Spotlight Quiz

Hedging with Options

Many companies use options to hedge cashflows, either singly or in combination. This quiz will cover the use of single options first and then look at possible combinations.

One of the first things to remember is that most non-financial companies do not use options to ‘play the market’ or to enhance (hopefully) profit-making risk positions, they use options to reduce risk.

**Question 1**

**Hedging: symmetry and asymmetry**

The argument often made is that if a future cashflow is uncertain and might be higher or lower than current expectations, then that is a symmetrical risk; higher cashflows are better while lower cashflows (if they are revenues) are worse. Hedging such an exposure with a ‘fixing’ instrument such as a forward contract or a swap involves giving up any gain if things turn out better than expected as well as generating a gain to offset any loss if things turn out worse than expected. The symmetrical risk of the exposure is hedged by an instrument of equal and opposite symmetrical risk. Gains on the exposure offset losses on the hedge and losses on the exposure offset gains on the hedge. The argument for hedging with options is that it would be better to hedge a symmetrical risk with an asymmetrical hedge. Then losses on the exposure would be offset by gains on the hedge while gains on the exposure are left without being offset. Such an asymmetrical hedging instrument is an option. A call option gives a gain when prices are higher without the corresponding loss when prices are lower and vice versa for a put option.

**Question**

Which of the following would be an effective asymmetrical hedge for a transaction in which a company contracts to sell a commodity at the market price in 3 month’s time?

1. A call option with strike price at the current market price
2. A put option with strike price at the current market price
3. A forward contract at the quoted forward price
4. A contract with the buyer to buy at today’s market price
5. Don’t know

**Answer**

The right answer is (b) A put option with strike price at the current market price.

A put option gains value as prices fall below the strike price. If the company is planning on selling a commodity, it will be concerned about prices falling. So there are three potential outcomes at the time of the sale: prices are higher than today, in which case the company gains and the option...
expires worthless; prices are the same as today in which case the company sells at an ‘acceptable’ price and the option expires at zero value; or prices are lower than today so that the company receives less revenue from the sale but also receives a gain on the put option to effectively compensate for the reduced revenue.

A call option would give a return to enhance the situation when prices are higher but no compensation when prices are lower – a doubling up of the exposure. A forward contract would ensure a fixed receipt; higher prices in the market would be offset by losses on the instrument while lower market prices would be offset by a gain on the instrument. This would be a symmetrical risk managed by a symmetrical instrument.

The contract with the buyer would achieve the same as the forward contract, a zero-sum game where either the buyer or the seller gains. The gain by one party will equal the loss by the other.

**Question 2**

It is argued that the use of an asymmetrical instrument allows the hedger to take the upside of market price risk while at the same time avoiding the downside. Of course, so far we are ignoring the cost of the premium.

**Question**

Which of the following would be an effective asymmetrical hedge for a transaction in which a company contracts to buy a commodity at the market price in 3 month’s time?

(a) Sell a call option with strike price at the current market price  
(b) Buy a call option with strike price at the current market price  
(c) Sell a put option with strike price at the current market price  
(d) Buy a put option with strike price at the current market price  
(e) Don’t know

**Answer**

The right answer is (b) Buy a call option with strike price at the current market price

The first thing to note here is that hedgers buy options rather than sell them. We may have to modify this rule later when discussing the construction of a collar, but when a single option is being used for hedging, we buy options not sell them.

When the company agrees a future *purchase* at the future market price, then if prices fall that is good news, we will have a lower cost. Under these circumstances we benefit from lower cost and the hedge (a call option) expires worthless. When prices rise, our cost is increased for the commodity, but we gain from the value of the call option at expiry effectively capping out cost at today’s market price. Rising prices are good news for call option holders as prices rise above the option’s strike price. Selling a call option would double our risk – if prices rise, we will incur higher cost and have to pay our option counterparty the increased value of the option.
**Question 3**

*Creating a collar for hedging sales revenue*

As has already been pointed out, the discussion so far has excluded the premium payable for an option. The idea of a symmetrical risk and an asymmetrical hedge is attractive, but the gains do have to be offset against the fixed, upfront cost of the option. That cost does skew the equation a bit. One way of hedging using options and reducing the premium cost is to construct a collar using options. In principle we are going to buy an option to cover the downside risk that we are concerned about, and at the same time, we sell some of the potential upside that we might get if prices move in our favour. We buy one option, and incur a premium cost while at the same time we sell another option and generate a premium income, leaving a reduced net premium, or a zero cost collar.

