Modifying shorts, spreads and volatility shapes

Derivatives and Risk Management

1 A story: the seat belt and the tip jar

- Short 10,000 Brindle Foods shares, sold at 60
- Price falls: she gains. Price rises: no ceiling on loss
- Buy a call: the seat belt, you pay a premium
- Write a put: the tip jar, you collect a premium

IN THE LESSON

- Think of driving a fast car.
- A seat belt costs you a little comfort, but it limits the damage in a crash.
- A tip jar on the dashboard brings in a few coins, but it does nothing in a crash.
- Tamsin Okoro's fund is short ten thousand shares of Brindle Foods, sold at sixty.
- A short seller gains as the price falls, but if the price rises the loss has no ceiling, because a share price can keep on climbing.
- Brindle reports results soon, and a takeover rumour is going round.
- She is weighing two option trades.
- Buying a call is the seat belt.
- Writing a put is the tip jar.

2 A short seller adds a call or a put

Chart: Profit per share vs Share price at expiry (sold at 60)

- Green: bought 65 call, loss stops at 8
- Red: written 55 put, gain stops at 8
- Plain short: no floor
- Each premium: 3

IN THE LESSON

- Here is the picture.
- The horizontal axis is the share price at expiry.
- The vertical axis is profit per share.
- The grey line is the plain short sale at sixty.
- It climbs to the left as the price falls, and keeps sinking to the right with no floor.
- Now the green line, the short plus a bought call struck at sixty five, premium three.
- It follows the grey line, shifted down by the premium, until the strike.
- After that it goes flat at minus eight.
- That is the cap on the loss.
- The red line is the short plus a written put struck at fifty five, premium three.
- On the right it sits just above the grey line, so the danger is still there.
- On the left it goes flat at plus eight.
- The gain is capped.

3 Example 1: the two trades at 80 and at 50

Short at 60; buy a 65 call for 3, or write a 55 put for 3

Bought call, price at 80	−20 + 15 − 3	**−8**
Written put, price at 80	−20 + 3	**−17**
Bought call, price at 50	10 − 3	**+7**
Written put, price at 50	10 − 5 + 3	**+8**
On 10,000 shares at 80	80,000 against 170,000	**put worse: 90,000**

IN THE LESSON

- Let us put numbers on it.
- The call has a strike of sixty five and costs three.
- The put has a strike of fifty five and earns three.
- First suppose Brindle jumps to eighty after a takeover bid.
- The short loses twenty.
- With the bought call, the call pays fifteen and the premium cost three, so the result is minus eight.
- With the written put, only the premium cushions the blow: minus seventeen.
- Now suppose the price falls to fifty.
- With the call she gains ten and paid three, so plus seven.
- With the put she gains ten, gives back five on the put, and keeps three, so plus eight.
- On ten thousand shares at eighty, the call version loses eighty thousand and the put version loses one hundred and seventy thousand.
- That is a big difference for one choice.

4 Two caps, one for each trade

Loss cap = X − S0 + c (short + bought call)
Gain cap = S0 − X + p (short + written put)

Strike	Strike of the option
Sale price	Price the stock was sold at
Call premium	Premium paid for the call
Put premium	Premium earned on the put

IN THE LESSON

- A pair of short formulas holds the whole idea.
- When you are short the stock and buy a call, the worst case is the strike minus the price you sold at, plus the call premium.
- When you are short the stock and write a put, the best case is the price you sold at minus the strike, plus the put premium.
- Here is the puzzle.
- The first formula caps a loss.
- The second caps a gain.
- That is because short stock plus a long call has the shape of a long put, which is insurance.
- Short stock plus a short put has the shape of a short call, which is income, not protection.
- Insurance puts a floor under the bad outcome.
- Income selling puts a ceiling on the good one.

