CASE STUDY

Gamestonked:

A case study for lawyers in short-selling, options and volatility trading.

January 2021 saw wild market swings in the share prices of a number of relatively small or unknown companies. The original trigger for this was short-selling of the shares of these companies by a number of hedge funds. However, the story became about much more than just this as amateur day traders organised themselves via social medial (specifically a chatroom on Reddit called "**r/WallStreetBets**") to take on the big boys.

The poster child for this market turbulence was a US company called "Gamestop". Gamestop is a retailer of computer games – a bit like "Game" in the UK. It's not really doing very well as it posted a USD 795 million loss last year. The shares of Gamestop are traded on the Russell 2000 – an index measuring the performance of approximately 2,000 small-cap American companies.

The Gamestop story can teach us

What is short-selling?

Let's start by reminding ourselves what short-selling is. Whilst doing this keep in mind the basic principle of "buy low, sell high".

Let's imagine that an investor has formed the view that the price of a stock is going to go down in the near future. What can the investor do to take advantage of that view? Well, they can borrow the stock whilst the price is still high. They might do this by entering into a stock loan using, say, a GMSLA.

Whilst the price is still high, the investor can sell that stock into the market (remember, we want to "sell high"), wait for the price to drop, buy it back at a lower price (remember, we want to "buy low"), return it to the original lender and pocket the difference in price as profit (less fees for entering into the stock loan).

non-traders a lot – not only about short-selling but also about various aspect of options trading. So, let's dig a bit deeper.

Background

Gamestop was the subject of short-selling by a number of hedge funds. However, amateur day traders organised themselves to purchase the stock – with the intention of inflicting losses on the hedge funds through the creation of something called a "short squeeze". Bear in mind that, in contrast to a huge company like Apple, Gamestop is a relatively small, thinly-traded name, so an orchestrated buying binge can really amplify the impact on the price of Gamestop shares.

In embarking on their buying binge, retail investors certainly drove up the price of Gamestop stock. At the end of 2020, shares in Gamestop were trading at less than $19 per share. By Wednesday 27 January 2021, the shares of Gamestop were trading at $353 each. That was an increase of 1,745% year to date and up a whopping 435% since the previous Friday (22 January 2021) – helped, at least in part – by Elon Musk's contribution to the discussion:

Did this create a "short squeeze"? Well, let's first understand what we mean by the term "short squeeze".

What is a "short squeeze"?

In order to understand how a "short squeeze" works, we need to appreciate that many stock loans are made on an 'on demand' basis. This means that the lender of the stock can call for its return at any time.

If you had loaned this stock and seen it increase by 435% in a little over two days, you might understandably want to sell it in order to lock in a handsome profit.

However, in order to do this, you'd have to call the stock back from the person who borrowed it from you. In turn, this means that the borrower will have to go back out into the market to buy the share.

Remember, the borrower was hoping that the price of the stock was going to FALL – this is how the borrower makes money. If the price of the stock RISES, the borrower loses money. Moreover, the higher the stock rises, the more money the borrower stands to lose. As such, this is all happening at a bad time (when viewed from the borrower's angle). Of course, the laws of supply and demand mean that the very fact of the borrower trying to BUY the stock will drive the price YET HIGHER – exacerbating its losses yet further.

It gets worse. Some of the short sellers were simply unable to get their hands on Gamestop shares in order to return them to the lenders. There simply weren't enough shares in Gamestop to satisfy all of the short-selling that had gone on AND to satisfy all of the obligations to deliver shares on the options in Gamestop that had been traded in the period. You can imagine the upward impact that this scarcity factor has on the price. This is the phenomenon known as a "short squeeze.

One hedge fund (called Melvin)

reportedly lost $3.75 billion in January 2020 alone as a result of being caught in the short squeeze. So, we are talking about big money.

Wait! There's more...

But the story didn't end there. In a double twist, access to the now famous Reddit chatroom within which amateur traders were organising themselves was temporarily suspended. It was reported that members had been swearing. Either way, this sent the price of Gamestop down 38% temporarily before the market reopened and the shares recovered most of those losses.

Away from Gamestop, the death match between hedge funds and day traders expanded to other heavily shorted stocks, including:

- **Nokia** (the company behind everyone's first mobile phone);
- **Pearson** (the company that used to own the FT); and
- **CD Projekt** (the company behind Cyberpunk 2077).

