Choosing option strategies and hedging rates and currency

Derivatives and Risk Management

1 A story: the doctor and the patient

- A good doctor diagnoses, then checks the patient
- Diagnosis: a view on direction and on volatility
- Check: loss limit, cost, horizon, holdings, tax, rules
- A cure that breaks the patient's rules is no cure

IN THE LESSON

- Think of a doctor.
- She first diagnoses the illness, and then she checks the treatment against the patient, because a cure that suits the illness may not suit the person.
- Choosing an option strategy works the same way.
- The diagnosis is your two views.
- Which way do you expect the price to go?
- And will implied volatility, the market's forecast of future price swings, rise or fall?
- Then comes the check against the client.
- How much can the client lose?
- What does the trade cost?
- Does the horizon fit?
- What does the client already own, and what does tax say?
- And do the rules forbid writing options with nothing behind them?
- A good adviser shows both steps.

2 Two views, four trades

Direction picks the row, volatility picks the trade

View on price and volatility	Trade
Bullish, volatility expected to rise	Buy calls
Bullish, volatility expected to fall	Write puts
Bearish, volatility expected to rise	Buy puts
Bearish, volatility expected to fall	Write calls

IN THE LESSON

- Here are the four basic answers.
- Read down the left side.
- If you are bullish and expect volatility to rise, buy calls.
- You gain from the price rise and from higher volatility.
- If you are bullish but expect volatility to fall, write puts.
- You collect a rich premium that shrinks as the market calms.
- If you are bearish and expect volatility to rise, buy puts.
- If you are bearish and expect volatility to fall, write calls.
- A bought option gains when volatility rises.
- A written option gains when volatility falls.
- With no view on direction, the choice is only about volatility: buy a straddle for a big move, or sell volatility for a quiet market.

3 The same put at three volatilities

Put price a share

Volatility 25%	**1.29**
Volatility 30%	**1.84**
Volatility 40%	**3.03**

Pelham Mills at 50, put strike 45, six months, rate 2%

IN THE LESSON

- Now the second view, in a picture.
- Fernhill owns shares in Pelham Mills, a gift from a donor, priced at fifty.
- Each bar is the price of the same put, struck at forty five and expiring in six months, but at a different level of implied volatility.
- At twenty five per cent, the put costs one point two nine a share.
- At thirty per cent, it costs one point eight four.
- At forty per cent, which is where the market is today, it costs three point oh three.
- Same share, same strike, same date, yet the price more than doubles.
- So buying options when implied volatility is already high means paying for that fear at its peak, which is the trap of choosing on direction alone.

4 Example 1: the Pelham collar

100,000 shares at 50; 6 months; no uncovered writing

Buy the 45 put	at 40% volatility	**3.03**
Write the 57 call	same volatility	**3.30**
Net premium received	3.30 − 3.03	**0.27**
Worst loss on 100,000 shares	(50 − 45 − 0.27) × 100,000	**473,000**
Best gain, up to the cap	(57 − 50 + 0.27) × 100,000	**727,000**

IN THE LESSON

- Now Imogen Park's problem.
- Fernhill holds one hundred thousand Pelham shares at fifty, a gift it would rather not sell this year, because in this made-up case a sale would trigger a tax charge.
- The trustees fear a fall over the next six months, and the policy bans writing options with nothing behind them.
- Her views: bearish, with implied volatility high and likely to fall.
- Buying a put alone would answer the first view and ignore the second.
- So she buys the forty five put for three point oh three, and writes the fifty seven call for three point three zero.
- The call brings in more than the put costs, a net credit of twenty seven cents a share.
- The worst case is a fall to forty five: a loss of four hundred seventy three thousand.
- The best case is a rise to fifty seven: a gain of seven hundred twenty seven thousand.