**Question**

Our company makes and sells nano-widgets, whose price is determined by supply and demand. There is a liquid market where prices are set daily. Costs are broadly fixed but selling price is determined by daily market fixings. Current price is EUR100/kg.

You want to ensure that your net revenue is no less than EUR90/kg but are willing to forego any further gains if the market price is above EUR100/kg.

Option prices are quoted as follows:

<table>
<thead>
<tr>
<th>Strike Price</th>
<th>Put Option</th>
<th>Call Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike Price 90</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Strike Price 100</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

How can you construct a collar to ensure a minimum revenue of EUR 90/kg and forego any gain from a market price in excess of EUR100/kg?

(a) Buy a call option with strike EUR90/kg and sell a put option with strike EUR100/kg at a net premium paid of EUR9/kg.
(b) Buy a call option with strike EUR100/kg and sell a put option with strike EUR90/kg at a net premium paid of EUR4/kg.
(c) Buy a put option with strike EUR100/kg and sell a call option with strike EUR90/kg at a net premium received of EUR9/kg.
(d) Buy a put option with strike EUR90/kg and sell a call option with strike EUR100/kg at a net premium received of EUR4/kg.
(e) Don’t know

**Answer**

The right answer is (d) Buy a put option with strike EUR90/kg and sell a call option with strike EUR100/kg at a net premium received of EUR4/kg.

This structure reflects an initial hedge of the downside risk – that expected revenue falls with market prices – similar to the situation in Question 1. The solution here was to buy a put option and now we use a strike price to reflect our lower acceptable price. Having covered the downside risk we can
then sell the potential for gain if market prices rise by selling a call option with a higher strike price, i.e. a call option with strike price at EUR 100/kg. We pay EUR 1 for our lower price put option and receive a premium of EUR 5 for the sold call option, so we have a net premium received of EUR4/kg. The net outcomes are therefore EUR94/kg for market prices of EUR90/kg and below (EUR90 strike price plus net premium of EUR4), market price plus EUR4 for prices between EUR90 and EUR100, and EUR104 for market prices above EUR100/kg.

Question 4
Creating a collar to hedge purchase costs
You wish to hedge a purchase cost using options. The purchase is of a traded commodity with daily market prices. The market price today is USD50/litre. You want to ensure that your effective cost does not exceed USD56/litre but are willing to forego gains if the net effective cost is below USD46/litre. Option prices are quoted as follows:

<table>
<thead>
<tr>
<th>3 month option premia</th>
<th>Put Option</th>
<th>Call Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike price 45</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Strike Price 55</td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

How would you construct a collar to ensure that your effective cost remains within the stated range?

(a) Buy a call option with strike USD45/litre and sell a put option with strike USD55/litre at a net premium paid of USD1/litre.
(b) Buy a call option with strike USD55/litre and sell a put option with strike USD45/litre at a net premium paid of USD1/litre.
(c) Buy a put option with strike USD55/litre and sell a call option with strike USD45/litre at a net premium received of USD1/litre.
(d) Buy a put option with strike USD45/litre and sell a call option with strike USD55/litre at a net premium received of USD1/litre.
(e) Don’t know

Answer
The right answer is (b) Buy a call option with strike USD55/litre and sell a put option with strike USD45/litre at a net premium paid of USD1/litre.

Initial coverage of the downside risk would be the purchase of a call option to hedge the possible rise in market price: as the market price rises over the strike price the option pays off to offset the price increase. To reduce the premium cost, the upside risk can be sold by selling a put option: as the market price falls below the strike you have to compensate the option buyer and so gain no benefit from further price falls.

The net premium is USD1/litre so that the net effective cost of the strategy is to add USD1/litre to the market price giving a maximum effective price of USD56/litre and a minimum of USD46/litre.

Question 5
Synthetic forward contract.
A logical extension of the idea of a collar is to bring the two strike prices of the collar options closer together. As the collar gets narrower the result looks more and more like a forward contract. In fact, in the early days of options, this artificial construction of a forward contract provided one limiting constraint on option pricing. If we can create a forward contract using something other than the conventional method than the normal rules of arbitrage would apply. That is, however the same effect is created the cost must be the same – otherwise there would be an arbitrage opportunity for buying a ‘conventional’ forward contract at one price and selling the ‘artificial’ one at another price.

So, a synthetic forward contract is created using the same logic as a collar; buying one option and selling the other but now with the same strike price. Buying a call option and selling a put option, both with the same strike price will give a pay off as below, before allowing for premium cost or receipt.