Strangely though, the huge price increases witnessed with respect to these companies took place within the context of a more general 2.6% fall in the value of the Nasdaq. The generally accepted explanation for this was that short-sellers were having to sell other stocks to cover the losses they had incurred on their short-selling – thus forcing down prices more generally.

In early February, the buying frenzy also spread to silver. Estimates suggested that retail investors had ploughed USD 93 m into the iShares Silver Trust on 1 Feb 2020 (this is the world largest silver-backed exchange traded fund). This sound like a lot until you realise that USD 6 billion worth of silver is traded globally – every day. So, good luck in moving that market with USD 93 million.

Given that silver dropped 7.7% on Tuesday 2 February 2020 alone (after rising 12% the day before) it looks like this particular cloud didn't have a silver lining for the little guy.

Anyway, back to Gamestop...

What goes up...

It seems as though that Newton chap (and indeed The Alan Parsons Project) may have been onto something. On Tuesday 2 February 2020, Gamestop shares more than halved in value on the day. This triggered an automatic trading halt in the stock (these are designed as firebreaks to calm jittery trading).

Gamestop was down 65% by mid-morning trading in New York, meaning that it had lost more than 80% of its value from an intraday peak the week before.

Despite traders on "r/WallStreetBets" telling each other to "hold the line", an index compiled by Goldman Sachs which tracks heavily shorted stocks was down 7% on that Tuesday alone (down 13% in the week). This suggested that hedge funds' short positions were beginning to pay off.

The impact on options markets

One of the most interesting aspects of the Gamestop story is the insight it can provide us non-traders into some of the risks involved in trading options.

Some options fundamentals

But before we look at this in more detail, let's just take a few minutes to remind ourselves of some fundamentals around options. There are basically two types of option:

1. **A CALL option** – this gives the holder of the option the right to BUY an asset (in this case, shares) at an agreed price (the agreed price is called the STRIKE PRICE).
2. **A PUT option** – this gives the holder of the option the right to SELL an asset at the STRIKE PRICE.

Within that, options can be either bought or sold. So I can sell a call option or buy a call option. Similarly, I can sell a put option or buy a put option. If we imagine a share of Gamestock with a current spot price of, say, $200, the situation could be summarised like this:

Scenario	Bought or Sold	Strike Price	Spot Price	ITM / ATM / OTM
1 (Put)	Bought	$250	$200	ITM
2 (Put)	Bought	$200	$200	ATM
3 (Put)	Bought	$180	$200	OTM
4 (Call)	Bought	$170	$200	ITM
5 (Call)	Bought	$200	$200	ATM
6 (Call)	Bought	$230	$200	OTM
7 (Put)	Sold	$175	$200	ITM
8 (Put)	Sold	$200	$200	ATM
9 (Put)	Sold	$260	$200	OTM
10 (Call)	Sold	$240	$200	ITM
11 (Call)	Sold	$200	$200	ATM
12 (Call)	Sold	$165	$200	OTM

To pick a couple of example from this table to demonstrate the point.

1. **Scenario 1 (Put):** If I have bought the right to sell a share in Gamestop to you for $250, and Gamestop shares are currently trading at only $200, that's a very profitable contract as far as I'm concerned and I would be said to be "In-the-money" to the tune of $50.

2. **Scenario 2 (Put):** If I have bought the right to sell a share in Gamestop for you for $180, but Gamestop shares are trading at $200, I will never sell the shares to you for $180. I'd be better off selling them into the market for $200. As such, that contract is not profitable to me and I'd be said to be "out-of-the-money" to the tune of $20.

3. **Scenario 4 (Call):** If I have bought the right to buy a share in Gamestop from you for $170 and shares in Gamestop are currently trading at $200 then that is a profitable contract for me and I would be said to be "in-the-money" to the tune of $30.

4. **Scenario 6 (Call):** If I have bought the right to buy a share in Gamestop from you for $230, but shares in Gamestop are only trading at $200 then I would never exercise the option against you. Instead, I would just buy the shares more cheaply in the market. As such, that option contract would not be profitable and I would be said to be "out-of-the-money" to the tune of $30.

