ARDEA
Investment Management

Volatility Strategies

How to profit from interest rate volatility

Key Points

- Interest rate option markets exhibit pricing inefficiencies just as global bond markets do, which represents an opportunity for investors with the right expertise to generate uncorrelated returns.
- 'Long volatility' (i.e. option buying) strategies offer a compelling way to profit from interest rate volatility, without having to rely on predicting the direction of rate movements.
- These strategies can be implemented in a favourable asymmetric way (i.e. small downside vs. disproportionally large upside) using interest rate options.
- The maximum downside risk is limited to the modest cost of the options and is therefore known with certainty up-front.
- These strategies generate profits from large interest rate moves, irrespective of their direction, which is what also makes them useful for portfolio protection in adverse market environments.
- Many market participants who specialise in options trading run them as silos, which means they have little tolerance to hold protective long volatility positions in benign environments.
- Our portfolios are run with 'risk balance', which means we can accumulate and always hold cheap long volatility positions irrespective of the market environment and without an onerous drag on returns.
- Running these strategies is resource intensive and requires specialised knowledge, which acts as a barrier to entry for more widespread adoption.
- Long volatility strategies are effective (yet underutilised) tools for portfolios that prioritise low volatility, defensive risk diversification and outperformance in adverse market environments.
- They are particularly useful for protection against downside risk in credit because the payoff profiles of credit investments are similar to selling options.
- At current levels of depressed volatility pricing it has never been cheaper to implement these types strategies for portfolio protection, as well as alpha generation.
- The growth of 'short volatility' (i.e. option selling) strategies is causing concerns about systemic financial risks. While not a base case, our portfolios are well positioned for this scenario.

Interest rate volatility strategies remain an underutilised but very effective risk management tool for defensive fixed income portfolios.

Introduction

One way to profit from interest rate volatility is to get directional calls right, ahead of a large move in rates.

Sadly, we have yet to come across anyone who has been able to consistently get these directional calls right. Even the bond kings and macro gods who pride themselves on being able to foresee market swings have struggled. (**The bears come for the bond king**, **Masters of the universe struggle to read market**)

Getting market directional calls consistently right is just really hard, which is why our preference is to position for market swings using non-directional interest rate option strategies.

We've previously discussed how the large and liquid universe of global interest rate options offers a great set of tools from which volatility strategies can be constructed to provide reliable downside protection for investment portfolios. (Refer - **Volatility strategies are reliable risk diversifiers**)

At the same time, these markets are subject to the same pricing inefficiencies and inconsistencies that are pervasive across global bond markets, so they also offer uncorrelated alpha opportunities, with downside risk that is modest and known with certainty.

We exploit these opportunities in a risk-controlled way using 'long volatility' strategies (i.e. option buying strategies), which can profit when markets start moving in any direction, while the maximum downside is limited to the modest cost of the options and is therefore known with certainty up-front.

Just such an opportunity presented itself last quarter, culminating in a sharp repricing of interest rate option markets in March, yielding profits for long volatility strategies.

(The terminology section at the end of this article covers some of the unavoidable option jargon.)

The Short Version

Option selling strategies – aka 'short volatility' strategies – generate returns by earning a premium (i.e. up-front payment) in return for selling options. The option seller's profit potential is limited to the premium earned but the loss can be unlimited.

By contrast, given the defensive nature of our strategies it suits us very well to be on the other side of these short volatility strategies and it's never been cheaper for option buyers like us to be 'long volatility'.

Long volatility strategies have a positively asymmetric payoff profile (i.e. downside limited to the cost of buying options vs. potentially unlimited upside), and can generate outsized profits when there are large movements in interest rates, as there have been this quarter.

Option sellers are effectively betting against tail risks i.e. infrequent but high impact market movements, which by definition don't happen often. So their return profile tends to show periods of stable positive returns (generated by earning option premiums), punctuated by short, sharp losses when large market movements impose losses.

