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Investment Analysis & Portfolio Management

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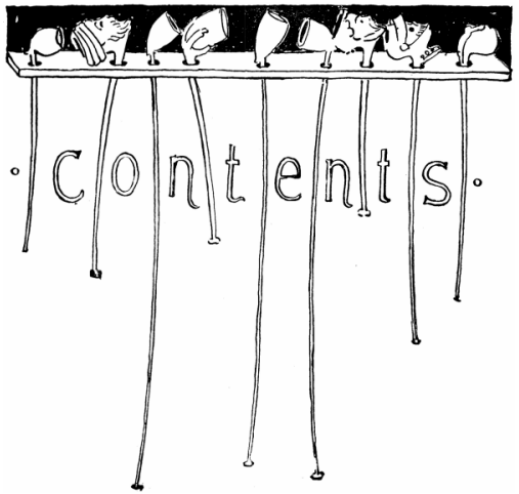
Lecture 5

Futures contracts

Discussion topics

- Futures contract contracts
  - Nature of a futures contract
  - Types of futures
  - Generic pricing and valuation of a futures contract
  - Pricing stock index futures
  - Pricing currency futures



Readings

- CFA Program Curriculum 2015 - Level II – Volume 6: Derivatives and Portfolio Management.
  - Reading 48
- Don M. Chance and Robert Brooks, *An Introduction to Derivatives and Risk Management,* 9th Edition, 2013, Thomson.
  - Chapters 8-9

Futures contracts

- Definition
  - Like a forward contract, a futures contract is an agreement between two parties in which one party, the buyer, agrees to buy from the other party, the seller, an underlying asset or other derivative, at a future date at a price agreed on today.

Futures contracts

- Important features
  - Unlike a forward contract, however, a futures contract is not a private and customized transaction but rather a public transaction that takes place on an organized futures exchange.
  - A futures contract is standardized.
    - The exchange, rather than the individual parties, sets the terms and conditions, with the exception of price.
    - As a consequence, futures contracts have a secondary market, meaning that previously created contracts can be traded.

Futures contracts

- Important features
  - Parties to futures contracts are guaranteed against credit losses resulting from the counterparty's inability to pay.
    - A clearinghouse, which is a division or subsidiary of the futures exchange, provides this guarantee via a procedure in which it converts gains and losses that accrue on a daily basis into actual cash gains and losses.
  - Futures contracts are regulated at the federal government level, whereas forward contracts are essentially unregulated.

Futures contracts

- Important features
  - Futures contracts are created on organized trading facilities referred to as futures exchange., whereas forward contracts are not created in any specific location but rather initiated between any two parties who wish to enter into such a contract.

Futures contracts

- Futures transaction before expiration
  - The long agrees to buy the underlying from the short at a later date, the expiration, at a price agreed on at the start of the contract.
  - Every day, the futures contract trades in the market and its price changes in response to new information.
  - Buyers benefit from price increases, and sellers benefit from price decreases.

Futures contracts

- At expiration
  - The contract terminates and no future trading takes place.
  - Either the buyer takes delivery of the underlying from the seller, or the two parties makes and equivalent cash settlement.

Public standardized transactions

- Forwards are private contracts
  - The parties do not publically report that they have engaged in the contract.
  - The two parties establish all of the terms of the contract, including the identity of the underlying, the expiration date, and the manner in which the contract is settled (cash or actual delivery), as well as the price.

Public standardized transactions

- Futures are public standardized contracts
  - Futures transaction is reported to futures exchange, the clearinghouse, and at least one regulatory agency.
  - The price of a futures contract is the only term established by the two parties; the exchange establishes all other terms.
    - The terms established by the exchange are standardized meaning that the exchange selects a number of choices for underlyings, expiration dates, contract size, and a variety of other contract-specific items

Public standardized transactions

- The exchange also determines what hours of the day trading takes place and at what physical location on the exchange the contract will be traded.
  - Trading pit
    - A trading floor, where traders enter and express their willingness to buy/sell by calling out and/or indicating by hand signals their bids and offers.
  - Electronic trading
    - Trading takes place on computer terminals, generally located in companies' offices.

Homogenization and liquidity

- By creating contracts with generally accepted terms, the exchange standardizes the instrument.
  - Making it more acceptable to a broader group of participants allows the instrument to be more easily traded in a type of secondary market.

Homogenization and liquidity

- A futures contract is said to have liquidity in contrast to a forward contract.
  - Futures contracts previously purchased can be sold.
  - This allows participants in the futures market to offset position before expiration, thereby obtaining exposure to price movements in the underlying without the actual requirement of holding the position to expiration.

