - coupon bonds with a 6% coupon rate that mature in 2029 at a price that yields the same interest rate on these bonds at today's, say 6%.
    - Rock Solid will buy the security at a future date – long position
    - The First National Bank will sell the security a future date – short position
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# Interest-Rate Forward Contracts

- The First National Bank have previously bought \$5 million of the 6s of 2029 Treasury bonds, which currently sell at par value and so their yield to maturity is 6%
  - Because these are long-term bonds you recognize that you are exposed to substantial interest-rate risk and worry that if interest rates rise in the future, the price of these bonds will be fall
    - How to hedge a risk?
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# Interest-Rate Forward Contracts

- Knowing the basic principle of hedging, you see that your long position in these bonds must be offset by an equal short position for the same bonds with a forward contract
  - That is, you need to contract to sell these bonds at a future date at the current par value price
  - As a result, you agree with another party, in this case, Rock Solid Insurance Company, to sell them the \$5 million of the 6s of 2029 Treasury bonds at par value one year from today
  - By entering into this forward contract, you have locked in the future price and so have eliminated the price risk First National Bank faces from interest-rate changes
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# Interest-Rate Forward Contracts

- Why would the Rock Solid Insurance Company want to enter into the forward contract with the First National Bank?
    - Rock Solid Insurance Company expects to receive premiums of \$5 million in one year's time that it will want to invest in the 6s of 2029 but worries that interest rates on these bonds will decline now and next year
    - By using the forward contract, it is able to lock in the 6% interest rates on the Treasury bonds
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# Pros and Cons of Forward Contracts

- The advantage of forward contracts is that they can be **flexible** as the parties involved in want to be
  - However, forward contracts suffer from two problems that severely limit their usefulness
    - The first is that it may be **very hard** for an institution **to find another party** – counterparty to **make the contract with**
      - There are brokers to facilitate the matching up of parties
      - But this mean that it may prove **impossible to find a counterparty** when a financial institution want to make a specific type of forward contract
      - Furthermore, even if the institution finds a counterparty, **it may not get as high a price as it wants** because there may not be anyone else to make the deal with
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# Pros and Cons of Forward Contracts

- A serious problem for the market in interest-rate forward contract, then, is that it may be difficult to make the financial transaction of that it will have to be made at a disadvantage price
  - This market suffers from a **lack of liquidity**
  - The second problem with forward contracts is that they are subject to **default risk**
    - The presence of default risk in forward contracts means that parties to these contracts must check each other out to be sure that the counterparty is both **financial sound** and likely **to be honest and live up to its contractual obligations**
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# Pros and Cons of Forward Contracts

- Because this is a costly process and because all the adverse selection and moral hazard problems
    - Default risk is a major barrier to the use of interest-rate forward contracts
    - When the default risk is combined with a lack of liquidity, we see that these contracts may be of **limited usefulness** to financial institutions
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# Financial Futures Markets

- Given the default risk and liquidity problems in the interest-rate forward market, another solution to hedging interest-rate risk was needed
  - This solution was provided by development of financial futures contracts by the Chicago Board of Trade starting in 1975
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# Financial Futures Contracts

- A financial futures contract is similar to an interest-rate forward contract in that it is **specified that a financial instrument must be delivered by one party to another on a stated future date**
    - However, it differs from an interest-rate forward contract in several ways that overcome some of the liquidity and default problem of forward markets
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# Financial Futures Contracts

- To understand what financial futures contracts are all about, let's look at one of the most widely traded futures contracts, that for Treasury bonds, which are traded on the Chicago Board of Trade
  - The contract value is for \$100.000 face value of bonds



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# Financial Futures Contracts

- This contract specifies that the bonds to be delivered must have at least 15 years to maturity at the delivery date
  - If the **Treasury bonds delivered** to settle the future contract have a **coupon rate different from the 6%** specified in the future contract, the amount of bonds to be delivered is adjusted to reflect the difference in the value between the delivered bonds and the 6% coupon bond
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# Financial Futures Contracts

- In line with the terminology used for forward contracts, parties who have bought a future contract and thereby agreed to buy of the bond are said to have taken a long position
  - Parties who have sold a future contract and thereby agreed to sell – deliver bonds have taken a short position
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# Financial Futures Contracts

- Let's consider what happens when you buy or sell one of these Treasury bond futures contracts
  - On February 1, you sell one \$100.000 June contract at a price of 115 (that is \$115.000)
  - By selling this contract, you agree to deliver \$100.000 face value of the long-term Treasury bonds to the contract's counterparty at the end of June for \$115.000
  - By buying the contract at a price of 115, the buyer has agreed to pay \$115.000 for the \$100.000 face value of bonds when you deliver the, at the end of June
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# Financial Futures Contracts