An example of such a loss occurred in February 2018, when short volatility strategies were badly hurt by the sudden equity market sell-off and many ETF's and other investment structures linked to the VIX index collapsed. (Refer - **Investors burned as bets on low market volatility implode**)

Such strategies use to be the domain of a few specialists and only represented a niche allocation for investment portfolios. However, as years of ultra-low interest rates forced return chasing investors to take more risk, these strategies have grown exponentially, even into products targeted at retail investors.

A 2017 paper by Bhansali and Harris estimates the total AuM of short volatility selling strategies is about $1.5 trillion. (Refer - **Everybody's doing it**)

Some believe the Feb-2018 VIX implosion was just a small taste of the volatility storm that could be

unleashed if an unexpected market movement forces these strategies to unwind.

Even back in 2013, the Dallas Federal Reserve stated the following;

> "Although selling volatility may seem like a simple, profitable idea, it carries risks that could potentially spread throughout the financial system. Given the growing popularity of this strategy, further investigation may be warranted to examine systemic issues arising from volatility selling."
>
> (Refer - **volatility selling strategies carry potential systemic cost**)

While short volatility strategies are a legitimate source of return, the risk vs. return characteristics can vary greatly over time as market conditions change, and as with any investment, it can be pushed too far when lots of capital floods into the sector chasing returns.

This is what's happening now as the pricing of volatility in option markets has collapsed to very low levels, meaning option sellers are no longer getting as much compensation for the risks they're exposed to.

The flip side being it's never been cheaper to run 'long volatility' strategies like ours.

While we can't know whether the growth of short volatility strategies will end up causing a crisis, we do sleep a lot better knowing that our portfolios are very well positioned if that was to happen.

The Long Version

Most of the time option markets price in a positive 'volatility risk premium', which basically means implied volatility is materially higher than realised.

(Refer to the 'Options Jargon' section below for definitions)

Intuitively this makes sense because a rational option seller would need to be enticed by a risk premium to compensate for taking the negatively asymmetric downside risk inherent in selling options.

On the other side, option buyers are willing to pay this risk premium because they are getting insurance-like protection against large market movements that might hurt their portfolios.

As with your home insurance, you expect there to be a cost for this protection, while the insurance company needs to earn a positive return for selling it to you i.e. on average, insurance premiums earned (akin to implied volatility) should exceed expected claim payments (akin to realised volatility).

