FINA2204 Tutorial 2: Futures markets

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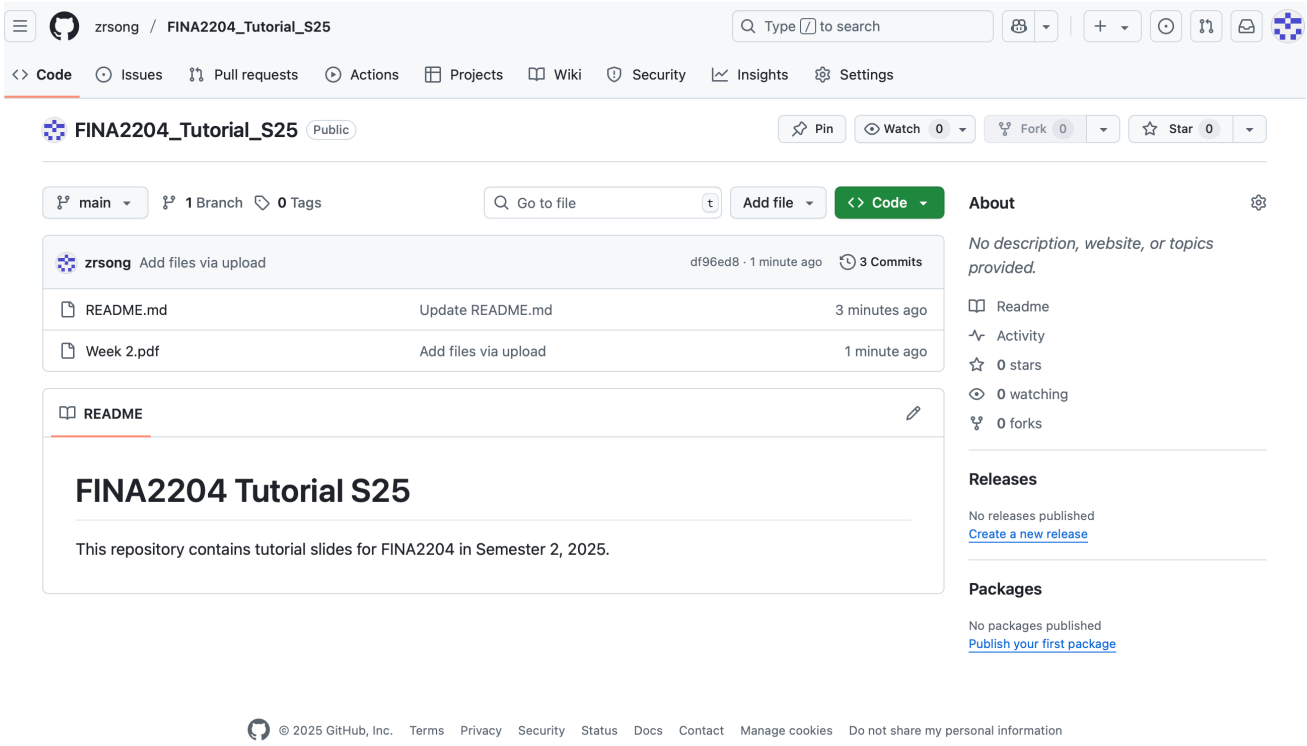
Information

