CHARTA LEARNING · LESSON NOTES

Derivative instruments and markets

CFA Level I · Derivatives

You will learn: Explain forwards, futures, swaps and credit default swaps, contrast a forward with a future, tell exchange-traded from over-the-counter contracts, and work out payoffs and margin calls.

Running example: Examples follow Maple Mills, a made-up bakery chain that needs 10,000 bushels of wheat every three months and agrees a forward price of $8.00 a bushel. Other examples use made-up figures.

1. Forwards, futures and swaps

- A derivative is a contract whose value is derived from an underlying (commodity, share, bond, interest rate or currency). Forwards, futures and swaps are forward commitments: both sides are bound, whatever the price does. Options differ: a right, not an obligation.
- A forward contract is a private agreement to buy or sell at a set forward price on a set expiry date. The buyer is long, the seller short.
- All three contracts start at zero value, because the fixed price or rate is set to be fair, so no premium is paid. Zero means fair, not worthless.
- A futures contract is a standardised forward traded on an exchange, with a clearing house in the middle and gains and losses paid in cash daily.
- A swap is an agreement to exchange a series of cash flows over time, like a bundle of forwards. In an interest rate swap one side pays fixed and the other floating. The notional is never exchanged, only the net difference.

> **Long payoff = S − F; short payoff = F − S (S = price at expiry, F = agreed price); net swap = (floating − fixed) × notional**

MAPLE'S LONG FORWARD (10,000 BUSHELS AT $8.00) AND SWAP

Wheat ends at $10.00	10,000 × (10 − 8)	**+$20,000 (miller −$20,000)**
Wheat ends at $6.00	10,000 × (6 − 8)	**−$20,000**
Swap: pay fixed 5% on $10m = $500,000; year 1 floating 4%	400,000 − 500,000	**−$100,000**
Year 2 floating 6% / year 3 floating 5%	600,000 − 500,000 / 500,000 − 500,000	**+$100,000 / $0**

Watch out: Thinking a forward costs something up front; treating a swap as a single deal; saying the swap notional is paid across.

2. Forward against future

- On paper they give the same exposure. The difference is when money moves: a forward settles once, at expiry; a future is marked to market daily, its gain or loss worked out and paid in cash each day. Total profit is about the same, only the timing of cash differs.
- Credit risk differs. A forward carries one named counterparty and the gain builds up as one growing claim. With a future the clearing house stands in the middle and daily settlement keeps exposure to about one day's move.
- A forward is customised and trades over the counter (OTC, directly between two parties). A future is standardised and trades on an exchange. In theory the prices are equal when interest rates do not move with the underlying.

THREE-DAY CONTRACT, LONG 10,000 BUSHELS, PRICE PATH 8.00 → 8.15 → 8.30 → 8.20

Future, day 1	10,000 × 0.15	**+$1,500**
Future, day 2	10,000 × 0.15	**+$1,500**
Future, day 3	10,000 × (−0.10)	**−$1,000**
Total, forward or future	10,000 × (8.20 − 8.00)	**+$2,000**

3. Credit default swaps

- A credit derivative transfers the credit risk of a borrower from one party to another without moving the loan or bond. The main one is the credit default swap (CDS), which works like insurance. Neither party needs to own the loan.
- The protection buyer pays a regular premium, the CDS spread, whatever happens. The protection seller pays only if a credit event hits the reference entity (bankruptcy, failure to pay, a qualifying restructuring). The seller pays the loss: face value minus what can be recovered, in cash or physically.
- The buyer is short the credit and gains when spreads widen. The seller is long the credit, like a bondholder. A downgrade alone is not a credit event and triggers no payment, but it makes the buyer's contract more valuable.

