Forwards and exchange futures

Fjord buys USD 40m six months forward. The bank sells the same dollars. The fair price F = S exp[(rEUR - rUSD)T] equals 0.910846 EUR per USD. The EUR price of USD is below spot because USD deposits earn more. Borrow euros, buy USD and invest the USD to reproduce delivery. At inception value is zero. Later, client value is USD notional times the EUR discount factor times (new forward minus contracted price).

Exhibit	Forward	USD futures teaching contract
Exposure	Known acquisition payment.	A separate importer needs USD 10m.
Execution	Tailored zero-value OTC trade.	Long 100 synthetic contracts of USD 100,000 at 0.90 EUR per USD. Flat equal rates at inception.
Interim	Month three at spot 0.88 gives EUR -1.402m.	At 0.91 cumulative VM is EUR 0.10m. The contract resets to zero after daily settlement.
Settlement	At expiry 1.02, receive EUR 4.366m and buy the dollars for EUR 40.8m.	Close futures at 0.94 on purchase date before contract expiry. Cumulative VM is EUR 0.40m. Buy USD at 0.945 for EUR 9.45m.
Result	EUR 36.434m net cost.	EUR 9.05m net. Difference from EUR 9.00m comes from remaining basis. Initial margin is refundable collateral.

The short futures trader pays the long side on up days through clearing. Even a profitable final hedge can need interim cash on down days. Contract size, delivery month and the exposure date create quantity and basis mismatches. An OTC forward can also have collateral terms.

Interview follow-up

Why would a futures hedge miss the budget? “I might close the futures before delivery. The change in its price can differ from the change in the spot rate I actually pay.”

Buying flexibility and selling a floor

A USD call is a right to buy USD for euros. At expiry it is in the money when spot exceeds strike. At inception the case strike equals the forward. The Garman-Kohlhagen price is the EUR discount factor times [F N(d1) - K N(d2)] times USD notional. Here d1 = [ln(F/K) + vol squared times T / 2] / [vol times square root of T], and d2 = d1 minus vol times square root of T. N is the standard normal cumulative probability.

The buyer pays EUR 1.017m and owns an asset of the same fair value. At month three the asset is worth EUR 0.218m in the specified market. At expiry 1.02 it pays EUR 4.366m. The seller receives premium and owes the payoff. Implied volatility is the volatility that reproduces a quoted premium with strike, maturity, forward and discount fixed. Here 10% is an assumption. Delta measures first-order spot risk, gamma the change in delta, vega volatility risk and theta sensitivity to passing time.

A collar for a buyer of one unit

With a one-year forward of USD 100, zero rates and 20% volatility, buy a call struck at 110 and sell a put struck at 90. Black forward pricing gives the call value. Put-call parity gives the put. The bank takes the opposite legs. The short put gives up savings below 90. Strike selection determines the net premium.

Cash or value	USD per unit
Net premium paid today	0.703
Half-year MTM at forward 105	2.924
At 120, call receipt / physical spend	10.000 / 120.000
Net spend at 120 including premium	110.703
At 75, short put payment / physical spend	15.000 / 75.000
Net spend at 75 including premium	90.703

Follow-up: “Could I keep the low purchase price if spot falls to 75?” The sold put requires paying the difference to 90, so the collar creates a minimum effective cost.

Swaps, caps and floors

For the borrower, a pay-fixed swap exchanges each floating benchmark receipt for a fixed coupon. Discount both legs. Par fixed rate = (1 - final discount factor) / sum(accrual x discount factor) = 4.0403%. At origination the two legs have equal PV. The bank receives fixed. At the second coupon, a 6% reset gives the client USD 0.588m, reducing USD 2.250m loan interest to USD 1.662m. A fall in rates makes remaining fixed payments expensive to terminate.

The borrower cap consists of calls on successive benchmark resets. For each unfixed caplet use Black-76 on the positive forward rate, reset time for volatility and payment date for discounting. Multiply by notional and accrual. Known fixings use discounted intrinsic value. Cap PV is USD 0.155m. At 6%, receive USD 0.300m. At 3%, receive zero and pay the lower floating coupon. The selling bank owes each caplet payoff. The refinancing exhibit in the report shows the remaining swap and cap MTMs.

A lender can instead buy a 3.5% floor on a USD 10m half-year coupon fixing in six months and paid in one year. Forward 4%, discount rate 4%, Black vol 30%. Use the corresponding put on the forward. Premium is USD 6,110. Three months later at a 3% forward it is worth USD 26,121. A 2% final reset gives USD 75,000 from the floor seller plus USD 100,000 loan interest. Net coupon after nominal premium is USD 168,890.

Cross-currency funding

A firm borrows USD 10m for one year but needs EUR 9m. Spot is 0.90 EUR per USD. At inception it gives the bank USD 10m and takes EUR 9m. Use annual effective USD 4% and EUR 2%, no basis. At maturity the firm receives USD 10.4m from the bank and pays EUR 9.18m. The par swap has zero initial PV. An immediate move to 0.95 raises the USD leg value, giving EUR 0.500m MTM. At expiry spot 0.96, the swap net receipt is EUR 0.804m equivalent. Its USD receipt retires the USD debt, leaving EUR 9.18m payable.

Follow-up: “Would a USD interest-rate swap solve this problem?” It changes USD coupons. Cross-currency principal exchanges also change which currency the borrower must deliver at maturity. The dealer must fund both currencies and manage cross-currency basis.

Fuel costs and default protection

A ferry operator needs 100,000 fuel units in one year. Benchmark forward and strike are USD 80, rates zero and Black volatility 25%. Choose long futures, pay-fixed/receive-index swap or a purchased call. Halfway through the year the benchmark forward is 85. At delivery the benchmark is 95 and the physical grade costs 97. Supplier and benchmark basis adds USD 0.2m to the hedged purchase.

USD millions	Initial premium	Interim value[1]	Receipt[1]	Net fuel cost
Fuel futures	0.000	0.500	1.500	8.200
Fuel swap	0.000	0.500	1.500	8.200
Fuel call	0.796	0.865	1.500	8.996

[1] Futures columns show cumulative variation margin. The swap pays quantity times (index - fixed price) at maturity and its mark is discounted remaining settlement at the new forward. The option pays only positive differences. At a benchmark of 65 the option expires while the buyer enjoys cheaper fuel. The bank or futures short has the opposite derivative cash flows. Commodity risk also includes delivery location, grade and changes in actual fuel volume.

Follow-up: “Why can the ferry operator still miss its budget?” Its supplier charges for a specific fuel grade at a specific port. Its hedge settles against a different published price.

Credit default swap

A lender owns USD 10m face of a par zero-coupon teaching bond. Buy one-year protection. Assume a single possible credit event at maturity, 2% risk-neutral default probability, 40% recovery and a 4% continuous discount rate. Premium is payable only on survival. Equate discounted premium N x coupon x (1-q) and discounted protection N x q x (1-R). Par annual premium is 1.22449% of face. Fair initial value is zero.

Halfway through, a conditional 5% default probability for the remaining term raises protection MTM to USD 0.180m. On a covered default the seller pays USD 6.0m and the bond recovers USD 4m. Combined proceeds are USD 10.0m. On survival the buyer receives face and pays USD 0.122m premium. In an actual contract qualifying credit events, auction recovery and premium accrual depend on documentation. Reference default risk and protection-seller default risk are distinct.

Follow-up: “What if the protection seller also fails?” An unpaid protection claim can leave the lender exposed precisely when the reference bond loses value. Collateral and counterparty quality matter.