- Slides: https://github.com/zrsong/FINA2204_Tutorial_S25



Agenda

- Problem 2.8
- Problem 2.11
- Problem 2.21
- Problem 2.25
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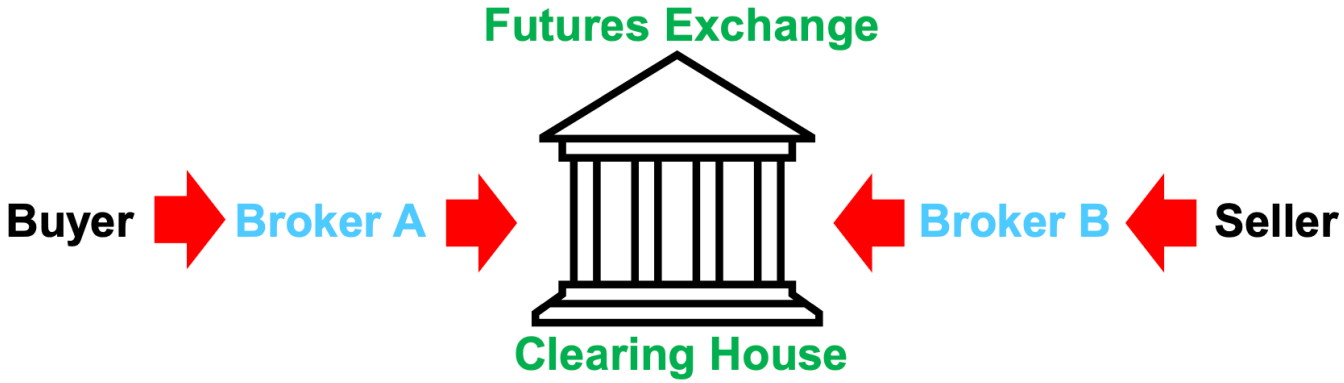
- Problem 2.29

Recap: market participants

- A futures contract is a standardized agreement, created and regulated by an **exchange** (e.g., CME group, ICE, Eurex).
- It obligates the **buyer** (long) to purchase and the **seller** (short) to deliver a specific quantity and quality of an underlying asset at a predetermined price. Both parties typically instruct their **broker** to place and manage the order on the exchange.



Recap: specifications

- Contract details (size, time, location etc.) are fixed by the exchange to ensure uniformity.
    1. The asset: **what** can be delivered
    2. The contract Size: **how much** must be delivered
    3. Delivery months: **when** it can be delivered
    4. Delivery arrangement: **where** it can be delivered
    5. Others: price quotes, price/position limits
- Premiums/discounts: price adjustments apply when delivery is made at a distant location or when the delivered grade differs from the specified grade.

Recap: specifications (cont.)

Eastern Australia wheat futures contract is traded on the ASX.

Contract specifications:

Grade	Size	Months	Final trading day	Delivery period	Delivery location
APW1 or better (GTA Wheat Standard)	20 metric tonnes	Jan, Mar, May, Jul, Sep	3rd Thursday of settlement month	From 2nd business day of settlement month to final trading day	Approved locations in QLD, NSW and VIC with rail/road outloading capability

Australian Premium White (APW1) is delivered with a guaranteed minimum protein level of 10.5%. APW is suitable for the production of a variety of Asian noodles, Middle Eastern and Indian style breads and Chinese steamed bread.

Problem 2.8

- *The party with a short position in a futures contract sometimes has options as to the precise asset that will be delivered, where delivery will take place, when delivery will take place, and so on. Do these options increase or decrease the futures price? Explain your reasoning.*

Answer 2.8

- These options make the contract less attractive to the party with the long position and more attractive to the party with the short position. They therefore tend to **reduce** the futures price.

Recap: contracts ‘fail’

- Two broad explanations
- Contract characteristics
    1. Challenges in defining grade or quantity
    2. Competition form alternatives like forwards and swaps
- Commodity characteristics
    1. Spot market too small
    2. Spot price lacks volatility

Problem 2.21

- *What do you think would happen if an exchange started trading a contract in which the quality of the underlying asset was incompletely specified?*

Answer 2.21

- The contract **would not be a success**. Parties with short positions would hold their contracts until delivery and then deliver the cheapest form of the asset. This might well be viewed by the party with the long position as garbage! Once news of the quality problem became widely known no one would be prepared to buy the contract. This shows that futures contracts are feasible only when there are rigorous standards within an industry for defining the quality of the asset. Many futures contracts have in practice failed because of the problem of defining quality.

Recap: closing out

- Once traded, the clearinghouse becomes the counterparty to both buyer and seller, guaranteeing performance.
- Daily market-to-market settlement and margin requirements reduce default risk.
- Futures contracts provide liquidity and lower counterparty risk, enabling participants to hedge or speculate on price movements efficiently.

Recap: closing out (cont.)