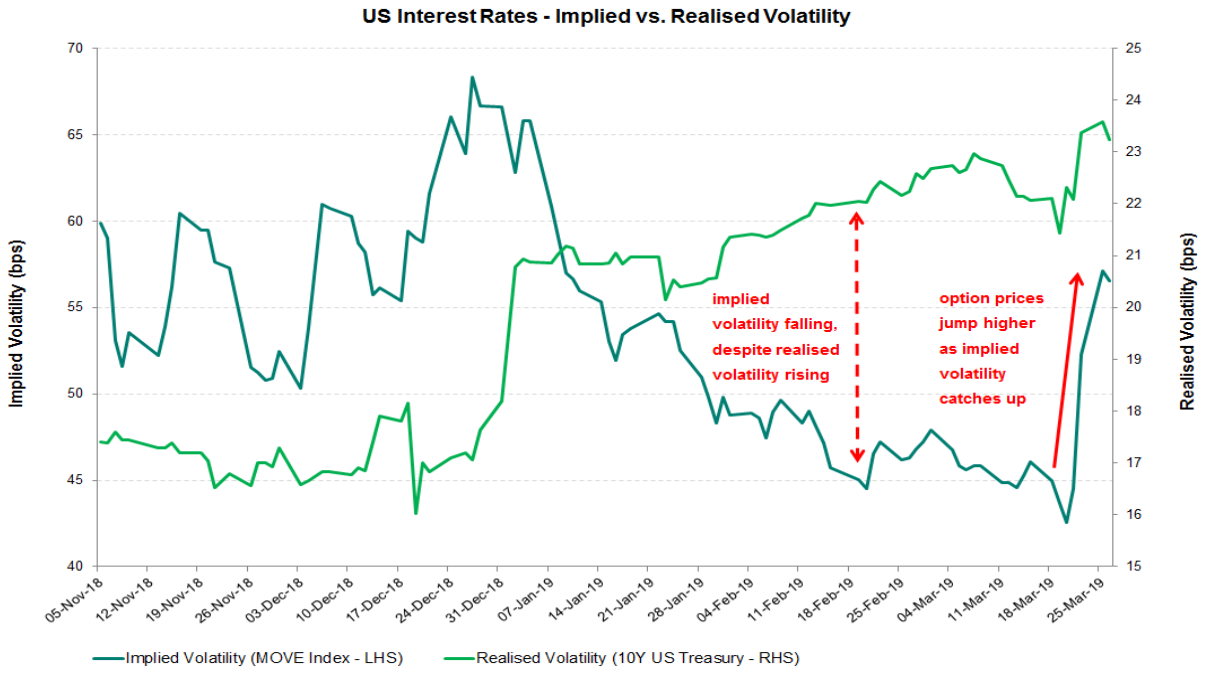
Option sellers are betting that future realised volatility will turn out to be lower than what is currently implied by option prices. So, when the gap between implied and realised volatility is large, the volatility risk premium is large and option sellers have a large safety cushion.

The flip side being that option buyers are paying more for protection.

However, just like with any financial market, changing demand-supply dynamics and market inefficiencies can cause these relationships to break down for periods of time.

This is exactly what happened in US interest rate option markets over the past few months as realised volatility rose but implied volatility continued to decline, resulting in a smaller volatility risk premium.

The chart below shows this divergence by comparing the MOVE index (Merrill Lynch Option Volatility Estimate index), which measures implied volatility in US interest rates, to realised volatility on a 10 year US Treasury (i.e. govt. bond).



Source: Ardea Investment Management, Bloomberg

The MOVE index is the bond market's equivalent of the VIX equity volatility index. It tracks the annualised implied volatility (measured in basis points) from short term option prices referencing a basket of US govt. bonds. It basically reflects the option markets' pricing of future expected volatility of the yields on these bonds.

After peaking in late Dec-2018, the MOVE index consistently declined all the way to late Mar-2019 (dark green line – implied volatility). What was unusual about this decline is that actual day to day movements in US interest rates were increasing over this period (light green line – realised volatility).

This kind of inconsistency (or market pricing inefficiency) doesn't last indefinitely and eventually it corrected, with implied volatility catching up to the increase in realised volatility, causing a big jump in option prices and profits for long volatility / convexity strategies.