![Constructing a synthetic forward contract](image)

This results in the net position shown below:
This is the pay off for a forward contract. It is for the contract alone – it gives a gain when market prices are high and a loss when prices are low – as such, when combined with a purchase exposure at high prices the good news comes from the forward contract and bad news comes from the high market price to be paid. At low market prices, good news comes from the low price and bad news comes from the need to pay out under the written option. The net effect is a constant net price paid for the purchase.

The constraint on option price (or premium) is that under specific circumstances, we can enter a forward contract for no fee, at zero cost. Those circumstances are when the present value of the strike price is equal to the current market price. Bear in mind that a ‘conventional’ forward price is the ‘future price’ of the current market price – in other words, the current market price transposed forwards in time – and we can see that if the strike price chosen is equal to the forward price, then the ‘present value of the strike price’ must be today’s market price, just by moving the forward price back in time.

Under these circumstances, the synthetic forward must be created at the same price as the conventional forward. Therefore the premium paid for the call option must be equal to the premium received for the put option.

This is the special case of put-call parity. In fact we can deduce more about the relationships between the put premium and the call premium, but that is for elsewhere rather than here.

**Question**

You intend to enter a forward contract to fix the revenue expected from the sale in three month’s time of goods whose price is market-determined. For unusual reasons the forward market is not available and so you intend to construct the forward contract using options. The current market price is USD 49.3/unit.

Option prices are as follows:

<table>
<thead>
<tr>
<th>3 month option premia</th>
<th>Put Option</th>
<th>Call Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>-20</td>
<td>-15</td>
</tr>
<tr>
<td>-15</td>
<td>-10</td>
<td>-5</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>20</td>
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<td>10</td>
<td>25</td>
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<td>15</td>
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<td>25</td>
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<td>30</td>
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<td>35</td>
<td>75</td>
<td>80</td>
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<tr>
<td>40</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>45</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>
Which construction would give the most advantageous outcome for hedging the expected revenue?

(a) Sell a put option and buy a call option, both at a strike price of USD 45/unit
(b) Sell a put option and buy a call option, both at a strike price of USD 50/unit
(c) Sell a put option and buy a call option, both at a strike price of USD 55/unit
(d) It doesn’t matter they all give the same result
(e) Don’t know

Answer
The right answer is (d) It doesn’t matter they all give the same result.

As long as the option premia are reasonably fairly priced, then it doesn’t matter which strike price is chosen as long as both options have the same strike price.
Selling the put option generates premium revenue and buying a call option incurs premium cost.
Given the prices above, the net premia are as follows:

<table>
<thead>
<tr>
<th>Strike price</th>
<th>net premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>5.60</td>
</tr>
<tr>
<td>50</td>
<td>0.60</td>
</tr>
<tr>
<td>55</td>
<td>-4.40</td>
</tr>
</tbody>
</table>

Each combination will give a pay off centred around the strike price before allowing for the net premium. After incorporating the net premium, the net position will be given by the strike price plus the net premium. In each case this is 50.60.

[45 + 5.60 = 50 + 0.60 = 55 + (-4.40) = 50.60]

Question 6
If you want to hedge the value of an expected receipt and had the choice of using a single option, a ‘conventional’ forward contract or leaving the exposure open to market risk, which of the following should help to guide you to the correct subjective decision?

(a) Using an option is always best, because you retain some upside risk
(b) Using a forward contract is always best because if prices are fixed, there is no risk
(c) Use a forward contract if you believe market prices are going against you
(d) Leave the exposure open if you believe market prices are going in your favour.
(e) An option will be the second best choice, except when market prices remain close to current levels
(f) Don’t know

Answer
The right answer is (e) An option will be the second best choice, except when market prices remain close to current levels.

If prices move in your favour, you are best leaving the exposure open: the forward contract would be worst in this case.
If prices move against you, the best result is from the forward contract and open exposure would be worst in this case.
When prices move in your favour, the option gives the benefit of the gain, less the premium. When prices move against you the option offers protection below the strike price, at the cost of the premium – but this is still normally a much better position that would have resulted from leaving the exposure open. The diagram shows that the option gives the second best outcome for prices increasing and prices falling. Only if the price remains nearly constant is the option the worst choice of the three.
If you could be really sure about the direction of future market prices then c) or d) would be correct but the fact is the future is uncertain, which is why you hedge.