Premium = spread × notional; protection payment = notional × (1 − recovery rate)

BANK LENT $10M TO HOLLIS FOODS, BUYS 5-YEAR PROTECTION AT 200 BASIS POINTS (2%)		
Annual premium; each quarter	2% × 10,000,000; ÷ 4	**$200,000; $50,000**
Premiums paid in 3 years, then default	3 × 200,000	**$600,000**
Loan recovers 40%	40% × 10,000,000	**$4,000,000**
Protection payment	10,000,000 × (1 − 0.40)	**$6,000,000**
Loan + swap − premiums	4m + 6m − 0.6m	**$9,400,000**

Watch out: Paying the whole notional: the seller pays only the loss. If new protection costs 3%, the old 2% contract saves $100,000 a year.

4. Exchange-traded against over the counter

- Exchange-traded derivatives are standardised in size, expiry and underlying, trade on a transparent order book, are cleared through a central counterparty so credit risk is small, and are liquid. OTC derivatives are negotiated one to one and can be tailored to an exact exposure.
- OTC drawbacks: less visible prices, thinner markets, direct counterparty credit risk, and harder, costlier exit. Forwards and most swaps are OTC; futures are exchange-traded.
- After the financial crisis regulators pushed many standard OTC swaps into clearing through central counterparties, so the line is blurrier. Test the contract: standardised and exchange-traded, or tailored and bilateral.

MAPLE NEEDS 12,300 BUSHELS IN 47 DAYS; FUTURES ARE 5,000 BUSHELS, EXPIRY IN 62 DAYS		
Contracts needed	12,300 ÷ 5,000	**2.46**
Contracts bought (whole only)	2 × 5,000	**10,000 bushels**
Bushels unhedged	12,300 − 10,000	**2,300**
Date mismatch	62 − 47	**15 days**

Watch out: Calling OTC unregulated or riskier for everybody. Its benefit is exact fit; its cost is credit exposure, thin liquidity and lower transparency.

5. Clearing house and margin

- Once a trade is accepted the clearing house (central counterparty) becomes the seller to the buyer and the buyer to the seller, so neither faces the other. It protects itself with margin and a default fund built from members' contributions.
- Margin is a deposit of cash or safe securities. Initial margin is posted when the position opens, sized to cover a plausible one-day loss. Variation margin is the daily settlement itself. Maintenance margin is the minimum balance; below it, the trader gets a margin call.
- The call restores the account to the initial margin, not just to maintenance. An unpaid call means the position is closed out, so the clearing house loses at most about one day's move, covered by margin already posted.

New balance = old balance + gain (or − loss); margin call = initial margin − balance

MAPLE LONG 2 CONTRACTS (10,000 BUSHELS); INITIAL MARGIN $8,000, MAINTENANCE $6,000		
Day 1: price falls to 7.90	8,000 − 1,000	**$7,000 (no call)**
Day 2: price falls to 7.70	7,000 − 2,000	**$5,000 (below $6,000)**
Margin call	8,000 − 5,000	**$3,000**
Day 3: price rises to 7.85	8,000 + 1,500	**$9,500**

Watch out: Computing the call as the gap to maintenance instead of to initial margin.

Key takeaways

- Forwards, futures and swaps bind both sides and start at zero value; options give a right, not an obligation.
- Long payoff = S − F, short payoff = F − S; the two always sum to zero.
- A future is a forward settled daily through a clearing house, so credit risk is small; a forward settles once and credit risk builds.
- A swap is a string of forwards; only the net is paid and the notional is never exchanged.
- CDS: the buyer pays the spread; on a credit event the seller pays notional × (1 − recovery rate).
- A margin call restores the initial margin, not the maintenance level.

Quick check

1. Long forward at $50; price at expiry is $58. Payoff per unit?
   Answer: 58 − 50 = +$8
2. CDS on $20m of debt; default, recovery 30%. Seller pays?
   Answer: 20m × (1 − 0.30) = $14m
3. Initial margin $5,000; balance falls to $3,800 (below maintenance). Margin call?
   Answer: 5,000 − 3,800 = $1,200

Summary notes for the Charta whiteboard lesson. Examples use made-up figures. Watch the full lesson at charta-learning.com.