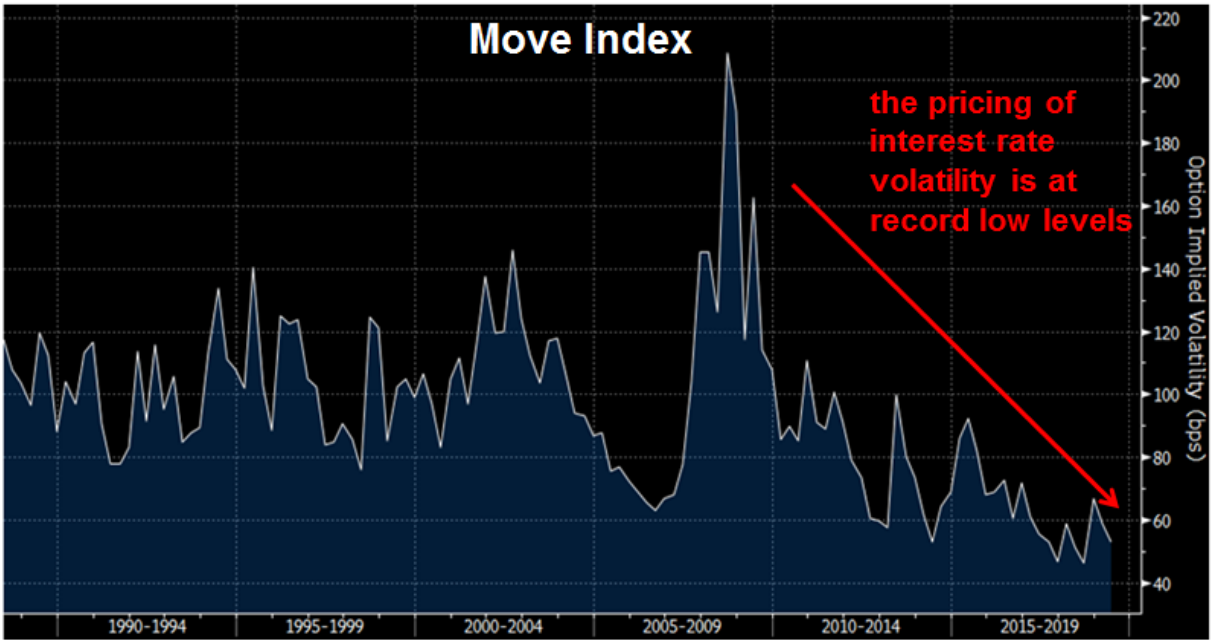
These strategies generate profits from situations like this in two ways;

1. As realised rates volatility rises the process of delta hedging allows consistent profits to be locked in, irrespective of the direction of interest rate movements.
2. As market pricing of implied volatility rises the prices of options will rise, irrespective of the direction of interest rate movements.

(Refer to the 'Options Jargon' section below for definitions of delta hedging and convexity)

As these profits are independent of market direction, they are an attractive source of uncorrelated alpha. Equally important, the downside risk in these strategies is always capped at the initial cost of buying the options.

The current environment is particularly fertile for these long volatility alpha generating opportunities because implied volatilities across global rate markets are at historically low levels and getting close to the zero bound (unlike interest rates themselves, rate volatility can't drop below zero).



Source: Ardea Investment Management, Bloomberg

These dynamics of abnormally low market pricing of interest rate volatility and compressed volatility risk premia used to be rare but are now becoming more common. Just as risk premia have shrunk in other markets like credit, the same has happened with interest rate options.

Much has been written to explain this. The more widely cited possibilities include the anchoring of inflation expectations, central bank buying of govt. bonds and ultra-low interest rates forcing yield seekers to boost returns by selling options.

But perhaps it's just that low volatility begets low volatility.

Prolonged low volatility conditions can create a self-reinforcing feedback loop resulting in option sellers, emboldened by the recent history of low volatility, being enticed into selling more options, which in turn reduces volatility further and generates profits for their short volatility strategies, in turn triggering yet more option selling.

This dynamic typically works and works and works … until it doesn't. Eventually an external catalyst of some kind creates unexpectedly large market movements, which causes volatility to spike higher, triggering losses for option sellers and profits for long volatility strategies.

To understand this, behavioural finance studies of 'recency bias' are useful. They find that investors tend to overemphasise the importance of recent history at the expense of a broader perspective that would yield more balanced analysis. (Refer – **WYSIATI**)

And indeed, current pricing of interest rate volatility seems more anchored to the recent history of benign market conditions than the potential for future uncertainty that it's supposed to reflect.

For investors with expertise in option markets, this represents a pricing inefficiency that can be exploited, not just to generate uncorrelated returns but also for defensive portfolio construction.

'Long volatility' strategies offer uncorrelated alpha opportunities, with downside risk that is modest and known with certainty.

The Role of Long Volatility Strategies in Defensive Portfolios

Long volatility strategies are a very effective tool for fixed income portfolios that prioritise low volatility, defensive risk diversification and outperformance in adverse market environments.