Clearinghouse & daily settlement

- Futures exchange guarantees to each party the performance of the other party, through a mechanism known as the clearinghouse.
  - The clearinghouse ensures that the money from the party owing the greater amount will be paid to the other party.
  - In contrast, each party to a forward contract assumes the risk that the other party will default.

Clearinghouse & daily settlement

- Daily settlement or marking to market
  - Gains and losses on each party's position are credited and charged on a daily basis.
  - This is equivalent to terminating a contract at the end of each day and reopening it the next day at the resettlement price.
    - i.e., a futures contract is like a strategy of opening up a forward contract, closing it one day later, opening up a new contract, closing it one day later, and continuing in that manner until expiration.

Regulation

- In most countries, futures contract are regulated at the federal government level.
  - In the US, the Commodity Futures Trading Commission regulates the future market.
  - In the UK, the Financial Services Authority regulates both the securities and futures markets.
  - In Thailand, the Securities and Exchange Commission (SEC) regulates both the securities and futures markets.

Futures trading

- Procedure
  - A person who enters into a futures contract establishes either a long position or a short position.
  - When a position is established, each party deposits a small amount of money, typically called “the margin”, with the clearinghouse.
  - Then, the contract is marked to market, whereby gains are distributed to and the losses are collected from each party.

Futures trading

- Procedure
  - At some point in the life of the contract prior to expiration, each party may wish to re-enter the market and close out the position ("offsetting".
    - The long offers the identical contract for sale.
    - The short offers to buy the identical contract.
    - Futures contract with any counterparty can be offset by an equivalent futures contract with another counterparty.
      - The clearinghouse inserts itself in the middle of each and becomes the counterparty to each party.

Futures trading

- Example
  - In early January, a futures trader purchases an S&P 500 stock index futures contract expiring n March. Through 15 January, the trader has incurred some gains and losses from the daily settlement and decides that she wants to close the position out.

Futures trading

- Example
  - Offsetting procedure:
    - Going back into the market and offering for sale the March S&P 500 futures.
    - Finding a buyer to take the position.
    - The trader now has a long and short position in the same contract
    - The clearinghouse considers that she no longer has a position in that contract and has no remaining exposure, nor any obligation to make or take delivery at expiration.

Margins

- Margins in the stock market
  - Margin means that a loan is made. This loan enables the investor to reduce the amount of his own money required to purchase the securities, thus generates leverage or gearing.
    - If the stock goes up (down), the percentage gain (loss) to the investor is amplified.

Margins

- Margins in the stock market
  - Margin percentage
    - (the market value of the stock – the market value of the debt)/the market value of the stock
  - Initial margin requirement (IMR)
    - In the US, an investor is permitted to borrow up to 50% of the initial value of the stock.
  - Maintenance margin requirement (MMR)
    - The margin percentage allowed on any day after the initial trading day (typically 25%-30%).

Margins

- Margins in the futures market
  - Margin is commonly used to describe the amount of money that must be put into an account by a party opening up a futures position.
  - IMR
    - A certain amount of money needed to initiate a futures contract (usually less than 10% of the futures price).
    - Similar to a down payment for the commitment to purchase the underlying at a later date.
    - Both the buyer and the seller of the futures contract must deposit margin.

Margins

- Margins in the futures market
  - MMR
    - As margin account balances change (through the daily settlement), holders of futures positions must maintain balances above a level called “MMR”.
    - On the day in which the amount of money in the margin account at the end of the day falls below the MMR,
      - the trader must deposit sufficient funds to bring the balance back up to the initial margin requirement (variation margin).
      - Alternatively, the trader can simply close out the position but is responsible for any further losses incurred if the price changes before a closing transaction can be made.

Mark-to-market & settlement price

- Settlement price
  - To provide a fair mark-to-market process, the clearinghouse must designate the official price for determining daily gains and losses. This price is called the settlement price (representing an average of the final few trades of the day).
  - Note that when futures trader close their position, their account is marked to market to the final price at which the transaction occurs, NOT the settlement price that day.