- A trader can either leave the initial position open and take delivery of the underlying asset, or ‘close out’ the position by entering an offsetting trade.
- Most positions (>95%) are offset before maturity, as participants prefer to close out rather than take delivery.
- For some contracts (e.g., stock index futures), delivery is not permitted; open positions are settled in cash at the spot price on the expiration date.

Recap: closing out

Business Snapshot 2.1 The unanticipated delivery of a futures contract

This story (which may well be apocryphal) was told to the author of this book a long time ago by a senior executive of a financial institution. It concerns a new employee of the financial institution who had not previously worked in the financial sector. One of the clients of the financial institution regularly entered into a long futures contract on live cattle for hedging purposes and issued instructions to close out the position on the last day of trading. (Live cattle futures contracts are traded by the CME Group and each contract is on 40,000 pounds of cattle.) The new employee was given responsibility for handling the account.

When the time came to close out a contract, the employee noted that the client was long one contract and instructed a trader at the exchange to buy (not sell) one contract. The result of this mistake was that the financial institution ended up with a long position in two live cattle futures contracts. By the time the mistake was spotted, trading in the contract had ceased.

The financial institution (not the client) was responsible for the mistake. As a result it started to look into the details of the delivery arrangements for live cattle futures contracts—something it had never done before. Under the terms of the contract, cattle could be delivered by the party with the short position to a number of different locations in the United States during the delivery month. Because it was long, the financial institution could do nothing but wait for a party with a short position to issue a *notice of intention to deliver* to the exchange and for the exchange to assign that notice to the financial institution.

It eventually received a notice from the exchange and found that it would receive live cattle at a location 2,000 miles away the following Tuesday. The new employee was sent to the location to handle things. It turned out that the location had a cattle auction every Tuesday. The party with the short position that was making delivery bought cattle at the auction and then immediately delivered them. Unfortunately the cattle could not be resold until the next cattle auction the following Tuesday. The employee was therefore faced with the problem of making arrangements for the cattle to be housed and fed for a week. This was a great start to a first job in the financial sector!

Source: textbook, p.44

Recap: convergence

- As the delivery period approaches, the futures price converges to the spot price of the underlying asset.
- Arbitrage opportunities push prices toward each other.
- If futures > spot, traders short futures and buy the asset for delivery.
- If futures < spot, traders buy futures and wait for delivery.
- As a result, by the delivery date, futures and spot prices become equal or near equal, leaving no arbitrage opportunity.

Recap: convergence (cont.)