- If **interest rates** on long-term bonds **rise** so that when the contract mature at the end of June **the price of these bonds has fallen** to 110 (\$110.000 per \$100.000 of face value), the **buyer of the contract** will have **lost \$5.000** because he paid \$115.000 for the bonds but he can sell them only for the market price of \$110.000
  - But you **the seller of the contract**, will have **gained \$5.000** because **you can now sell the bonds to the buyer for \$115.000** but **have to pay only \$110.000** for them in the market
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# Financial Futures Contracts

- It is even easier to describe what happens to the parties who have sold futures contracts if we recognize the following fact:
    - At the expiration date of future contract, the price of the contract converges to the price of the underlying asset to be delivered
  - On the expiration date of the June contract at the end of June, when the price of the underlying \$100.000 face value Treasury bond is 110 (\$110.000)
    - If the futures contract is selling below 110, say, at 109
      - A trader can buy the contract for \$109.000, take delivery of the bond, and immediately sell it for \$110.000, thereby earning a quit profit of \$1.000
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# Financial Futures Contracts

- Because this profit involves no risk, it is a great deal that everyone would like to get it on
  - That means that everyone will try to buy the contract, and as a result, its price will rise
  - Only when the price rises to 110 will the profit opportunity cease to exist and the buyer pressure disappear
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# Financial Futures Contracts

- Conversely, if the price of the futures contract is above 110, say at 111, everyone will want to sell the contract
  - Now the sellers get \$111.000 from selling the futures contract but have to pay only \$110.000 for the Treasury bonds that they must deliver to the buyer of the contract
    - \$1.000 difference is their profit
    - Because this profit involves no risk, traders will continue to sell the futures contract until its price falls back down to 110, at which price there are no longer any profits to be made
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# Financial Futures Contracts

- The elimination of riskless profit opportunities in the futures market is referred to as **arbitrage**, and it guarantees that the price of a futures contract at expiration equals the price of the underlying asset to be delivered
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# Financial Futures Contracts

- Armed with the fact that a futures contract at expiration equals the price of the underlying asset, it is even easier to see who profits and loses from such a contract when interest rates change
  - When **interest rates have risen** so that the **price of the Treasury bond is 110** on the expiration day at the end of June, the June Treasury bond **futures contract will also have a price of 110**
  - Thus, **if you bought the contract for 115 in February**, you have a **loss of 5 points**, or \$5.000 (5% of \$100.000)
  - But if you **sold the futures contract at 115 in February**, the decline in price to 110 means that **you have a profit of 5 points, or \$5.000**



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# Financial Futures Contracts

- The hedge just described is called a **micro hedge**
    - Because the financial institution is hedging the interest rate risk for a specific asset it is holding
  - A second type of hedge that financial institution engage in is called a **macro hedge**
    - In which the hedge is for institution's entire portfolio
    - E.g., if a bank has more rate-sensitive liabilities than assets
      - By **selling interest-rate future contracts** that will yield a profit **when interest rate rise**, the bank can **offset the losses on its overall portfolio** from an interest-rate rise and thereby hedge its interest-rate risk
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# Organization of Trading in Financial Futures Markets

- Financial futures contracts are traded **on organized exchanges** such as the Chicago Board of Trade, the Chicago Mercantile Exchange, the New York Futures Exchange, etc
  - These exchanges are highly competitive with one to another, and each organization tries to design contracts and set of rules that will increase the amount of futures trading on its exchange
  - The futures exchanges and all trades in financial futures in the U.S. are regulated by the Commodity Futures Trading Commission CFTC, which was created in 1974 to take over the regulatory responsibilities for futures markets from the Department of Agriculture
    - The CFTC oversees futures trading and the futures exchanges to ensure that prices on the market are not manipulated
    - In addition, the CFTC approves proposed futures contracts to make sure that they serve to public interest
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# Globalization on Financial Futures Market

- Because American futures exchanges were the first to develop financial futures, they dominated the trading of financial futures in the early the 1980's
  - With rapid growth of financial futures markets and the resulting high profits made by American exchanges, foreign exchanges saw a profit opportunity and began to enter this business
    - By the 1990's, Eurodollar contracts traded on the London International Financial Futures Exchange
    - Japanese government bond contracts and Euroyen contracts traded on the Tokyo Stock Exchange, etc.
    - Even developing countries are getting into the act.
      - In 1996, seven developing countries also referred as a emerging market countries established futures exchanges
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# Globalization on Financial Futures Market