Mark-to-market & settlement price

- Example: Marking-to-market process
  - Initial futures price = $100, IMR = $5, MMR = $3
  - Holder of long position of 10 contracts

Day	Beginning balance	Funds deposited	Settlement price	Futures price change	Gain/loss	Ending balance
0	0	50	100.00			50
1	50	0	99.20	-0.80	-8	42
2	42	0	96.00	-3.20	-32	10
3	10	40	101.00	5.00	50	100
4	100	0	103.50	2.50	25	125
5	125	0	103.00	-0.50	-5	120
6	120	0	104.00	1.00	10	130

Mark-to-market & settlement price

- Example: Marking-to-market process
  - Holder of short position of 10 contracts

Day	Beginning balance	Funds deposited	Settlement price	Futures price change	Gain/loss	Ending balance
0	0	50	100.00			50
1	50	0	99.20	-0.80	8	58
2	58	0	96.00	-3.20	32	90
3	90	0	101.00	5.00	-50	40
4	40	0	103.50	2.50	-25	15
5	15	35	103.00	-0.50	5	55
6	55	0	104.00	1.00	-10	45

Mark-to-market & settlement price

- Example: Marking-to-market process
  - Gain/loss to each party
    - The long: $90 was deposited over the six-day period. The account balance at the end of the sixth day is $130.
      - Nearly 50% return over six days.
    - The short: $85 was deposited over the six-day period. The account balance at the end of the sixth day is $45.
      - Nearly 50% loss over six days.

Mark-to-market & settlement price

- Example: Marking-to-market process
  - Margin call
    - Since the difference between IMR and MMR is $5 - $3 = $2. The price would need to fall from $100 to $98 for a long position (or rise from $100 to $102 for a short position) to trigger a margin call.
  - Closing out the position after the margin call
    - Consider the position of the long at the end of the second day when the margin balance is $10. This amount is $20 below the MMR and he is required to deposit $40 to bring the balance up to the IMR.

Mark-to-market & settlement price

- Example: Marking-to-market process
  - Closing out the position after the margin call
    - He can close out the position as soon as the following day if he prefers not to deposit the variation margin.
    - If the price is moving quickly at the opening on Day 3 and falling from $96 to $95, he will lose $10 more wiping out the margin account balance. If the price falls further, he would lose more than the amount of money placed in the initial margin.

Mark-to-market & settlement price

- Example: Marking-to-market process
  - Closing out the position after the margin call
    - The total amount that the trader could lose is limited to the price per contract at which he bought.
      - Maximum possible loss = $100×10 = $1,000
    - The total amount that the holder of the short position is loss is theoretically infinite.

Price limits

- Some futures contracts impose limits on the price change that can occur from one day to the next.
  - Suppose the price limit was $4.
    - Each day, no transaction cold take place higher than the previous settlement price plus $4 or lower than the previous settlement price minus $4.
    - If the price at which a transaction would be made exceeds the limits, then price essentially freezes at one of the limits.

Defaults in futures contracts

- The clearinghouse guarantees to each party that it need not worry about colleting from the counterparty. The clearinghouse essentially positions itself in the middle of each contract, becoming the short counterparty to the long and vice versa.
- Some defaults do occur, but the counterparty is defaulting to the clearinghouse, which has never failed to pay off the opposite party.

Delivery and cash settlements

- Most futures contracts are offset before expiration. Those that remain in place are subject to either delivery or a final cash settlement.
- When the exchange designs a futures contract, it specifies whether the contract will terminate with delivery or cash settlement.
  - Cash settlement contracts have significantly lower transaction costs than delivery contracts.
  - Many delivery contracts permit the short to choose when delivery takes place (usually not immediately after expiration), delivery locations, and even what to deliver.

Delivery and cash settlements

- Example:
  - Two days before expiration, a party goes long one futures contract at a price of $50.
  - The following day (one day before expiration), the settlement price is $52.
    - The trader's margin account is marked to market by crediting it with a gain of $2.
    - The futures contract is repriced to $52.

Delivery and cash settlements

- Example:
  - The next day, the contract expires with the settlement price at $53.
    - Possibility 1: If the contract is deliverable, the trader may choose to close out the position as the end of the trading day draws near.
      - The margin account is marked to market at the price at which she sells. If she sells close enough to the expiration, the selling price would be very close to the final settlement price of $53. Doing so would add $1 to her margin account balance.

Delivery and cash settlements

- Example:
  - The next day, the contract expires with the settlement price at $53.
    - Possibility 2: If the contract is deliverable, the trader may choose to leave the position open at the end of the trading day and take delivery.
      - She is required to take possession of the asset and pay the short the settlement price of the previous day.
        - Paying $52 and receiving the asset worth $53.

Delivery and cash settlements

- Example:
  - The next day, the contract expires with the settlement price at $53.
    - Possibility 3: If the contract is cash-settled, the trader would not need to close out the position close to the end of the expiration day. She could simply leave the position open. When the contract expires, her margin account would be marked to market for a gain on the final day of $1.