Such strategies generate profits from large interest rate moves, irrespective of their direction, which is what makes them reliable risk diversifiers that can protect investment portfolios from capital losses.

For example, a large move lower in rates might occur in a recession scenario, while a large move higher in rates would accompany an inflation break out that forces central banks to hike rates aggressively. Both scenarios would be negative for equities and credit investments, while the latter would also be negative for government bonds.

Therefore volatility strategies can be used for reliable protection in scenarios where conventional equity, credit and government bond investments all get incur losses at the same time.

They can be structured to provide more efficient protection than simply buying put options, which means they provide protection when needed, without imposing an onerous return drag in benign market environments.

A powerful combination is incorporating volatility strategies into a broader non-directional fixed income relative value portfolio. This is because volatility can and does stay low for long periods of time, punctuated by short sharp bursts as in February this year. A standalone volatility strategy can struggle to survive through these benign periods, long enough to take advantage of the volatility burst when it happens.

Having a strategy that can access a broad range of uncorrelated relative value return sources, in addition to volatility based strategies, provides the risk balance that allows the portfolio to generate reliable returns during the long benign periods, while still being able to take advantage of the volatility bursts when they happen.

These strategies are particularly useful for protection against downside risk in credit because the payoff profile of credit investments is inherently asymmetric to the downside.

Long Volatility Strategies Diversify Risk from Credit Investments

In many ways, the return profile of credit investments, particularly investment grade bonds, is similar to selling an option.

The upside from credit investments is capped to receiving income plus limited spread compression potential, while the downside can be a lot larger. In this sense, the negative asymmetry in credit is similar to the payoff profile of selling an option.

This idea has been covered extensively in academic literature. Most widely cited is a 1974 paper on the pricing of corporate debt by Robert C. Merton;

> Merton, who jointly won a Nobel Prize for his work on the Black-Scholes-Merton option pricing model, pioneered the use of option pricing techniques in valuing corporate debt and credit spreads.
>
> He showed how investing in a company's debt, for example buying a corporate bond, has a similar risk-return profile to buying a govt. bond (the interest rate component), combined with selling a put option on that company's assets (the credit spread component).

Essentially, corporate bond investors are selling put options on the value of the bond issuing company's assets and are therefore negatively affected when volatility rises and/or the value of the firm's assets falls (proxied by the equity price).

For these reasons, long volatility strategies provide compelling risk diversification and downside protection benefits for portfolios that invest in credit.

This is particularly relevant in the current credit market environment, which is characterised by low returns, rising credit spread volatility and growing late cycle credit risk. (Refer - **Why are you accepting more risk for less return?**)

Long Volatility Strategies Suit Our Defensive Relative Value Investment Approach

More broadly, long volatility strategies are well suited to defensive portfolios like ours for two reasons;

1. The downside is always capped at a modest amount and known with certainty, while the largest upside often materialises in adverse market environments, when we're expected to outperform.
2. The 'risk balance' in our portfolios allows us to always remain long volatility, irrespective of the market environment, without these strategies becoming an onerous drag on returns, while still providing protection when a market downturn hits.

   This risk balance comes from combining long volatility strategies with a diverse range of unrelated relative value positions that do well in benign environments, when volatility is low.

An additional benefit of this 'risk balance' approach is that we can be more patient than most with our volatility strategies.

This is effectively another source of market inefficiency because many market participants who specialise in options trading (e.g. bank trading desks) run them as silos. This means they have little tolerance for holding these positions in low volatility environments, when owning options can become a drag on profits. Therefore many market participants are quick to dump them cheaply into the market when volatility is low and markets don't 'seem risky'.

This gives us the opportunity to accumulate volatility protection when it's cheap, which is the best time to do it, and not chase after the protection only when markets 'seem risky', which is what human nature tends to favour.