5 The collar, drawn

Chart: Value per share vs Share price at expiry

- Floor 45.27
- Cap 57.27
- No hedge

IN THE LESSON

- Here is the picture.
- The horizontal axis is the Pelham share price when the options expire.
- The vertical axis is what each share is worth to Fernhill, counting the premium.
- The straight grey line is the shares with no hedge: the value equals the price.
- The green line is the collar.
- On the left, however far the shares fall, each share is worth forty five point two seven, the floor plus the credit.
- In the middle, the green line rises with the shares.
- On the right, beyond the call strike, it goes flat at fifty seven point two seven, the cap.
- So the collar gives away the gains above the cap to buy protection below the floor.
- Imogen must say so plainly: what is given up is every gain beyond the cap.

6 Payoffs at three plausible prices

100,000 shares worth 50; collar 45 to 57; credit 0.27

Price falls to 35	floor 45 + credit 0.27	**−473,000**
Price stays at 50	only the credit	**+27,000**
Price rises to 65	cap 57 + credit 0.27	**+727,000**
No collar at 35	(35 − 50) × 100,000	**−1,500,000**
No collar at 65	(65 − 50) × 100,000	**+1,500,000**

IN THE LESSON

- Next, test the collar at prices the shares might plausibly reach.
- If Pelham falls to thirty five, the put pays, and each share is worth the floor of forty five plus the credit.
- Fernhill loses four hundred seventy three thousand.
- Without the collar the loss would have been one million five hundred thousand.
- If Pelham stays at fifty, both options expire worthless and Fernhill keeps the credit, twenty seven thousand.
- If Pelham rises to sixty five, the written call is exercised against the shares, so the gain stops at the cap, seven hundred twenty seven thousand, where unprotected shares would have gained one million five hundred thousand.
- That is the full bargain: a bounded loss, and a bounded gain.
- A good justification shows these numbers.

7 Testing the collar against the client

Six month horizon; Imogen's checklist for Fernhill

Client test	Collar result
Worst loss 9.46% against limit 10%	Passes
Credit 0.27; breakeven 49.73	Passes
Holdings kept, so no tax bill	Passes
Written call is covered	Allowed

IN THE LESSON

- Having picked the trade from the two views, Imogen now tests it against the client, one test at a time.
- Maximum loss against risk tolerance: the worst loss is nine point four six per cent of the holding, against a trustee limit of ten per cent.
- It passes.
- Cost and breakeven: there is no cost, since the collar pays a credit of twenty seven cents, and the shares only need to hold at forty nine point seven three to break even.
- Holdings and tax: the shares are kept, so there is no sale and no tax bill.
- Rules: the written call is covered by the shares, so the ban on uncovered writing is respected.
- The horizon is six months, which is the period the trustees worry about.
- Every test is passed.

8 Example 2: a straddle when options are cheap

Index fund at 100; 10,000 units; 3 months; volatility 18%; rate 2%

Buy the 100 call	18% volatility	**3.84**
Buy the 100 put	same strike and date	**3.34**
Cost of the straddle	3.84 + 3.34	**7.18**
Breakevens	100 ± 7.18	**92.82 / 107.18**
Most you can lose	7.18 × 10,000	**71,800**

IN THE LESSON

- Now a case with no view on direction.
- Fernhill's tactical sleeve holds ten thousand units of a broad index fund, priced at one hundred.
- A major policy announcement is due in three months.
- Imogen cannot say whether the market will rise or fall, but she expects a big move.
- And here implied volatility is only eighteen per cent, below its long run level, so options are cheap.
- She buys a straddle: the one hundred call for three point eight four and the one hundred put for three point three four, together seven point one eight.
- She needs the index to finish below ninety two point eight two or above one hundred seven point one eight to profit.
- The most she can lose is seventy one thousand eight hundred.
- If the market stays quiet, she loses, and she must say so.