Types of futures contract

- Commodity futures
  - Covering traditional agricultural, metal, and petroleum products
- Financial futures
  - Futures on stocks
  - Futures on bonds
  - Futures on interest rates
  - Futures on currencies

Short-term interest rate futures

- T-bill futures
  - Recall that T-bill is a discount instrument.
    - Price per $1 par of a 180-day T-bill selling at a discount of 4% is $1 – 0.04(180/360) = $0.98. Holding this bill to maturity would receive $1 at maturity, netting a gain of $0.02.
  - The futures contract is based on a 90-day $100,000 US T-bill. On any given day, the contract trades with the understanding that a 90-day T-bill will be delivered at expiration.

Short-term interest rate futures

- T-bill futures
  - T-bill futures price
    - International Monetary Market (IMM) Index is a reported and publically available price on which the T-bill futures price is based.
      - IMM Index = 100 – Rate
      - IMM Index Price changes with market interest rates.
    - Futures price = $1,000,000[1 – (Rate/100)(90/360)]
      - This futures price also fluctuates with the variability of the IMM Index Price.

Short-term interest rate futures

- Example
  - Suppose on a given day the rate priced into the contract is 6.25%.
    - IMM Index Quoted Price = 100 – 6.25 = 93.75
    - Actual futures price = $1,000,000[1 – (6.25/100)(90/360)] = $984,375
  - Suppose the rate goes to 6.50 (an increase of 25 basis points).
    - The IMM Index declines to 93.50
    - The actual futures price drops to $1,000,000[1 – (6.50/100)(90/360)] = $983,750 (a decrease of $625)
      - The long would have lost $625 ($25 per one basis point).

Short-term interest rate futures

- Eurodollar futures
  - Eurodollar deposit
    - A bank that borrows $1 million at a rate of 5% for 90 days will owe $1,000,000[1+0.05(90/360)] = $1,012,500 in 90 days.
  - Eurodollar futures
    - The Eurodollar futures contract of the Chicago Mercantile Exchange is based on $1 million notional principal of 90-day Eurodollars.

Short-term interest rate futures

- Eurodollar futures
  - Eurodollar futures
    - Quoted price
      - Suppose on a given day, the rate priced into the futures contract is 5%, the quoted price will be 100 – 5.25 = 94.75
    - Actual futures price
      - With each contract based on $1 million notional principal of Eurodollars, the actual futures price is $1,000,000[1-0.05(90/360)] = $987,500
        - A bank borrowing $1,000,000 at a rate of 5% would receive $987,500 and would pay back $1,000,000 in 90 days.

Long-term interest rate futures

- The US T-bond futures contract
  - The contract is based on the delivery of a US T-bond with any coupon but with a maturity of at least 15 years.
  - If the deliverable bond is callable, it cannot be called for at least 15 years from the delivery date.
  - By having a large number of deliverable bonds, the conversion factor must exist to protect the long.

Long-term interest rate futures

- The US T-bond futures contract
  - At expiration
    - When a trader holding a short position at expiration delivers a bond with a coupon greater (less) than 6%, she receives an upward (a downward) adjustment to the price paid for the bond by the long.
      - The amount the long pays the short is the futures price at expiration multiplied by the convention factor.
    - Conversion factor = price of a $1 par bond with a coupon and maturity equal to those of a deliverable bond and a yield of 6%, with all calculations made assuming semiannual interest payments

Long-term interest rate futures

- The US T-bond futures contract
  - Cheapest-to-deliver bond
    - When making the delivery decision, the short compares the cost of buying a given bond on the open market with the amount she would receive upon delivery of that bond. The most attractive bond for delivery would be the one in which the amount received for delivering the bond is largest relative to the amount paid on the open market for that bond. This bond is called “cheapest-to-deliver” bond.

Stock index futures contract

- The S&P 500 Stock Index Futures
  - Example
    - If the S&P 500 Index is at 1183, a two-month futures contract might be quoted at a price of 1187.
    - The contract implicitly contains a multiplier.
      - E.g., the multiplier for the S&P 500 futures is $250. when you hear a futures price of 1187, the actual price is 1187($250) = $296,750.
  - S&P 500 futures expirations are March, June, September, and December and go out about two years.