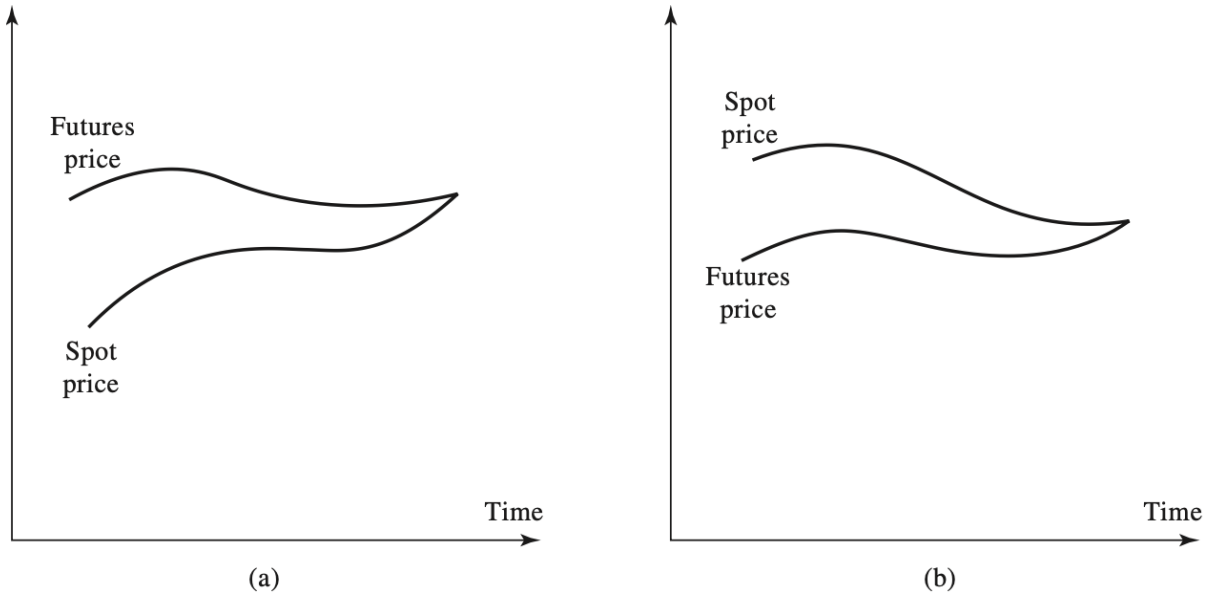


Figure 2.1 Relationship between futures price and spot price as the delivery month is approached: (a) futures price above spot price; (b) futures price below spot price

Source: textbook, p. 46

Recap: margin accounts

- Margin accounts act as collateral to ensure both parties can cover potential losses and honor the contract.
- Daily settlement prevents large unpaid losses from accumulating, reducing default risk for the clearinghouse and market participants.
- If the account balance falls below the maintenance margin, the trader must deposit extra funds to restore it to the initial margin level (aka margin call).

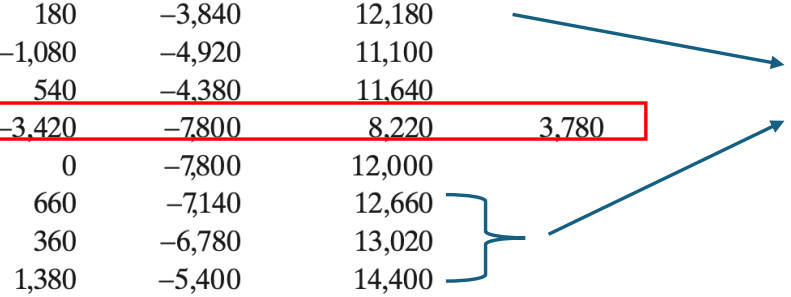
Margin call (2011)

- An investment bank realizes internally that its mortgage-backed securities (MBS) have fallen below collateral requirement, triggering a margin crisis.
- Executives decide to sell all toxic assets overnight at any price to avoid bankruptcy.
- Widely seen as inspired by events at firm like Lehman Brothers in 2008.