9 A story: the volume knob

- Exposure = shares plus options, in share-equivalents
- Delta: the shares-worth of one option, 0.50 is half a share
- Options reset exposure without selling the shares
- Fernhill: 100,000 Marsden Rail shares at 50, big gain

IN THE LESSON

- Imagine the exposure to shares in a portfolio as the volume on a speaker.
- Selling shares turns it down, but that knob is stiff.
- Selling can trigger tax or cost a lot.
- Options give a second knob.
- Each option behaves like a fraction of a share, and that fraction is its delta.
- A call with a delta of point five moves about as much as half a share.
- So a manager can count options as share equivalents and reach any exposure she likes without touching the shares.
- Fernhill holds a second large stock, Marsden Rail, with a big unsold gain, yet the trustees want less exposure to it.

10 Sizing the option position

Options = (target − current delta) ÷ option delta
Check: 10,000 shares to zero, delta 0.50: (0 − 10,000) ÷ 0.50 = −20,000

Target delta	Exposure you want, in shares
Current delta	Exposure you hold now
Option delta	Shares-worth of one option
Options needed	Negative: write. Positive: buy

IN THE LESSON

- The sizing formula is simple division.
- The options needed equal the target delta minus the current delta, divided by the delta of one option.
- Delta here is counted in shares, and each share you hold has a delta of one.
- The answer carries a sign.
- A negative answer means write that many options, because writing calls lowers your exposure.
- A positive answer means buy.
- Here is a quick check.
- A holder of ten thousand shares wants zero exposure, using calls with a delta of point five.
- Zero minus ten thousand, divided by point five, gives minus twenty thousand.
- She writes twenty thousand calls.

11 Example 3: Marsden Rail, exposure cut to 45,000

100,000 shares at 50; call delta 0.50; do not sell

Current delta	100,000 × 1.00	**100,000**
Target delta	45% of the holding	**45,000**
Calls needed	(45,000 − 100,000) ÷ 0.50	**−110,000**
Check	100,000 − 110,000 × 0.50	**45,000**
Zero exposure instead	(0 − 100,000) ÷ 0.50	**−200,000**

IN THE LESSON

- Now the foundation's second holding.
- Fernhill owns one hundred thousand Marsden Rail shares at fifty, so its current delta is one hundred thousand.
- The trustees want the exposure cut to forty five per cent of that, which is forty five thousand share equivalents.
- Imogen picks calls with a delta of point five.
- Calls needed: forty five thousand minus one hundred thousand, divided by point five.
- That is minus one hundred ten thousand, so she writes one hundred ten thousand calls.
- Check it.
- One hundred thousand shares, less one hundred ten thousand calls times point five, leaves forty five thousand.
- Cutting the exposure all the way to zero would need two hundred thousand calls.
- The shares never move, so there is no sale.

12 Other ways to trim exposure

Per share held; call delta 0.50, put delta −0.40

Position	Delta per share
Shares alone	1.00
Covered call: write a call	0.50
Protective put: buy a put	0.60
Collar: write call, buy put	0.10

IN THE LESSON

- Writing calls is not the only way.
- Look at the table, counting delta per share held.
- The shares alone have a delta of one.
- A covered call, writing one call per share, subtracts the call's delta of point five and leaves point five.
- A protective put, buying one put per share, adds the put's delta of minus point four, leaving point six.
- A collar does both, so one minus point five minus point four leaves point one: almost no exposure, with a floor and a cap.
- Each of these trims exposure without selling a share.
- Buying calls goes the other way: it adds upside, and the most you can lose is the premium.

13 The exposure will not sit still

Chart: Exposure (thousand shares) vs Marsden Rail share price

- Target 45
- Set at 50: 45
- At 54: 23

IN THE LESSON

- This picture shows the position as the price moves.
- The horizontal axis is the Marsden Rail share price.
- The vertical axis is the exposure, in thousands of share equivalents.
- The flat green line is the target, forty five thousand.
- The red curve is the actual exposure: the shares less the written calls.
- At fifty it sits on the target.
- Now follow it to the right.
- As the price rises, the delta of the calls climbs towards one and cancels more of the shares, so the exposure falls.
- At fifty four it is down to about twenty three thousand, half the target, just when a rise is what the client wanted to keep.
- Follow it to the left.
- As the price falls, the calls' delta shrinks, and the exposure climbs back towards the full holding as the losses arrive.
- That drift is gamma.
- A position short options is short gamma.