5. **Scenario 7 (Put):** if I have sold you the right to sell me a share in Gamestop for $175 but shares in Gamestop are currently trading at $200, you would never exercise that option against me. It would be better for you to sell your shares at a higher price in the market. Therefore, this is a profitable contract for me and I'm said to be "in-the-money".

6. **Scenario 9 (Put):** If I have sold you the right to sell me a share in Gamestop for $260 and shares in Gamestop are currently trading at $200, then it is profitable for you to exercise that option against me. That puts me in a loss-making position and I would be said to be "out-of-the-money".

7. **Scenario 10 (Call):** If I have sold you the right to buy shares in Gamestop from me for $240 but Gamestop shares are currently trading at only $200 then you will never exercise this option against me because it will be cheaper for you to simply buy the shares in the market for $200 instead. As such, this is a profitable contract for me and I'm "in-the-money".

8. **Scenario 12 (Call):** If I have sold you the right to buy shares in Gamestop from me for $165 and Gamestop shares are currently trading at $200 then you will exercise this option against me because you will be able to acquire the shares at a price which is below their current market value. Being profitable to you, this contract is loss-making for me and I'm said to be "out-of-the-money".

For all the other lines in this table, we can see that the strike price matches the spot price. These contracts are neither profitable nor loss-making. For all of these contracts, we are both said to be "at-the-money".

We should also be aware of the fact that there are seven inputs required to value an option, as set out here:

Input	Known or unknown
Current price of the underlying	Known
Strike price of the option	Known
Type of option (call or put)	Known
Maturity of the option	Known
Risk-free interest rate	Known
Dividends on the underlying	Known
Volatility	**Unknown**

As we can see, all of these inputs are already known – with the exception of volatility.

Back to Gamestop (again)...

The Gamestop trading frenzy had a significant impact on options markets. A number of the assumptions used to price options in normal times were placed under severe stress. Fundamentally, this was because the level of volatility (in other words, the degree to which prices swung) seen in relation to Gamestop shares was so high.

To put it in some context, volatility of, say, 20% is not unusual, but volatility levels with respect to Gamestop shares reached **500%**.

The impact on puts

The price of puts (so – remember – we are talking about the right to SELL a share in Gamestop at an agreed price) barely moved despite the fact that prices were see-sawing wildly.

To put some numbers on this, on 25 January 2021, shares in Gamestop were trading at $77 each. A put option with a strike price of $70 (so a contract giving the right to SELL Gamestop shares for $70 each – slightly below market value) was trading at $25. Two days later on 27

January 2021, the shares of Gamestop were trading at $348.

In normal circumstances, a put option with a strike of $70 when the underlying was trading at $348 should have been pretty much worthless. They should have been trading at a few cents – nothing more.

Ask yourself – who would pay for the right to sell an asset at $70 when it is valued at $348? The chances of a collapse in price like that would normally be regarded as tiny.

Despite this, though, Gamestop put option contracts were actually trading at $19 each – not really much less than the $25 of two days earlier.

This table summarises the situation:

Date	Option	Bought or Sold	Strike Price	Spot Price	ITM / ATM / OTM	Price
25 Jan 2021	Put	Bought	$70	$77	OTM	$25
27 Jan 2021	Put	Bought	$70	$348	**OTM!!!!!!**	$19

The impact on calls

Deeply ITM calls traded below their intrinsic value

Whilst the price of put options barely moved as they went deeply out-of-the-money, deeply in-the-money calls (so, we are talking about the right to BUY a share for LESS than it is currently trading at) traded below their intrinsic value.

The intrinsic value of a call option is calculated as its Spot Price – Strike Price.

So, if the current price of the underlying share is $130 and the strike price at which it can be purchased is £100, the intrinsic value is $30 – we would make a $30 profit by exercising the option and acquiring a share worth $130 for just $100. However, in the case of Gamestop, the actual bid price quoted for this type of call option (so, we are talking about the price that a dealer would pay to acquire this option from a seller) was less than the intrinsic price.

Why did this happen?

Well, in order to cash in their in-the-money options, retail traders have to exercise the option and buy the share (which they can then on-sell into the market at a profit).

The problem was that most retail investors didn't have the actual money to buy the share. That being the case, they were trying to sell the option – something which is totally normal – to someone else (someone who needed the share). Of course, if you have lots of people all trying to sell something, it's price is going to go down – and this is what happened to the call options being sold.