5 The damage if Brindle reaches 80

Loss if price hits 80

Plain short	**200,000**
With bought call	**80,000**
With written put	**170,000**

10,000 shares sold at 60; premium 3 each

IN THE LESSON

- Here is the damage as a picture.
- The vertical axis is the loss if Brindle reaches eighty, on ten thousand shares sold at sixty.
- The first bar is the plain short, which loses two hundred thousand.
- The second bar is the short with the bought call.
- The loss stops at eighty thousand, and that is the cost of the seat belt, paid in advance as the premium.
- The third bar is the short with the written put.
- It loses one hundred and seventy thousand.
- The put's premium trimmed only a little off the plain short's loss.
- If Tamsin is afraid of a rally, the call is the trade that answers the fear.

6 Choose by what you fear

Tamsin's rule for modifying the short

Her view	Her trade
Fears a sharp rally	Buy a call
Wants a capped loss	Insurance
Expects a modest fall	Write a put
Wants extra income	Not a hedge

IN THE LESSON

- So how does Tamsin decide?
- She starts from what keeps her awake, not from the premium.
- If she fears a sharp rally, perhaps from a takeover bid, she buys the call.
- It is insurance, and the premium is its cost.
- If instead she expects only a modest fall and wants a little extra return, she can write the put.
- But she must describe it honestly, as income enhancement with a capped gain.
- And here is the trap the exam sets.
- A colleague says the premium collected on the written put protects the short, so the put is the cheaper hedge.
- It is not a hedge.
- It leaves almost all of the rally risk where it was.

7 A story: one toolbox, three clients

- Index fund unit trades at 100
- Client A expects a modest rise
- Client B expects a big move, direction unknown
- Client C owns the units and wants a free floor

IN THE LESSON

- A good carpenter does not own one tool.
- She picks the tool for the job.
- Tamsin Okoro now has three clients on the same morning, all looking at the same index fund unit, which trades at one hundred.
- Client A thinks it will rise a little.
- Client B thinks a court ruling is about to move it a long way, but has no idea which way.
- Client C already owns the units and wants a floor under their value, without paying for it.
- Three different views, so three different structures.
- For each one we need to know the same things: the objective, the cost, the best result, the worst result, and the price at which it breaks even.

8 Four structures, four views

Each structure suits one view

Structure	View it backs
Bull call spread	Modest rise
Bear put spread	Modest fall
Long straddle	Big move
Collar on an asset	Band of value

IN THE LESSON

- A bull call spread buys a call at a lower strike and writes a call at a higher strike.
- It backs a modest rise.
- A bear put spread is the mirror image: buy the put at the higher strike and write the put at the lower strike.
- It backs a modest fall.
- A long straddle buys a call and a put at the same strike.
- It makes no bet on direction, only on a big move.
- A collar starts with an asset the fund already holds, buys a put below, and writes a call above.
- It puts a band around the value.
- In each case the written option brings in cash to pay for part of the option bought, in return for giving up some of the gain.

9 Bull call spread: three numbers

Max profit = XH − XL − net premium
Max loss = net premium
Breakeven = XL + net premium

Lower strike	Strike of the call bought
Higher strike	Strike of the call written
Net premium	Cost of bought less written

IN THE LESSON

- Take client A first.
- The net premium of a bull call spread is what you pay for the lower strike call, less what you receive for the higher strike call.
- That net premium is also the most you can lose.
- That happens if the index finishes at or below the lower strike and both calls expire worthless.
- The most you can make is the gap between the strikes, less the net premium.
- You reach it at or above the higher strike.
- The breakeven is the lower strike plus the net premium, because the long call must first earn back what you paid.
- A bear put spread works the same way, flipped over.
- The maximum profit and loss are the same, but the breakeven is the higher strike minus the net premium.