14 Example 4: the price rises to 54

Marsden Rail at 54; 110,000 calls written

Delta of the calls	0.50 → 0.70	**0.70**
Position delta now	100,000 − 110,000 × 0.70	**23,000**
Target		**45,000**
Shortfall	45,000 − 23,000	**22,000**
Calls to buy back	22,000 ÷ 0.70	**31,429**

IN THE LESSON

- Now let the price rise to fifty four, a month on.
- The delta of the written calls climbs from point five to point seven.
- The position delta is one hundred thousand minus one hundred ten thousand times point seven, which is twenty three thousand.
- The target was forty five thousand, so the exposure is twenty two thousand short.
- To reset, Imogen buys back calls: twenty two thousand divided by point seven, about thirty one thousand four hundred twenty nine calls.
- Notice the cost.
- She buys back after the calls have risen in price, and must keep doing so.
- That is the price of being short gamma.
- The hedge was right at the old price and wrong after the rise, so it is good for small moves only.

15 Neutralising gamma

Options to add = position gamma ÷ gamma of added option
Then reset delta with futures or shares

Position gamma	Short options make it negative
Added option's gamma	Per option, always positive
Options to buy	Brings total gamma to zero

IN THE LESSON

- There are two ways to live with gamma.
- One is to rebalance often, paying costs each time.
- The other is to remove the gamma first.
- First, add up the position's gamma.
- Written options make it negative.
- Second, buy another option with a positive gamma, in the number that brings the total back to zero: the position gamma, with its sign dropped, divided by the added option's gamma.
- Third, the added options carry their own delta, which has pushed the exposure off target again.
- Use futures or shares to put the delta back on target, because futures and shares have delta but no gamma.
- The order matters: set the delta, fix the gamma, then reset the delta.

16 Example 5: gamma first, then delta

Written calls: gamma 0.05. Added 58 calls: gamma 0.04, delta 0.19

Gamma of 110,000 written calls	110,000 × 0.05	**−5,500**
Added 58 calls to buy	5,500 ÷ 0.04	**137,500**
Delta they add	137,500 × 0.19	**26,125**
Delta after the options	45,000 + 26,125	**71,125**
Sell futures to reset	71,125 − 45,000	**26,125**

IN THE LESSON

- Here is the order of work for Marsden Rail.
- The written calls, one hundred ten thousand of them with a gamma of point oh five each, leave the position short five thousand five hundred of gamma.
- Imogen buys calls struck at fifty eight, with a gamma of point oh four and a delta of point one nine.
- She needs five thousand five hundred divided by point oh four, which is one hundred thirty seven thousand five hundred of them.
- Gamma is now zero.
- But those calls carry delta of twenty six thousand one hundred twenty five, which lifts the exposure to seventy one thousand one hundred twenty five.
- So she sells futures on the stock for twenty six thousand one hundred twenty five share equivalents, and the exposure is back at forty five thousand.

17 Mistakes to avoid so far

- Choosing on direction alone
- Buying options when implied volatility is already high
- Skipping the client tests: loss limit, tax, uncovered ban
- Treating a delta hedge as permanent
- Wrong sign: a negative count means write

IN THE LESSON

- Here are the mistakes so far.
- One: choosing on direction alone, and ignoring the volatility view.
- Two: buying options when implied volatility is already high, which overpays for the very protection you want.
- Three: skipping the client tests, so a trade that suits the view breaks a loss limit, a tax rule or the ban on uncovered writing.
- Four: treating a delta hedge as permanent, when it is right only for small moves and drifts as gamma works.
- Five: getting the sign wrong in the sizing formula, where a negative answer means write options.
- The exam likes to build a whole story around one of these.