Recap: margin accounts

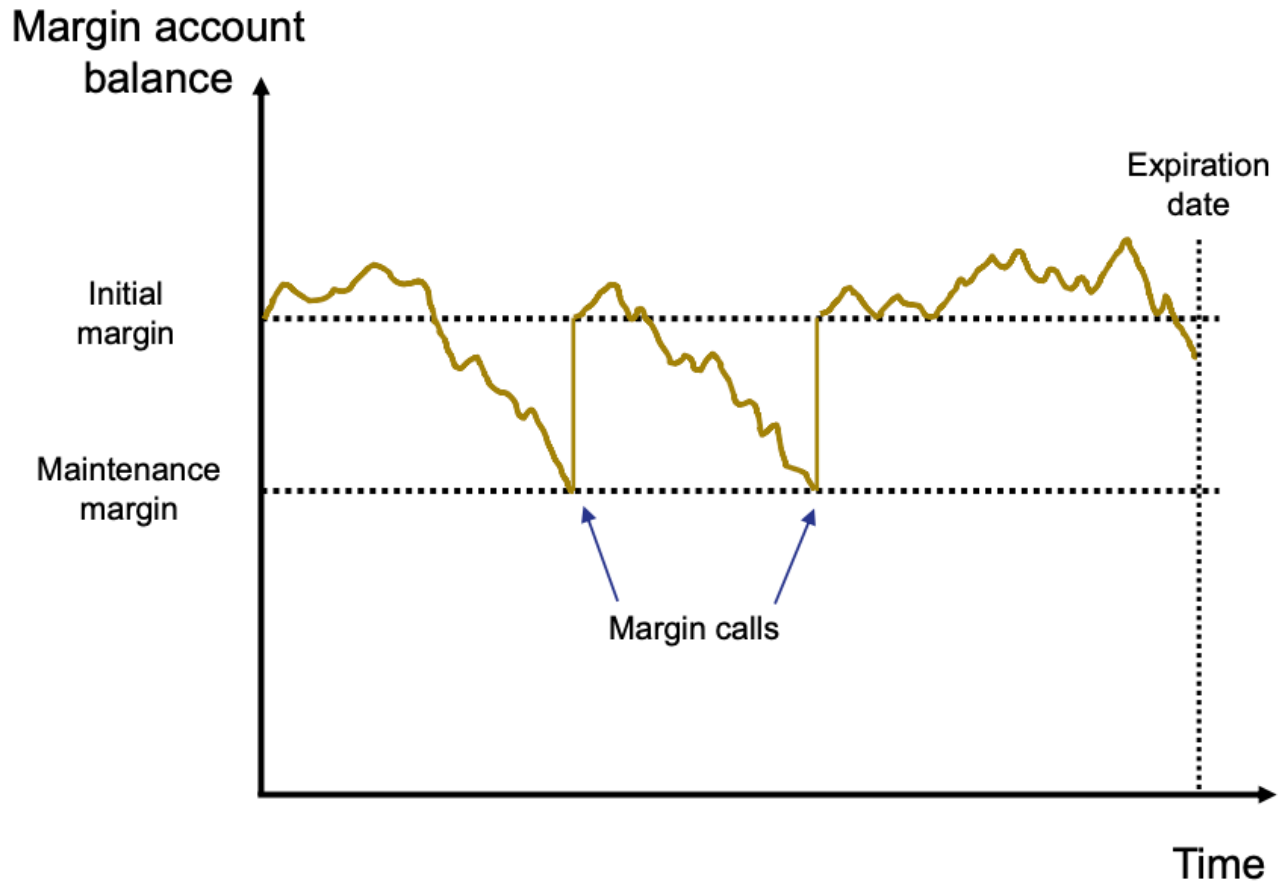
Table 2.1 Operation of margin account for a long position in two gold futures contracts. The initial margin is $6,000 per contract, or $12,000 in total; the maintenance margin is $4,500 per contract, or $9,000 in total. The contract is entered into on Day 1 at $1,250 and closed out on Day 16 at $1,226.90

Day	*Trade price ($)*	*Settlement price ($)*	*Daily gain ($)*	*Cumulative gain ($)*	*Margin account balance ($)*	*Margin call ($)*
1	1,250.00				12,000	
1		1,241.00	−1,800	−1,800	10,200	
2		1,238.30	−540	−2,340	9,660	
3		1,244.60	1,260	−1,080	10,920	
4		1,241.30	−660	−1,740	10,260	
5		1,240.10	−240	−1,980	10,020	
6		1,236.20	−780	−2,760	9,240	
7		1,229.90	−1,260	−4,020	7,980	4,020
8		1,230.80	180	−3,840	12,180	
9		1,225.40	−1,080	−4,920	11,100	
10		1,228.10	540	−4,380	11,640	
11		1,211.00	−3,420	−7,800	8,220	3,780
12		1,211.00	0	−7,800	12,000	
13		1,214.30	660	−7,140	12,660	
14		1,216.10	360	−6,780	13,020	
15		1,223.00	1,380	−5,400	14,400	
16	1,226.90		780	−4,620	15,180	



Source: textbook, p.48

One possible sequence of futures price



Problem 2.11

- *A trader buys **two** July futures contracts on frozen orange juice. Each contract is for the delivery of 15,000 pounds. The current futures price is 120 cents per pound, the initial margin is $6,000 per contract, and the maintenance margin is $4,500 per contract. What price change would lead to a margin call? Under what circumstances could $2,000 be withdrawn from the margin account?*

Answer 2.11

- There is a margin call if more than $1,500 is lost on one contract. This happens if the futures price of frozen orange juice falls by more than 10 cents to below 110 cents per lb.

$$\frac{-1{,}500\ dollars}{15{,}000\ pounds} \times 100 = -10\ cents$$

- $2,000 can be withdrawn from the margin account if there is a gain on **one contract** of $1,000. This will happen if the futures price rises by 6.67 cents to 126.67 cents per lb.