10 Example 2: client A's bull call spread

Index at 100. Buy a 95 call at 7.50, write a 105 call at 3.00

Net premium paid	7.50 − 3.00	**4.50**
Maximum loss	the net premium	**4.50**
Maximum profit	105 − 95 − 4.50	**5.50**
Breakeven	95 + 4.50	**99.50**
Profit if the index ends at 100	5.00 − 4.50	**0.50**

IN THE LESSON

- Now client A, with the index at one hundred.
- The call struck at ninety five costs seven and a half.
- The call struck at one hundred and five brings in three.
- The net premium is seven and a half minus three, which is four and a half, and that is the most client A can lose.
- The maximum profit is the gap between the strikes, less four and a half, which is five and a half.
- The breakeven is ninety five plus four and a half, which is ninety nine and a half.
- If the index ends at one hundred, the long call is worth five, so the profit is only half a point.
- Client A gives up everything above one hundred and five.

11 The bull call spread at expiry

Chart: Profit vs Index at expiry (strikes 95 and 105)

- Loss stops at 4.50
- Gain stops at 5.50
- Breakeven 99.50

IN THE LESSON

- Here is client A's spread drawn out.
- The horizontal axis is the index at expiry, and the strikes are in the label.
- The vertical axis is profit.
- The line is a ramp between two flat stretches.
- On the left, below the lower strike, both calls expire worthless, and the loss is flat at four and a half.
- That is the net premium.
- Climbing the ramp, the call that was bought gains one for one.
- The line crosses zero at the breakeven, ninety nine and a half.
- On the right, above the higher strike, the written call takes every extra point, so the profit is flat at five and a half.
- Notice the shape.
- A modest loss and a modest gain, both known before the trade is made.

12 Example 3: the mirror image, a bear put spread

Index at 100. Buy a 105 put at 8.00, write a 95 put at 3.50

Net premium paid	8.00 − 3.50	**4.50**
Maximum loss	the net premium	**4.50**
Maximum profit	105 − 95 − 4.50	**5.50**
Breakeven	105 − 4.50	**100.50**
Which view it backs	gain needs a fall	**Modest fall**

IN THE LESSON

- If client A had expected a modest fall, the mirror image is a bear put spread.
- With the index at one hundred, buy the put struck at one hundred and five for eight, and write the put struck at ninety five for three and a half.
- The net premium is eight minus three and a half, which is four and a half again, and again that is the most that can be lost.
- The maximum profit is the gap between the strikes, less four and a half, so five and a half.
- The breakeven moves to the other side.
- It is one hundred and five minus four and a half, which is one hundred point five.
- The gain needs the index to fall below that.

13 The long straddle

Max loss = total premium
Breakevens = K ± total premium

Strike	Strike of both options
Call premium	Premium paid for the call
Put premium	Premium paid for the put
Total premium	Call premium plus put premium

IN THE LESSON

- Now client B, who expects a big move but not its direction.
- A long straddle buys a call and a put with the same strike.
- The cost is the call premium plus the put premium, the total premium.
- That total is also the most you can lose.
- It happens only if the index finishes exactly at the strike, where both options expire worthless.
- The gain on the upside is unlimited, because the call keeps rising.
- On the downside the gain is large but limited, because a price cannot go negative.
- There is a breakeven on each side.
- They are the strike plus the total premium, and the strike minus the total premium.
- The straddle is a bet on volatility, not on direction.

14 Example 4: client B's straddle

Index at 100. Buy a 100 call at 5.00 and a 100 put at 4.00

Total premium	5.00 + 4.00	**9.00**
Maximum loss	index ends at exactly 100	**9.00**
Upper breakeven	100 + 9.00	**109**
Lower breakeven	100 − 9.00	**91**
Profit if the index ends at 120	20 − 9.00	**11.00**

IN THE LESSON

- Client B buys the straddle at the one hundred strike.
- The call costs five and the put costs four, so the total premium is nine, and that is the most client B can lose.
- The breakevens are one hundred plus nine, which is one hundred and nine, and one hundred minus nine, which is ninety one.
- So the index must move nine points, either way, before client B makes a penny.
- If the court ruling sends it to one hundred and twenty, the call pays twenty, and after the nine of premium the profit is eleven.
- If the ruling disappoints everyone and the index ends at one hundred, client B loses the full nine.
- The risk is time.
- Every quiet day eats into the value of both options.