18 A story: the dial on a bond portfolio

- Rate risk of a bond portfolio is set by its duration
- BPV: money change for one basis point of yield
- Futures and swaps add or remove duration
- Fernhill: 200m bonds, duration 3.1, BPV 62,000

IN THE LESSON

- Switch to interest rates.
- Fernhill keeps two hundred million in bonds to pay scholarships.
- How much those bonds lose when yields rise depends on their duration.
- Practitioners measure it as a money amount called basis point value, the change in value for a one basis point move in yield.
- Fernhill's bonds have a duration of three point one, so a basis point value of sixty two thousand.
- Now suppose Imogen expects yields to rise and wants less exposure, but selling a big bond portfolio is slow and costly.
- Derivatives let her change the duration without touching the bonds.
- Futures and swaps each carry a duration of their own, and adding them shortens or lengthens the whole portfolio.

19 Sizing a futures hedge

Contracts = (target BPV − portfolio BPV) ÷ futures BPV
Futures BPV = CTD BPV ÷ conversion factor

Target BPV	Set by the liabilities or view
Portfolio BPV	Money per basis point now
Futures BPV	CTD BPV over conversion factor
Contracts	Negative: sell. Positive: buy

IN THE LESSON

- The sizing rule uses basis point value as the common currency.
- The number of contracts is the target basis point value minus the portfolio's basis point value, divided by the basis point value of one futures contract.
- A futures contract is priced off a bond, the cheapest to deliver, so its basis point value is roughly that bond's basis point value divided by its conversion factor.
- As with options, the answer has a sign.
- A negative number means sell futures, because selling futures is like shortening the bonds.
- A positive number means buy.
- The same sign rule holds for swaps: shortening means paying fixed, and lengthening means receiving fixed.
- Do the subtraction in the right order, target minus portfolio, and the sign takes care of itself.

20 From 62,000 to 44,000

BPV, dollars a basis point

Portfolio	**62,000**
Target	**44,000**
Gap to remove	**18,000**

Duration cut from 3.1 to 2.2

IN THE LESSON

- Here is the gap in a picture.
- The vertical axis is basis point value, in dollars per basis point.
- The first bar is where the portfolio stands today, sixty two thousand.
- Imogen expects yields to rise, so she wants the portfolio at forty four thousand, the second bar.
- That is a cut in duration from three point one to two point two.
- The third bar is the gap, eighteen thousand, and it must be removed, so the sign is negative: eighteen thousand to take off.
- Shortening the portfolio means selling futures, or paying fixed on a swap.
- Had the target been higher, the formula would have given a positive number, and she would have bought futures.

21 Example 6: sell bond futures

CTD BPV 90, conversion factor 0.75; target BPV 44,000

Futures BPV	90 ÷ 0.75	**120**
BPV gap	44,000 − 62,000	**−18,000**
Contracts	−18,000 ÷ 120	**−150**
Yields +10: bonds, futures	−620,000 + 180,000	**−440,000**

IN THE LESSON

- Now size it for Fernhill.
- The cheapest to deliver bond has a basis point value of ninety per contract and a conversion factor of point seven five, so one futures contract has a basis point value of one hundred twenty.
- The gap is forty four thousand minus sixty two thousand, which is minus eighteen thousand.
- Divide by one hundred twenty and you get minus one hundred fifty.
- The sign is negative, so Imogen sells one hundred fifty futures.
- Now test it.
- If yields rise ten basis points, the bonds lose six hundred twenty thousand.
- The short futures gain one hundred eighty thousand.
- The net loss is four hundred forty thousand, exactly what a portfolio with a basis point value of forty four thousand would lose.
- The hedge works.

