

Charta Learning

Forwards, Futures and Put-Call Parity

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Forward Commitments

DE.1.a · Explain what forwards, futures and swaps are

What do forward commitments oblige the parties to do?	Both parties must transact at terms agreed today.
What is a forward contract and what risk does it carry?	A customised, over-the-counter agreement to buy or sell an asset at a set price on a set date. It carries counterparty credit risk.
How do futures differ from forwards?	Futures are exchange-traded and standardised, with a clearing house between the parties and daily marking to market, which largely removes credit risk.
How can a swap be viewed?	It exchanges series of cash flows over time and can be viewed as a bundle of forward contracts.

DE.1.b · Contrast futures with forwards on cash flows and counterparty credit risk

How does a forward settle, and what exposure results?	Once, at expiry, so the whole gain or loss accumulates as an unrealised claim on a single counterparty.
How does daily marking to market change credit exposure in futures?	Profit or loss is settled in cash every day through an exchange, so credit exposure never accumulates beyond one day's move.
Why does the timing of cash flows matter between futures and forwards?	Daily settlement changes the timing of cash flows, which matters when interest rates are correlated with the underlying.
What does a futures position require that a forward does not?	A margin account that must be topped up on demand.

DE.1.c · Show how an interest rate swap works as a string of forward commitments

What does a plain vanilla interest rate swap exchange?	A fixed rate for a floating rate on a notional that is never itself exchanged.
How can a swap be read as forward commitments?	Each payment date is a separate forward contract on the reference rate.
What is the swap's fixed rate?	The single rate that makes the whole strip of forwards worth zero at inception.
Why does a swap have no value when struck but acquires value later?	As rates move, the package of implied forwards is repriced while the contracted fixed rate stays where it was.

Forward Commitment and Contingent Claim Features and Instruments

DE.1.d · Set out what credit derivatives are and their main features

What does a credit derivative do?	Transfers the credit risk of a reference entity from one party to another without transferring the underlying debt.
How does a credit default swap work?	The protection buyer pays a periodic premium (the CDS spread); on a credit event the seller compensates the buyer for the loss, by physical or cash settlement.
What counts as a credit event, and what does not?	Bankruptcy, failure to pay or a qualifying restructuring count; a rating downgrade alone does not.
Which party is long and which short credit risk in a CDS?	The protection buyer is short credit risk; the seller is long, much like a bondholder.
What is the difference between single-name and index CDS?	Single-name references one issuer; index CDS covers a portfolio of names, used to hedge or take broad credit exposure.

Put-Call Parity

DE.4.a · Use put-call parity to link option prices with the underlying's price

What does put-call parity state?	$p + S = c + X/(1 + r)^T$: a put plus the underlying equals a call plus the present value of the exercise price.
Why does put-call parity hold?	Both sides are worth the same at expiry whatever the underlying does, so any price difference today is a riskless profit. It is an identity enforced by arbitrage, not a model.
For which options does the stated parity apply?	European options on an underlying that pays no income.
What is the practical use of put-call parity?	Rearranged, it shows any one of the four instruments can be synthesised from the other three.
Put-call parity	$c + X \div (1 + r)^t = p + S_0$ where c = the price of a European call; p = the price of a European put, same strike and same expiry; X = the exercise price both options share; r = the risk-free rate; t = the years to expiry; S_0 = the price of the underlying now A call plus cash equal to the strike, and a put plus the share, pay the same in every state at expiry, so they cost the same now. European options only, and no dividends before expiry, or the two sides no longer match.

DE.4.b · Work with put-call-forward parity

What does put-call-forward parity state?	A long call plus the present value of the exercise price equals a long put plus the present value of the forward price.
How does it differ from standard put-call parity?	A forward contract replaces the spot underlying. It is the same no-arbitrage statement.
How can a synthetic forward be built?	From a long call and a short put at the same strike.
Why is put-call-forward parity useful?	It uses instruments that may be cheaper or more practical to trade than the underlying, letting desks manufacture forward exposure without touching the cash market.
Put-call-forward parity	$c + X \div (1 + r)^t = p + F_0 \div (1 + r)^t$ where c = the price of a European call; p = the price of a European put, same strike and expiry; X = the exercise price; r = the risk-free rate; t = the years to expiry; F_0 = the forward price agreed today for delivery at expiry Put-call parity with the underlying replaced by a forward on it, which is what to reach for when the underlying cannot be held - an index, a commodity, a currency.