15 The straddle is a V

Chart: Profit vs Index at expiry (strike 100)

- Breakeven 91
- Breakeven 109
- Worst: lose 9

IN THE LESSON

- Here is client B's straddle.
- The horizontal axis is the index at expiry.
- The vertical axis is profit.
- The shape is a V.
- At the bottom of the V, right at the strike, the loss is the full nine of premium.
- That is the worst case.
- As the index moves away from the strike in either direction, one of the two options gains one for one, and the line climbs.
- It crosses zero at the two breakevens, ninety one on the left and one hundred and nine on the right.
- Beyond those points client B is ahead.
- Compare it with the spread, which was a ramp with two flat ends.
- The straddle has no flat end.
- It simply asks for a big move and pays more the bigger the move is.

16 The collar

Value at expiry = S + max(floor − S, 0) − max(S − cap, 0)

Price at expiry	Price of the asset at expiry
Floor	Strike of the put bought
Cap	Strike of the call written

IN THE LESSON

- Now client C, who already owns the index units.
- A collar adds a put and a call to a long asset.
- The fund buys a put at a lower strike, which is the floor, and writes a call at a higher strike, which is the cap.
- At expiry the value is the price itself, plus whatever the put pays when the price is below the floor, less whatever the call takes when the price is above the cap.
- So below the floor the value is held at the floor, and above the cap it is held at the cap.
- Between the two, the asset moves freely.
- If the call premium equals the put premium, the net cost is zero.
- The call funds the put.
- That is a zero cost collar.

17 Example 5: client C's zero cost collar

Units at 100. Buy a 90 put for 2.00, write a 110 call for 2.00

Put bought, strike 90	premium paid	**−2.00**
Call written, strike 110	premium received	**+2.00**
Net cost of the collar	−2.00 + 2.00	**0**
Value if the index ends at 80	put pays 10	**90**
Value if the index ends at 120	call takes 10	**110**

IN THE LESSON

- Client C holds the index units at one hundred.
- The fund buys the put struck at ninety for two, and writes the call struck at one hundred and ten for two.
- The cost of the put is exactly covered by the premium from the call, so the net cost is nothing.
- Now see what the value does.
- If the index falls to eighty, the put pays ten and the value is held at ninety.
- If the index rises to one hundred and twenty, the call takes ten and the value is capped at one hundred and ten.
- Anywhere between ninety and one hundred and ten, client C simply owns the units.
- So the floor was free, but only because client C sold the upside above one hundred and ten to pay for it.

18 What each structure gives up

The price of each client's structure

Structure	What it gives up
Bull call spread	Gain above 105
Bear put spread	Gain below 95
Long straddle	9.00 if no move
Collar	Gain above 110

IN THE LESSON

- Every structure gives something up, and that is where a recommendation gets tested.
- Client A's bull call spread has capped the gain, so a surge far beyond one hundred and five earns no more than a rise to it.
- The bear put spread caps the gain on the way down in the same way.
- Client B's straddle gives up time.
- If the ruling is delayed, both options lose value every day, and the nine of premium may never be earned.
- Client C's collar gives up the upside above the cap, which paid for the floor.
- Spreads and collars cap the gain.
- Straddles bleed time value.
- Say which one applies, and you have the risk part of the answer.

19 A story: two candles

- An option's price: intrinsic value plus time value
- Time value melts, and the near option melts faster
- Long calendar: sell the near call, buy the far call
- Share at 100: sell 1 month call, buy 3 month call

IN THE LESSON

- Picture two candles of the same wax, one that burns out in a month and one that burns out in three.
- In the first month the short candle shrinks much faster than the long one, even though they are the same size now.
- Options are like that.
- An option's price has two parts.
- The first is intrinsic value, what it would pay if exercised now.
- The second is time value, the extra you pay for the chance of a move before expiry.
- Time value melts away as expiry nears, and the near option melts faster.
- A calendar spread uses this.
- Tamsin expects the share at one hundred to sit still for a month.
- She sells a one month call and buys a three month call, both struck at one hundred.
- That is the long calendar.