22 Example 7: the swap route

Receive-fixed swap: BPV 450 per 1m of notional

BPV gap	44,000 − 62,000	**−18,000**
Pay-fixed BPV per 1m	opposite sign	**−450**
Notional needed	18,000 ÷ 450	**40m**
Yields +10: swap gains	40 × 450 × 10	**+180,000**
Net loss on the portfolio	−620,000 + 180,000	**−440,000**

IN THE LESSON

- A swap can do the same job.
- Fernhill's bank quotes a swap in which a receive fixed position changes by four hundred fifty dollars per basis point for each million of notional.
- Paying fixed has the opposite sign.
- It acts like having issued a fixed rate bond, which is why it shortens duration.
- The gap is again minus eighteen thousand.
- Divide by four hundred fifty and the notional is forty million, paying fixed.
- If yields rise ten basis points, the swap gains forty times four hundred fifty times ten, which is one hundred eighty thousand, the same as the futures, and the net loss is again four hundred forty thousand.
- So why choose between them?
- Futures are liquid and margined daily.
- A swap can be tailored to the exact maturities of the liabilities, but it brings counterparty risk and collateral calls.

23 Example 8: locking in a reinvestment rate

10m for 6 months; FRA receive 4.0%; market falls to 3.2%

FRA settlement received	0.8% × 0.5 × 10m ÷ 1.016	**39,370**
Interest on 10m at 3.2%	10m × 3.2% × 0.5	**160,000**
Settlement grown at 3.2%	39,370 × 1.016	**40,000**
Total interest	160,000 + 40,000	**200,000**
As a rate for half a year	200,000 ÷ 10m ÷ 0.5	**4.0%**

IN THE LESSON

- Forward rate agreements do a narrower job.
- They fix one future rate.
- Fernhill has ten million maturing in six months, to be reinvested for six months.
- Imogen fears rates will fall, so she agrees today a forward rate agreement at four per cent, receiving fixed: if the market rate turns out lower, she is paid the difference.
- Suppose the rate falls to three point two per cent.
- The settlement is point eight per cent, times half a year, times ten million, discounted by one point oh one six because it is paid at the start: thirty nine thousand three hundred seventy.
- Reinvesting ten million at three point two per cent earns one hundred sixty thousand.
- The settlement, invested at the same rate, grows to forty thousand.
- Together that is two hundred thousand, which is four per cent for half a year on ten million.
- The rate is locked in.

24 Rate tools compared

Which tool fits which job

Tool	Strength
Futures: standard, margined daily	Liquid
Swaps: tailored to liability dates	Exact fit
Forward rate agreement: one rate	Narrow
Basis risk: curve moves unevenly	Trap

IN THE LESSON

- Compare the tools.
- Bond futures are standard, liquid and margined daily, so they are cheap to put on and take off, but their duration comes from one cheapest to deliver bond.
- Swaps can be tailored to the exact dates of the liabilities, but they bring counterparty risk and collateral calls.
- A forward rate agreement fixes one future rate, nothing more.
- Then there is the trap that follows all of them: basis risk.
- Matching basis point value works for a parallel move in yields.
- If long rates fall while short rates stay put, a hedge concentrated at one maturity can miss.
- And watch the sign.

25 A story: two bets in one bond

- A foreign bond is two bets: the bond and the currency
- Fernhill (dollar base): 40m of euro bonds at 2.0%
- A forward sells the euros later at a rate fixed today
- Rates: dollars 4.0%, euros 2.0%; spot 1.1000

IN THE LESSON

- Now currency.
- Buying a foreign bond is really two bets.
- One is on the bond: will the issuer pay, and will yields move?
- The other is on the currency: will it be worth more or fewer dollars when the money comes home?
- Fernhill's base currency is the dollar.
- It holds forty million euros of euro bonds yielding two per cent, and one euro costs one dollar and ten cents today.
- Imogen can remove the second bet with a forward contract: agree now to sell the euros a year from now, at a rate fixed today.
- The rate she gets is not a guess about the future.
- It is set by the gap between the two interest rates, which are four per cent in dollars and two per cent in euros.