Forward Pricing

DE.5.a · Show how the absence of arbitrage fixes a forward price

What sets a forward price?	The cost of replicating it, not a forecast of where the underlying will trade.
How does replication fix the forward price?	Buying the asset with borrowed money and holding it to delivery gives what the forward delivers, so the forward price equals spot compounded at the financing rate, adjusted for what the asset pays or costs while held.
How do income and storage costs affect the forward price?	Income received while holding lowers it; storage costs raise it.
How does the arbitrage work if the quoted forward price departs from the replicated price?	Buy the cheap side and sell the dear one. The positions cancel at delivery, leaving the difference.
Forward price of an asset with no cash flows	$F_0 = S_0 \times (1 + r)^t$ where S_0 = the spot price today; r = the risk-free rate; t = the years to delivery; F_0 = the price agreed today for delivery then Not a forecast of the spot price. It is what stops an arbitrage: borrow, buy the asset, hold it, deliver it. Any other forward price lets somebody do that for free money.

DE.5.b · Explain carrying costs and how they shift the forward price

What does the forward price equal?	The spot price compounded at the risk-free rate, adjusted for anything the underlying costs or yields while held.
Why do storage and insurance raise the forward price?	The seller must be compensated for carrying the asset.
Why do dividends, coupons and convenience yield lower the forward price?	Holding the spot asset confers a benefit that the forward holder does not receive.
When does the forward price fall below spot?	When benefits exceed financing and storage costs. This is usually called backwardation.
Forward price with carry costs and benefits	$F_0 = (S_0 + \text{storage} - \text{income}) \times (1 + r)^t$ where S_0 = the spot price today; storage = the present value of the cost of holding the asset; income = the present value of what holding it pays - dividends, coupons, a convenience yield; r = the risk-free rate; t = the years to delivery Costs of carry raise the forward price and benefits lower it, because the buyer of the forward avoids the one and gives up the other. Income large enough makes the forward cheaper than the spot.

DE.5.c · Work out what a forward contract is worth before it matures

What is a forward worth at inception, and why?	Zero, because its price is set to make it so.
How is a forward's value to the long calculated before maturity?	The present value of the difference between the current forward price for the remaining term and the contracted forward price.
What is the distinction between price and value in a forward?	The contracted price is fixed for the life of the deal, while the value floats as the market reprices the same delivery date.
Value of a forward during its life	$V_t = S_t - F_0 \div (1 + r)^{(T - t)}$ where V_t = the value to the long party today; S_t = the spot price today, part way through the contract; F_0 = the forward price agreed at the start; r = the risk-free rate; T = the years from the start to delivery; t = the years elapsed A forward is worth nothing at inception, because F_0 is set to make it so, and moves away from zero as the spot moves. What the long gains the short loses exactly.

Pricing and Valuation of Forward Contracts and for an Underlying with Varying Maturities

DE.5.d · Explain how the rate on an interest rate forward contract is fixed

At what rate is an interest rate forward fixed, and why?	The implied forward rate from today's spot rates, so the contract has zero value at initiation; any other rate would allow arbitrage.
What is the annual-compounding formula for the one-year rate one year forward?	$(1 + S_2)^2 \div (1 + S_1) - 1$.
What is the money-market forward rate for days a to b?	$[(1 + R_b \times b/360) \div (1 + R_a \times a/360) - 1] \times 360 \div (b - a)$.
Who uses a long FRA and who a short FRA?	A long FRA pays fixed and receives floating, gaining when rates rise, so a future borrower locks in costs; a short FRA suits a future lender.
How is the FRA settlement payment determined?	The rate difference on notional for the period, discounted at the reference rate.

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