20 Time value fades faster in the near option

Chart: Time value vs Time passing (first month)

- 3 month call: 4.98 to 4.07
- 1 month call: 2.88 to 0

IN THE LESSON

- Here is the idea drawn out.
- The horizontal axis is time passing, over the first month.
- The vertical axis is time value.
- Both calls are struck at the money, so all of their price is time value.
- The top line is the three month call.
- It starts at four point nine eight and slides gently down, to four point zero seven after one month.
- The lower line is the one month call.
- It starts at two point eight eight and falls faster and faster until it reaches zero at expiry.
- The gap between the two lines widens as time passes.
- That widening gap is what the long calendar earns.
- She sold the line that melts to nothing and kept the line that still has value left.

21 Example 6: Tamsin's long calendar

Share at 100, 25% volatility, zero rates; look one month on

Sell 1 month call	premium received	**+2.88**
Buy 3 month call	premium paid	**−4.98**
Net cost, her most to lose	4.98 − 2.88	**2.10**
Profit if share ends at 100	4.07 − 0 − 2.10	**+1.97**
Profit if share ends at 115	15.43 − 15 − 2.10	**−1.67**

IN THE LESSON

- Now the numbers, at twenty five per cent volatility and zero interest.
- Selling the one month call brings in two point eight eight.
- Buying the three month call costs four point nine eight.
- The net cost is the difference, two point one zero, and that is the most she can lose.
- Now fast forward one month, when the near call expires.
- If the share is still at one hundred, the short call expires worthless, and the long call, now with two months left, is worth four point zero seven.
- After the cost of two point one zero she is up one point nine seven.
- If the share has jumped to one hundred and fifteen, she owes fifteen on the short call, the long call is worth fifteen point four three, and she is down one point six seven.
- A big move spoils the trade.

22 A tent around the strike

Chart: Profit vs Share at near expiry (strike 100)

- Best at the strike: +1.97
- Lose at the edges: up to 2.10

IN THE LESSON

- Here is the result as a picture.
- The horizontal axis is the share price when the near call expires.
- The vertical axis is profit.
- The shape is a tent, and the peak sits right at the strike of one hundred.
- There, the call that was sold expires worthless, and the call that was bought still has two months of time value, which is largest when an option is at the money.
- Move away from one hundred in either direction and the profit falls.
- Far below, the long call has little time value left.
- Far above, both calls are deep in the money, and the gain on one is the loss on the other.
- At the edges the calendar loses money, but never more than its cost.

23 Example 7: when volatility rises

Share at 100 after one month; the far call has 2 months left

Far call, volatility 25%	model price	**4.07**
Far call, volatility 30%	model price	**4.88**
Gain from the rise	4.88 − 4.07	**+0.81**
Profit at 100, volatility 30%	4.88 − 2.10	**+2.78**
Profit at 100, volatility 25%	4.07 − 2.10	**+1.97**

IN THE LESSON

- A calendar has a second source of profit.
- Vega measures how much an option's price changes when implied volatility changes, and the long dated option has far more vega than the near one.
- So a long calendar is net long vega.
- Back to the share at one hundred after one month, with the three month call now a two month call.
- At twenty five per cent volatility it is worth four point zero seven.
- Suppose implied volatility rises to thirty per cent.
- It is now worth four point eight eight, a gain of point eight one.
- After the cost of two point one zero, the profit at one hundred rises from one point nine seven to two point seven eight.
- A short calendar does the reverse.
- It suits a view that a big move is coming soon, or that longer dated implied volatility will fall.

24 Three uses of a calendar spread

What the calendar is for

Use	Trade
Trade time decay	Long calendar
View: far volatility rises	Long calendar
View: far volatility falls	Short calendar
Event between expiries	Pick the dates

IN THE LESSON

- So what is a calendar spread used for?
- First, to trade time decay.
- The long calendar sells the fast melting near option and owns the slow melting far one, and it profits if the price sits near the strike at the near expiry.
- Second, to express a view on the term structure of volatility.
- A long calendar gains if longer dated implied volatility rises, and a short calendar gains if it falls.
- Third, to position around a known event that falls between the two expiry dates.
- If an announcement lands after the near expiry but before the far one, only the option that was bought spans it.
- A manager who expects a big move soon would run the short calendar instead.