Currency futures contract

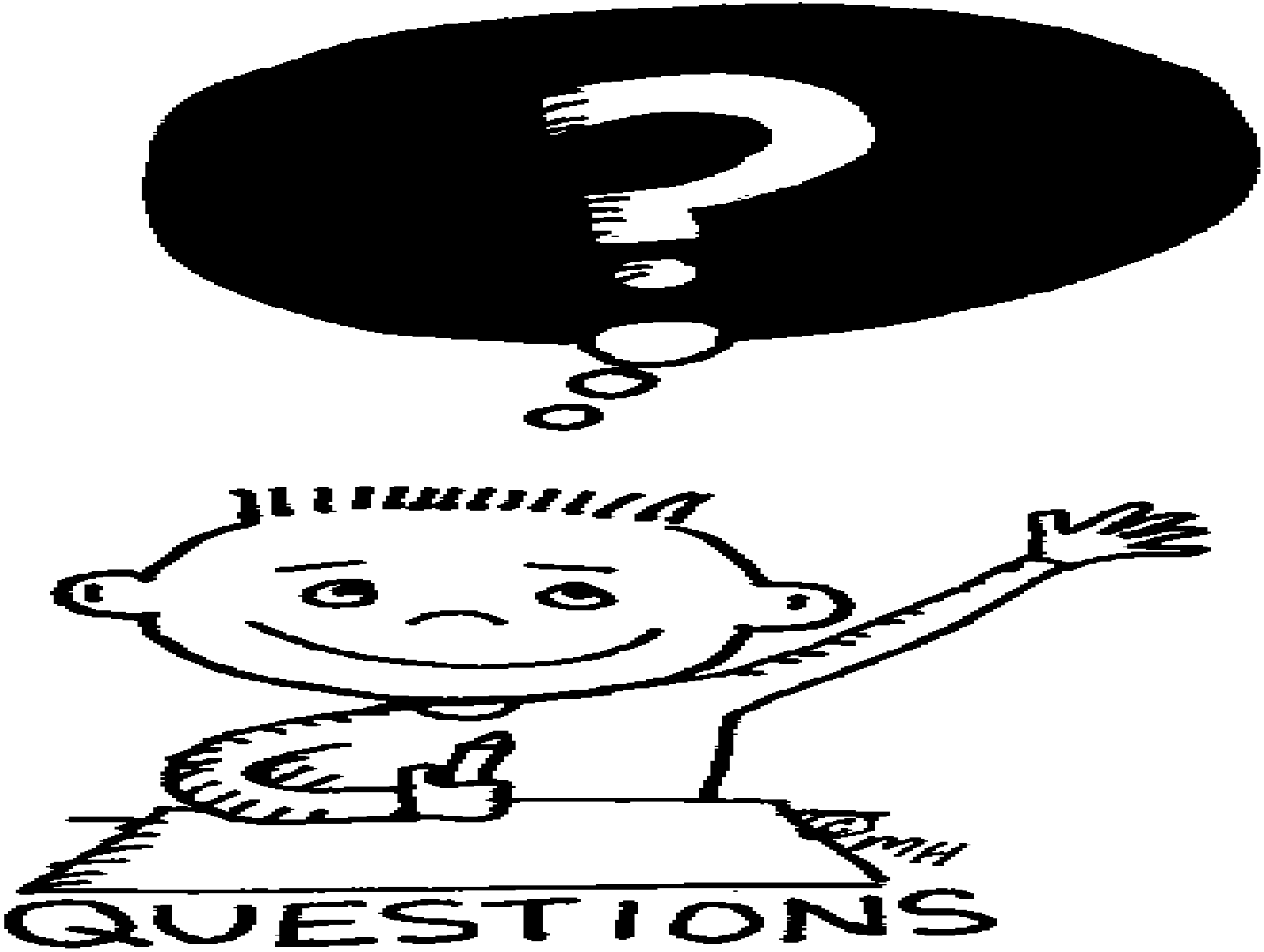
- Compared with forward contracts on currencies, currency futures contracts are much smaller in size. Each contract has a designated size and a quotation unit.
  - Example
    - The euro contract covers €125,000 and is quoted in dollars per euro. A futures price such as $0.8555 is stated in dollars and converts to a contract price of
      - 125,000($0.8555) = $106,937.50

Currency futures contract

- Compared with forward contracts on currencies, currency futures contracts are much smaller in size. Each contract has a designated size and a quotation unit.
  - Example
    - The Japanese yen futures price is quoted in dollars per 100 yens. The contract covers ¥12,500,000. E.g., a price might be stated as 0.8205, but this actually represents a price of 0.008205, which converts to a contract price of
      - 12,500,000(0.008205) = $102,562.50.

Currency futures contract

- Currency futures contracts expire in the months of March, June, September, and December.
- Currency futures contracts call for actual delivery, through book entry, of the underlying currency.


QUESTIONS