- Foreign competition has also knockoffs of the most popular financial futures contracts initially developed in the U.S.
  - These contracts traded on foreign exchanges are virtually identical to those traded in the U.S. and have an advantage that they can be traded when the American exchanges are closed
  - The movement to 24-hour-a-day trading in financial futures had been further stimulated by the development of the GLOBEX – electronic trading platform, that allows traders throughout the world to trade futures even when the exchanges are not officially open
  - Financial futures trading has thus become completely international
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# Explaining the Success of Futures Markets

- Several features of futures contracts were designed to **overcome the liquidity problem** inherent in forward contracts
  - In contrast to forward contracts, the **quantities delivered and the delivery dates** of futures contracts are **standardized**
    - Making more likely that different parties can be matched up in the futures market, thereby increasing the liquidity of the market
  - After the futures contract **has been bought or sold, it can be traded – sold or bought again** at any time until the delivery date
  - Trading on the futures market has been organized differently from trading on forward markets to overcome the default risk problems arising in forward contracts

# Explaining the Success of Futures Markets

- In both types, for every contract there must be a buyer who is taking a long position and a seller who is taking a short position
- However, the buyer and seller of a futures contract **make their contract not with each other but with the clearing house associated with the futures exchange**
  - This setup means that the buyer of the futures contract does not need to worry about the financial health of the seller and vice versa, as in the forward market
  - As long as the clearing house is financially solid. Buyers and sellers of futures contracts do not have to worry about default risk

# Explaining the Success of Futures Markets

- To make sure that the clearing house is financially sound and does not run into financial difficulties that might jeopardize its contracts, buyers or sellers of futures contracts must put an initial deposit, called a **margin requirement**
- Futures contracts are then **marked to market** every day
  - At the end of every trading day, the change in the value of the futures contracts is added to or subtracted from the margin account
  - If the amount in this margin account falls below the maintenance margin requirement, the trader is required to add money to the account

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# Stock Index Futures

- As we have seen, financial futures markets can be used in hedging interest-rate risk
    - Financial institution managers, particularly those who manage e.g. mutual funds or pension funds, or insurance companies also worry about stock market risk
      - Risk that occurs because stock prices fluctuate
  - Stock index futures were developed in 1982 to meet the need to manage stock market risk, and they have become among the most widely traded of all futures contracts
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# Stock Index Futures

- To understand stock index futures contracts, let's look at the Standard & Poor's 500 Index futures contract
    - The most widely traded stock index futures contract in the U.S.
  - Stock index futures contract differ from most other financial futures contracts in that they are settled with a cash delivery rather than with the delivery of a security
    - Cash settlement gives these contracts the advantage of a high degree of liquidity
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# Stock Index Futures

- In the case of the S&P 500 Index contract, at the final settlement date, the cash delivery due is \$250 times the index
    - So if the is at \$1.000 on the final settlement date, \$250.000 would be the amount due
  - Let's look at what happens when you buy or sell this futures contract
  - Suppose that on February 1, you sell on one June contract at a price at \$1.000 (that is \$250.000)
  - By selling the contract, you agree to a delivery amount due of \$250 times the S&P 500 Index on the expiration date at the end of June
  - By buying this contract at the price \$1.000, the buyer has agreed to pay \$250.000 for the delivery amount due of \$250 times the S&P 500 Index at expiration date at the end of June
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# Stock Index Futures

- If the stock market falls so that the S&P 500 Index decline to 900 on the expiration date, the buyer of this contract will have the lost \$25.000 because he agreed to pay \$250.000 for the contract but has a delivery amount due of \$250.000 ( $900 * \$250$ )
  - But you, the seller of the contract will have a profit of \$25.000 because you agreed to receive a \$250.000 purchase price for the contract but the delivery amount due of only \$225.000.
    - Because the amount payable and due are netted out, only \$25.0000 will change hands, you the seller of the contract receive \$25.000 from the buyer
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# Summary

- Interest-rate forward contracts, which are an agreement to sell a debt instrument at a future (forward) point in time, can be used to hedge interest rate risk
    - The advantage of forward contract is that it is flexible
    - Disadvantages are that they are the subject of default risk and their market is illiquid
  - A financial futures contract is similar to forward contract
    - However, it has advantages over a forward contract in that it is not subject to default risk and is more liquid
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# Summary

- Stock index futures are financial futures whose underlying financial instrument is a stock market index like S&P 500 Index
    - Stock index futures can be used to hedge stock market risk by reducing systematic risk in portfolios or by locking in stock prices
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Thank you for your attention

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