25 Mistakes to avoid so far

- A written put hedges the short: no, it is income
- Forgetting a spread caps the gain too
- Straddle breakevens: strike plus or minus total premium
- A long calendar is safe: no, a big move erodes it
- Calling the skew a mispricing: it prices tail risk

IN THE LESSON

- Let us collect the common mistakes from the first three topics.
- One: believing that a written put hedges a short position.
- It earns income, but leaves the rally risk in place.
- Two: forgetting that a spread caps the gain as well as the loss, so a surge beyond the higher strike earns nothing more.
- Three: measuring straddle breakevens from the strike without adding the total premium of both options.
- Four: assuming a long calendar is safe because the far option protects it.
- A sharp move either way erodes it.
- Five, which comes next: calling the volatility skew a mispricing.
- It is the market's price for tail risk.

26 A story: the umbrella on a rainy day

- Implied volatility: backed out of an option's price
- One constant volatility would give one number for all strikes
- Real markets give a different number at each strike
- The shape shows what investors fear

IN THE LESSON

- On a dry morning an umbrella seller charges little.
- When the sky turns black, the same umbrella costs more, not because the cloth changed, but because everyone wants one.
- Option protection works the same way.
- Implied volatility is the volatility that, put into an option pricing model, gives the option's market price.
- We cannot see it directly, we back it out of the price.
- A simple model with one constant volatility would give the same implied volatility at every strike, because it is the same share and the same expiry.
- But markets do not agree.
- The implied volatility changes with the strike, and the shape it makes tells you what investors fear.

27 A skew and a smile

Chart: Implied volatility vs Strike, % of the current price

- Skew: 30% at far left
- At the money: 18%
- Smile: currency options

IN THE LESSON

- Here are the two shapes.
- The horizontal axis is the strike as a share of the current price, so the middle is at the money.
- The vertical axis is implied volatility.
- A model with one constant volatility would draw a flat line, and neither of these is flat.
- The red line is a skew, typical of equity index options.
- It starts high on the left and falls steadily as the strike rises.
- Low strikes are the puts that investors buy against a crash, and that demand pushes their implied volatility up.
- At the money it is eighteen per cent, and at the far left it reaches thirty.
- The blue line is a smile, typical of currency options.
- It is lowest at the money and higher on both wings, which gives it the look of a smile.

28 Example 8: what the skew does to a put

Index 4,000; 3 months; a put struck at 3,600; zero rates

Implied volatility, at the money		**18%**
Implied volatility, 3,600 strike		**24%**
3,600 put at a flat 18%	model price, points	**20.3**
3,600 put at the skew's 24%	model price, points	**47.6**
Extra cost of the skew	47.6 − 20.3	**27.3**

IN THE LESSON

- Now what does the skew cost?
- Tamsin runs a fund holding exposure to an index at four thousand, and wants three months of protection below thirty six hundred.
- The at the money implied volatility is eighteen per cent.
- But on the skew, the thirty six hundred strike put trades at twenty four per cent.
- Using model prices with zero interest, the put priced at a flat eighteen per cent would cost twenty point three index points.
- At the skew's twenty four per cent, it costs forty seven point six.
- The extra cost of the skew is twenty seven point three points, for the same strike, expiry and index.
- The only difference is the fear of a crash.

29 The skew more than doubles the price

3,600 put cost (index points)

Flat 18%	**20.3**
Skew 24%	**47.6**

Index at 4,000, three months, illustrative

IN THE LESSON

- Here are the two prices side by side.
- The vertical axis is the cost of the thirty six hundred put, in index points.
- The first bar is the price if volatility were flat at eighteen per cent, twenty point three.
- The second bar is the price on the skew, at twenty four per cent, forty seven point six.
- The second bar is more than twice as tall.
- That is what a steep skew does to protective puts.
- For a manager buying protection it is a real cost, and it is worth knowing before the trade is placed.
- The question is what to do about it.
- Calling the price wrong is not an answer, because someone is willing to pay it every day.