26 Covered interest parity

Forward = Spot × (1 + home rate) ÷ (1 + foreign rate)
Dollars per euro: 1.1000 × 1.04 ÷ 1.02 = 1.1216

Spot	Home money per foreign unit
Home rate	Home rate for the same term
Foreign rate	Other currency's rate, same term
Forward	Fixed today for a later swap

IN THE LESSON

- This is covered interest parity.
- The forward rate equals the spot rate times one plus the home interest rate, divided by one plus the foreign interest rate, for the same period.
- Rates are quoted as home money per one unit of foreign money, here dollars per euro.
- Fernhill's numbers: one point one zero zero zero times one point oh four, divided by one point oh two, gives one point one two one six dollars per euro.
- Why is the forward higher than spot?
- Because dollar rates are higher than euro rates.
- Otherwise someone could borrow in one currency, lend in the other, hedge, and earn a free profit.
- So the forward does not forecast the exchange rate.
- It simply carries the interest rate gap.

27 Example 9: hedging the euro bonds

€40m bond at 2.0%; spot 1.1000; dollar rate 4.0%

Cost today	40m × 1.1000	**$44.0m**
Euros back in a year	40m × 1.02	**€40.8m**
Sell forward at	1.1000 × 1.04 ÷ 1.02	**1.1216**
Hedged dollars received	40.8m × 1.1216	**$45.76m**
Return: hedged, or euro at 1.0500	$45.76m, or $42.84m	**+4.0%, −2.6%**

IN THE LESSON

- Work it through.
- Fernhill pays forty million euros times one point one zero zero zero, so forty four million dollars.
- A year later the bond returns forty million times one point oh two, forty point eight million euros.
- Imogen sells those euros forward at one point one two one six.
- She receives forty point eight million times that rate, forty five point seven six million dollars, which is a return of four per cent on forty four million.
- Without the hedge, suppose the euro drifts down to one point oh five zero zero.
- The proceeds are forty two point eight four million, a loss of two point six per cent.
- Notice what the hedge did.
- It turned a two per cent euro bond into a four per cent dollar return, exactly the dollar interest rate.
- Hedging a lower yielding currency earns the rate gap.

28 Hedging earns the gap or gives it up

Dollar base, dollar rate 4.0%; one year

Foreign bond	Hedged return
Euro bond, 2.0%: earns 2.0 points	4.0%
Australian bond, 5.0%: gives up 1.0	4.0%

IN THE LESSON

- Put two cases side by side.
- Euro bonds yield two per cent and the dollar rate is four per cent.
- Hedged into dollars, the investor earns four per cent: the hedge earns the two point zero gap.
- Australian dollar bonds yield five per cent.
- Hedged into dollars, they also return four per cent, so the hedge gives up one point.
- Either way, a fully hedged foreign bond earns about the home currency interest rate.
- So hedging is never free.
- When the foreign yield is higher, the hedger pays the gap away, and hedging a bond can remove the very reason for holding it.
- When the foreign yield is lower, hedging adds return.
- That is why hedging decisions depend on interest rate gaps as well as on views about the currency.

29 Forwards, futures and swaps

Choosing the currency tool

Tool	Best for
Forward: exact amount and date	Tailored
Future: standard size, margined	Liquid
Swap: principal swapped both ends	Long loans

IN THE LESSON

- Three tools do the job in different ways.
- A forward is a private contract, so it can match Fernhill's exact amount and date, but it carries credit risk.
- A currency future is the exchange traded version: standard sizes and dates, daily margining and a clearing house, so it is liquid and cheap but never an exact fit.
- A currency swap is different, and it lasts longer.
- The two sides exchange principal at the start, pay interest in each currency along the way, and exchange the principal back at the end.
- That turns foreign currency borrowing or foreign currency assets into home currency ones, as the next example shows.