Efficient implementation of long volatility strategies is a priority. A blunt approach to buying volatility, for example simply buying put options, can become a material drag on returns in benign market environments. A more nuanced approach focuses on asymmetry, relative mispricing and intensive delta rebalancing across the very large universe of different option types and structures to maximise efficiency and minimise cost.

For example, the MOVE index referenced earlier only references short dated options, while the biggest mispricing often occurs in longer dated options, so by shifting the maturity profile of options you can minimise costs and maximise upside.

Such an approach is resource intensive, requires specialised knowledge and needs experience of using options through varying market environments, all of which act as barriers to entry for more widespread adoption of volatility strategies.

For these reasons they remain underutilised in conventional fixed income approaches, even though they are a very effective risk management tool that offers compelling alternatives for risk diversification and downside protection beyond the more commonly used but blunt instruments like duration.

Interest rate volatility strategies remain an underutilised but very effective risk management tool for defensive fixed income portfolios.

Options Jargon

Interest rate options

- Derivative instruments that allow the buyer to gain exposure to changes in interest rates.
- Similar to equity options, they can be in the form of a put option (value increases if rates rise) or a call option (value increases if rates fall). Remember that bond prices move inversely to interest rates, so if rates rise, bond prices fall, which is why interest rate put options profit from rising rates and vice versa.
- The 'option premium' is the cost of the option, which is fixed and paid up-front.
- The option buyer pays the option premium, which is the most she can ever lose on the trade, but can (in theory) make unlimited profits.
- The option seller receives the option premium, which is the most she can ever make from the trade, but can (in theory) incur unlimited losses.

Asymmetric payoff profiles

- Generally, option buyers incur a small fixed cost relative to potentially large upside (i.e. a positively asymmetric payoff profile)
- Generally, option sellers earn a small fixed income relative to potentially large downside (i.e. a negatively asymmetric payoff profile) ,
- The key to balancing this asymmetry is the probability of that large potential upside/downside actually materialising