30 Example 9: part funding the protection

Cover below 3,600 for 3 months, paid for in part

Buy 3,600 put, volatility 24%	pay	**47.6**
Write 3,400 put, volatility 27%	receive	**27.7**
Put spread cost	47.6 − 27.7	**19.9**
Single put on a flat skew	for comparison	**20.3**
Cover ends below	no protection under it	**3,400**

IN THE LESSON

- One response to an expensive skew is to give back part of the protection.
- Tamsin buys the thirty six hundred put at twenty four per cent, paying forty seven point six.
- She also writes a thirty four hundred put.
- The skew is even steeper down there, at twenty seven per cent, so it brings in twenty seven point seven.
- The put spread costs forty seven point six minus twenty seven point seven, which is nineteen point nine, close to the twenty point three the single put would cost on a flat skew.
- The price of that saving is clear.
- The cover runs from thirty six hundred down to thirty four hundred, and below that there is none.
- She has handed the deepest part of the tail back.

31 Reading the skew like a manager

What the shape tells a manager

Situation	Sensible move
Skew steep, puts dear	Write a lower put
Expect the skew to flatten	Risk reversal
Colleague says mispriced	No: tail risk
Currency options	Smile, both wings

IN THE LESSON

- So how should a manager use the skew?
- When the skew is steep and protection is dear, she can part fund the put by writing a lower strike put, as we saw, accepting the gap in cover.
- If she is moderately bullish and expects the skew to flatten, she can use a risk reversal.
- That means writing an out of the money put and buying an out of the money call.
- It gains if put volatility falls relative to call volatility.
- If a colleague says an out of the money put is mispriced because a model should give one volatility, the answer is no.
- The skew prices tail risk.
- And for currency options, expect a smile, where both wings are dear.
- Add maturity and the picture becomes the volatility surface.

32 Recap: the lesson in five lines

- Short + bought call = insurance; written put = income
- Spreads cap both ends; straddle needs a big move
- Collar: put funded by a call, value held in a band
- Long calendar: sell near, buy far, wins in a quiet market
- Skew prices tail risk; it is not a mispricing

IN THE LESSON

- Let us pull it together.
- First, a short seller who fears a rally buys a call, which caps the loss like a put.
- Writing a put earns income but is not a hedge.
- Second, a bull or bear spread caps both the gain and the loss, a straddle bets on a big move with breakevens at the strike plus and minus the total premium, and a collar holds value between two strikes, often at zero cost.
- Third, a long calendar sells the near option and buys the far one, to trade time decay, the term structure and events.
- Fourth, a skew slopes and a smile curves.
- Fifth, a skew is the price of tail risk, not a mistake.

33 Try three quick questions

1. Short 5,000 shares at 40; buys a 44 call for 1.50. Largest loss?
   Answer: 5.50 × 5,000 = 27,500.
2. Straddle at strike 50: call 3.00, put 2.00. Breakevens?
   Answer: Total premium 5.00, so 45 and 55.
3. Index put: vol 24%, at the money 18%. Mispriced?
   Answer: No. The skew is the price of tail risk.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A fund is short five thousand shares at forty and buys the forty four call for one and a half.
- What is the largest loss?
- Four plus one and a half is five and a half a share, times five thousand, which is twenty seven thousand five hundred.
- Question two.
- A straddle at a strike of fifty costs three for the call and two for the put.
- Where are the breakevens?
- The total premium is five, so the breakevens are forty five and fifty five.
- Question three.
- A manager sees the out of the money index put at twenty four per cent volatility against eighteen at the money, and says it is mispriced.
- Is she right?
- No.
- The skew is the market's price for crash risk, so it is not an error.