$$\frac{1{,}000\ dollars}{15{,}000\ pounds} \times 100 = 6.67\ cents$$

Problem 2.28

- *A company enters into **a short futures** contract to sell 5,000 bushels of wheat for 250 cents per bushel. The initial margin is $3,000 and the maintenance margin is $2,000. What price change would lead to a margin call? Under what circumstances could $1,500 be withdrawn from the margin account?*

Answer 2.28

- There is a margin call if $1000 is lost on the contract. This will happen if the price of wheat futures rises by 20 cents from 250 cents to 270 cents per bushel.

$$\frac{1{,}000\ dollars}{5{,}000\ bushels} \times 100 = 20\ cents$$

- $1500 can be withdrawn if the futures price falls by 30 cents to 220 cents per bushel.

$$\frac{-1{,}500\ dollars}{5{,}000\ bushels} \times 100 = -30\ cents$$

Recap: forward vs. futures

FORWARDS	FUTURES
Private contract between two parties	Exchange-traded contract
Non-standard (customized) contract	Standardized contract
Settled at end of contract	Settled daily
Delivery and cash settlement usually occurs	Contracts usually closed out Prior to maturity
Some credit risk (no marking-to-market)	Virtually no credit risk (marked-to-market daily)

The key difference is that futures involve daily cash outflows for losses, while forwards settle only once at maturity.

Problem 2.25

- *Trader A enters into **futures** contracts to buy 1 million euros for 1.1 million dollars in three months. Trader B enters in a **forward** contract to do the same thing. The exchange (dollars per euro) declines sharply during the first two months and then increases for the third month to close at 1.1300. Ignoring daily settlement, what is the total profit of each trader? When the impact of daily settlement is taken into account, which trader does better?*