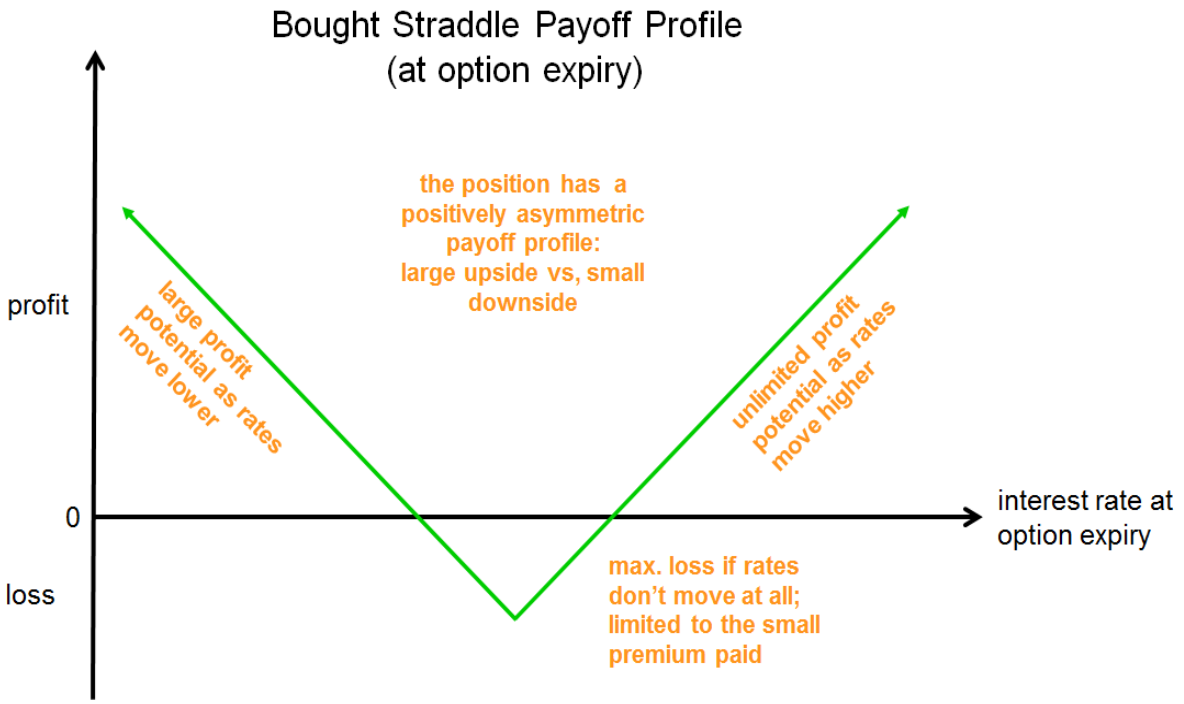
Volatility Concepts

- In the context of interest rate options, volatility reflects the speed and size of movements in govt. bond yields or interest rates referenced by derivatives such as interest rate swaps and futures.
- The measurement of volatility is independent of the direction of interest rates.
- 'Realised volatility' refers to the actually volatility observed in these instruments. The more that bonds yields or interest rate swap rates move around on a daily basis, the higher their realised volatility.
- 'Implied volatility' refers to the option markets pricing of future expected volatility of these rates and is a key variable in option pricing. Higher implied volatility translates to higher option prices.
- A 'long volatility' strategy usually involves buying options and profits when either realised or implied volatility rises, and vice versa for a 'short volatility' strategy.
- The 'volatility risk premium' refers to the compensation an option seller receives in return for being 'short volatility' and in a simplified way can be approximated by the difference between implied and realised volatility.

The diagram below illustrates the positively asymmetric payoff profile of a common long volatility strategy – buying a straddle.

A bought straddle comprises simultaneously buying a call option and a put option at the same reference interest rate (called the 'strike price'). If interest rates subsequently move higher or lower than the strike price, the option will generate a profit.

The more that rates move, the more profit potential for the option. Hence higher volatility benefits the position, irrespective of the direction of the rate move.