30 Example 10: a currency swap

Turn 20m of euro bonds into dollar exposure

Start: swap principal	pay $22.0m, get €20.0m	**at 1.1000**
Each year: euro interest	pay €20m × 2.0%	**€0.40m**
Each year: dollar interest	receive $22m × 4.0%	**$0.88m**
End: swap principal back	pay €20.0m, get $22.0m	**at 1.1000**
Result	euro bond acts as dollar bond	**4.0%**

IN THE LESSON

- Here is a swap at work.
- Fernhill wants to hold twenty million euros of euro bonds, but wants its returns in dollars.
- At the start it swaps principal at the spot rate of one point one zero zero zero.
- It pays twenty two million dollars and receives twenty million euros, which buys the bond.
- Every year the bond's coupon of two per cent of twenty million, point four zero million euros, goes straight to the swap counterparty, and the foundation receives four per cent on twenty two million dollars, point eight eight million.
- At the end the bond repays twenty million euros, which go to the counterparty, and the foundation receives twenty two million dollars at the same rate as the start.
- Whatever the euro did, the foundation has held a dollar bond.
- The cost is counterparty risk and collateral.

31 The trap: the hedge drifts

€30m of euro shares; €30m sold forward

Shares rise 20% to	30m × 1.20	**€36.0m**
Hedge ratio	30 ÷ 36	**83.3%**
Shares fall 20% to	30m × 0.80	**€24.0m**
Hedge ratio	30 ÷ 24	**125%**
Fix	resize the forward often	**rebalance**

IN THE LESSON

- One last trap.
- A forward hedges a fixed amount, but a share portfolio's value keeps changing.
- Fernhill holds thirty million euros of euro shares and sells thirty million euros forward.
- Suppose the shares rise twenty per cent, to thirty six million.
- The hedge now covers thirty divided by thirty six, eighty three point three per cent.
- Some euros are uncovered, and they are exposed to the currency.
- Now suppose instead the shares fall twenty per cent, to twenty four million.
- The hedge covers one hundred twenty five per cent.
- The extra forward sales are now a bet that the euro will fall, which the mandate never asked for.
- Shares and funds need the hedge resized regularly.

32 Recap: the lesson in five lines

- Two views pick the trade; the client tests decide
- Options = (target − current delta) ÷ option delta
- Contracts = (target BPV − portfolio BPV) ÷ futures BPV
- Shorten duration: sell futures or pay fixed
- Hedging carries the rate gap; resize the hedge

IN THE LESSON

- Let us pull the lesson together.
- First, choose an option strategy from two views, direction and implied volatility, and then test it on the client: loss limit, cost, horizon, holdings, tax and rules.
- Second, delta turns options into share equivalents, so the count is the target minus the current delta over the option delta, and gamma is why the hedge drifts.
- Third, interest rate risk is a basis point value, and the contracts are the target minus the portfolio value over the futures value.
- Shortening means selling futures or paying fixed.
- Fourth, a forward carries the interest rate gap, so hedging earns it or gives it up.
- Last, a forward covers a fixed amount, so the hedge must be resized.

33 Try three quick questions

1. 20,000 shares, zero exposure wanted, call delta 0.40. Trade?
   Answer: (0 − 20,000) ÷ 0.40 = −50,000: write 50,000 calls.
2. BPV 80,000, target 100,000, futures BPV 125. Trade?
   Answer: (100,000 − 80,000) ÷ 125 = +160: buy 160 futures.
3. Dollar rate 4%, foreign bond yields 6%, fully hedged. Return?
   Answer: About 4%: the hedge gives up the 2 point gap.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A holder of twenty thousand shares wants zero exposure, using calls with a delta of point four zero.
- What trade?
- Zero minus twenty thousand, divided by point four zero, gives minus fifty thousand, so she writes fifty thousand calls.
- Question two.
- A portfolio has a basis point value of eighty thousand, the target is one hundred thousand, and one futures contract has a basis point value of one hundred twenty five.
- What trade?
- One hundred thousand minus eighty thousand, divided by one hundred twenty five, gives plus one hundred sixty, so she buys one hundred sixty futures.
- Question three.
- The dollar rate is four per cent, and a bond in another currency yields six per cent.
- It is fully hedged into dollars.
- What return?
- About four per cent, so the hedge gives up the two point gap, and that is the answer.