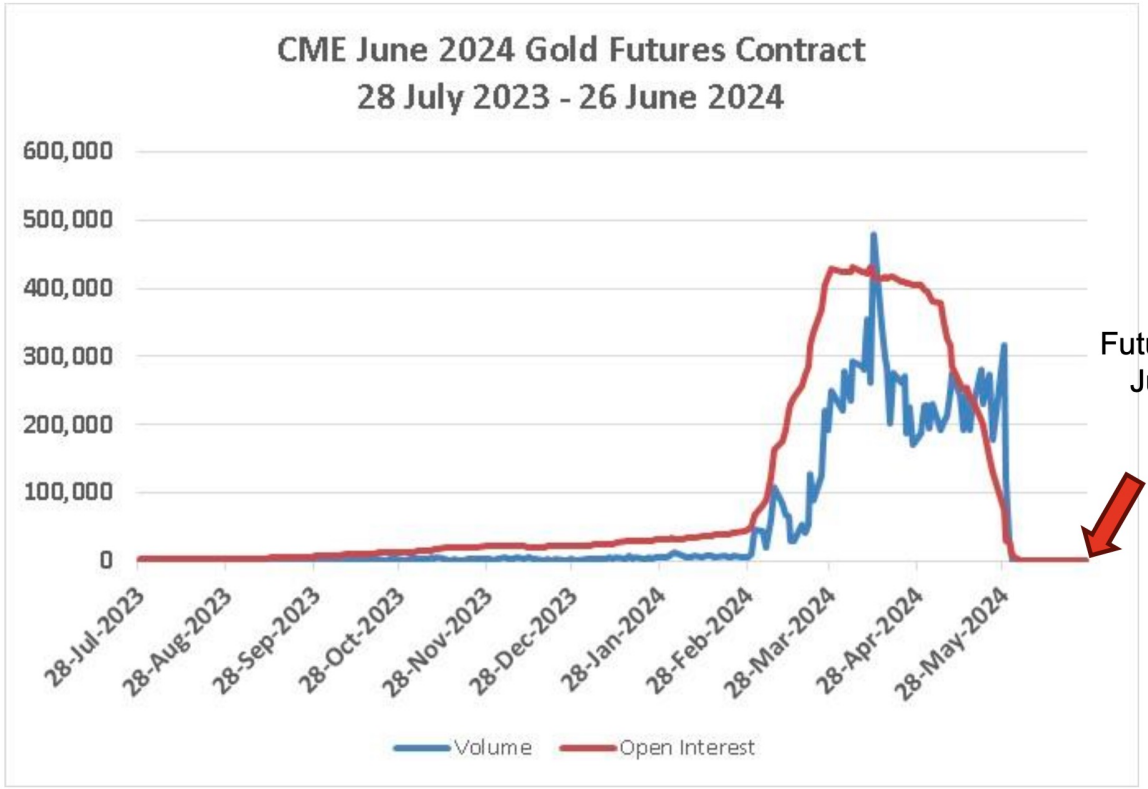
Answer 2.25

- The total profit of each trader in dollars is 0.03×1,000,000 = **30,000**. Trader B's profit is realized at the end of the three months. Trader A's profit is realized day-by-day during the three months. Substantial losses are made during the first two months and profits are made during the final month. It is likely that **Trader B has done better** because Trader A had to finance its losses during the first two months.
- *Note: The losses that Trader A experienced in the first two months were cash outflows due to daily settlement, not final losses. However, Trader A had to provide cash earlier to meet margin calls,* ***losing the opportunity*** *to use that cash elsewhere.*

Recap: open interest

- Definition: open interest is the number of **outstanding** (equal to total long positions or total short positions)
- Difference from volume: volume is the total contracts **traded** in a day. And it can exceed open interest if many trades are opened and closed within the day.
- How it changes:
  1. +1 → new buyer + new seller (open interest: +1; volume:+1)
  2. -1 → closing buyer + closing seller (open interest: -1; volume: +1)
  3. 0 → one opens, one closes (open interest: 0; volume: +1)

Recap: open interest (cont.)



Futures: CME June 2024 Gold Futures, GCM4

Problem 2.26

- *Explain what is meant by open interest. Why does the open interest usually decline during the month preceding the delivery month? On a particular day, there were 2,000 trades in a particular futures contract. This means that there were 2,000 buyers (going long) and 2,000 sellers (going short). Of the 2,000 buyers, 1,400 were closing out positions and 600 were entering into new positions. Of the 2,000 sellers, 1,200 were closing out positions and 800 were entering into new positions. What is the impact of the day's trading on open interest?*

Answer 2.26

- Open interest is the number of contracts outstanding. Many traders close out their positions just before the delivery month is reached. This is why the open interest declines during the month preceding the delivery month.
- The open interest **went down by 600**. We can see this in two ways. First, 1,400 shorts closed out and there were 800 new shorts. Second, 1,200 longs closed out and there were 600 new longs.

Answer 2.26

- Open interest at the beginning: 2,000

1. New positions created
   - 600 new buyers
   - 800 new sellers
   - New contracts = min(600, 800)=600 → open interest +600
2. Positions closed
   - 1,400 closing buyers
   - 1,200 closing sellers
   - Contracts closed = min (1,400, 1,200)=1,200 → open interest -1,200

- Net change in open interest
  - Increase: +600
  - Decrease: -1,200
  - Net change = -600
- Open interest at end of day: 2,000 – 600 =1,400

Problem 2.29

- *Suppose that there are no storage costs for crude oil and the interest rate for borrowing or lending is 5%* ***per annum****. How could you make money if the June and December futures contracts for a particular year trade at $60 and $66, respectively.*

Answer 2.29

- You could go long one June oil contract and short one December contract. In June you take delivery of the oil borrowing $60 per barrel at 5% to meet cash outflows. The interest accumulated **in six months** is about 60×0.05×**0.5** or $1.50. In December the oil is sold for $66 per barrel and $61.50 is repaid on the loan. The strategy therefore leads to a profit of $4.50. Note that this profit is independent of the actual price of oil in June or December. It will be slightly affected by the daily settlement procedures.

Answer 2.29

FV of amount *A*, invested @ *R*% for *n* years (compounded annually)	$FV = A(1+R)^n$	
FV of amount *A*, invested @ *R*% for *n* years (compounded *m* times p.a.)	$FV = A\left(1+\frac{R}{m}\right)^{mn}$	(4.1)
FV of amount *A*, invested @ *R*% for *n* years (cont. compounded)	$FV = Ae^{Rn}$	(4.2)