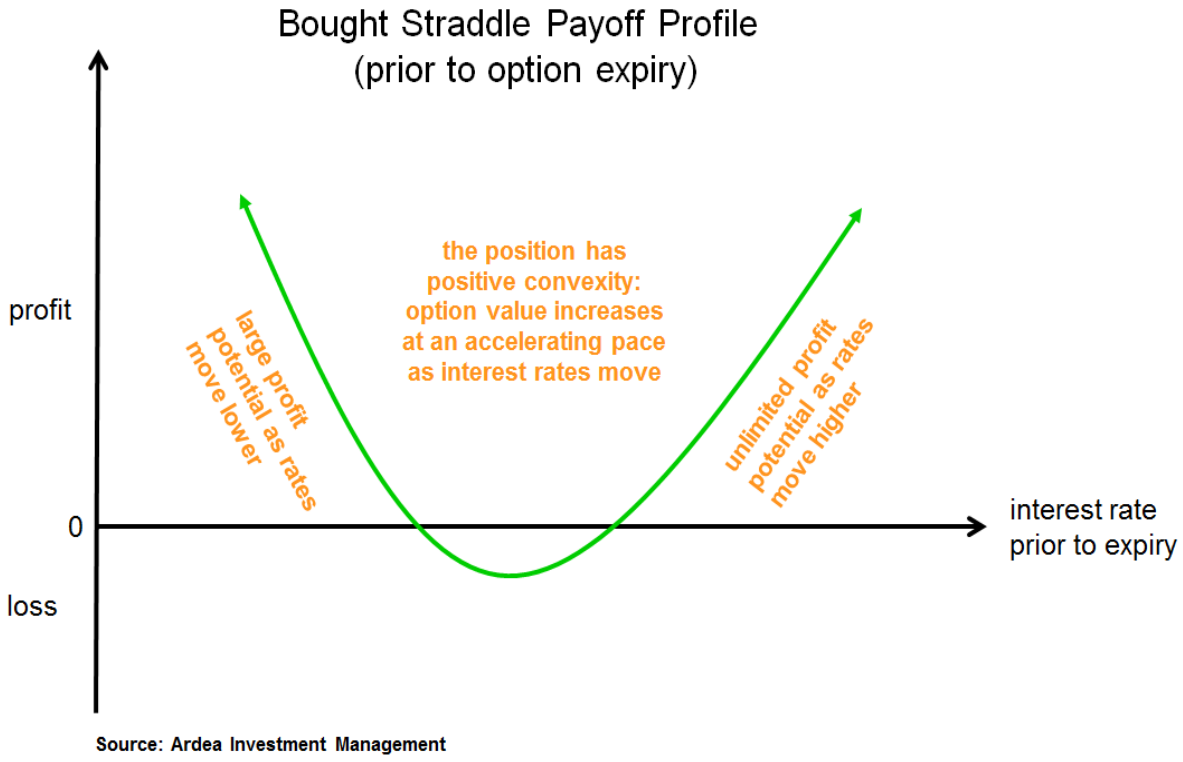
Source: Ardea Investment Management

Convexity Concepts

- While duration measures the sensitivity of the price of fixed income instruments to changes in interest rates, this sensitivity is not static and actually changes as interest rates move. Convexity measures the rate of change of duration.
- Using the analogy of travelling in a car. Duration is like speed, which measures the relationship between distance travelled (i.e. price) and time (i.e. rates), while convexity is like acceleration, which measures change in speed.
- Interest rate options can have a lot of convexity, meaning their prices can change rapidly and at an accelerating pace as interest rates move.
- For example, not only does a put option increase in value as rates rise, convexity means the sensitivity of that option to rates actually increases as they rise more, which means the option price increases at an accelerating pace.
- A 'long convexity' strategy usually involves buying options and profits when there are large movements in the underlying interest rate being referenced by that option, and vice versa for a 'short convexity' strategy.
- Convexity is attractive because it means the option buyer's exposure to rate movements automatically increases when rates move in a favourable way and decreases when they do not. In this way convexity amplifies gains while dampening losses.
- Long convexity strategies are particularly attractive for risk diversification because they generally profit in periods of market stress, when realised volatility typically rises. For this reason they are also very useful for investment strategies that are intended to behave in a defensive way.

- Profits for long convexity strategies are driven more by the size and speed of interest rate movements, rather than their direction. The flip side is that long convexity strategies incur losses when rates don't move much. However, the loss is always limited to the premium paid.

The diagram below illustrates the idea of convexity. As the underlying interest rate moves, the option value changes in a non-linear way.



Source: Ardea Investment Management

Delta hedging

- Pure volatility/convexity focused option strategies are non-directional, meaning the direction of interest rate movements don't matter much.
- 'Delta hedging' is the process by which directionality is taken out of the option position and profits are also locked in as rates move.
- For example, a put option in isolation has directional exposure because its value increases when rates rise. This directionality can be quantified by the 'delta' of the option, which is the directional interest rate exposure of the option. This delta can be stripped out by 'delta hedging' the option with an offsetting position in another instrument (e.g. interest rate futures) that has the same magnitude of delta exposure as the option, but in the opposite direction.
- Delta hedged option positions are therefore immune to modest directional movements in rates because whatever profit/loss is generated by the option will be offset by an equal loss/profit on the delta hedge.
- However, delta hedged option positions still profit from volatility/convexity. This is because when large rate movements occur the option exposure, being positively convex, will change more than the delta hedge, resulting in a larger profit (or smaller loss) on the option position relative to the delta hedge. When the delta hedge is then rebalanced, this profit is locked in.

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