To put some numbers on this, on 29 January 2021, the price of Gamestop was $325.

If you held 100 call option contracts (each contract giving the ability to purchase 100 shares) with a $200 strike price, you would have a mark-to-market profit of 100*100*125 = **$1.25 million** (less whatever premium you paid to acquire the options in the first place).

However, here comes the sting. To buy the shares you would have to have $200*100*100 = **$2 million** to hand.

Having acquired the shares for $2 million you could then on-sell them for $3.25 million – locking in your profit, but the point is that you would have to have the $2 million upfront to make the initial purchase.

So, not having this kind of capital available, many small investors were forced to sell the options. Who could they sell to? The dealers. This is where the price started to dislocate and the little guys started to lose out. Just before the close on 29 January the bid price on $200 strike call options on Gamestop was $115.40. In other words, a dealer would pay an investor $115.40 to buy that particular call option.

However, at the same time, shares in Gamestop were trading at $318.96. So, a dealer could pay an investor $115.40 to acquire the call option, exercise the option, and acquire the share for $200. The total outlay would therefore be of **$315.40.** The dealer could then immediately sell the share for $318.96 – resulting in a risk-free profit of **$3.56**. Pure

arbitrage in operation.

Deeply OTM calls traded at multiple times their theoretical value

At the same time as deeply in-the-money calls were trading below their intrinsic value, deeply out-of-the-money calls were trading at multiple times above their theoretical value.

Let's look at the day before - Thursday 28 January 2021.

On 28 January 2021, shares in Gamestop were trading at $194 each. Call options with a strike price of $570 (so options to BUY the share at $570 – miles ABOVE its then current value) should really have been trading for just a few cents – after all, they were basically worthless. But they were trading at many times their theoretical value - $9 to be exact.

In addition, the bid/ask spread on these options was incredibly wide. The bid price (the price a dealer would buy the call option) was $4.60. Compare that to the price at which the dealer would sell that same call option - $9.00. Normally, you might just see a few cents difference between these prices. It was symptomatic of the uncertainty in the market.

Nonetheless, the ultra-expensive pricing and incredibly wide bid-offer spreads didn't deter the day traders. Apparently, over 13,000 call options with strike prices of $400 dollars (which expired just the next day!) were traded on that Thursday.

So, to put that in some context, investors (retail investors) were spending $9 per option on options which would allow them to ACQUIRE shares of Gamestop at $400 when the shares themselves were only trading at $194. But those options only had a one-day maturity. Put simply, they would expire worthless the very next day unless the share price climbed from $194 to above $400 within 24 hours.

Why did this happen?

Taking a step back, why did options prices become so dislocated from the norm?

Obviously, basic supply and demand had a huge impact. We've already mentioned that deeply in-the-money call options were trading below their intrinsic value – probably because so many retail investors – unable to acquire the underlying shares through lack of cash – were looking to sell their options.

But something called volatility also had an impact.

It's all to do with how options are priced.

We mentioned earlier how there are

Input	Known or unknown
Current price of the underlying	Known
Strike price of the option	Known
Type of option (call or put)	Known
Maturity of the option	Known
Risk-free interest rate	Known
Dividends on the underlying	Known
Volatility	**Unknown**

In normal times, it is the change in the price of the underlying (in other words, the first input) that tends to have the biggest impact on the price of the option. The change in the value of an option given a change in the value of the asset underlying that option is known as "delta".

However, when the value of the underlying asset is fluctuating as violently as Gamestop shares were in January 2021, it was actually the volatility that took over and had the biggest impact on the price of options. The change in the value of an option given a change in the volatility of the asset underlying that option is known as "vega".

If we think about it from a non-technical point of view, if you have a call option (so the right to buy a share) with a strike price of $200 but the share is currently trading at $500, that is a hugely profitable contract for you. In other words, you are hugely in-the-money. The value attributed to your option contact will reflect the fact that you are hugely in-the-money. However, the value of your option isn't going to change much if the share subsequently goes up to $501. You are now just a little-bit-more hugely in-the-money.

The same applies at the other end of the spectrum. If you have a call option (so the right to buy a share) with a strike price of $200 but the share is currently trading at just $2, you are never going to exercise that option contract because it's far cheaper simply to buy the share in the market. That being the case, the option contract itself is largely worthless and it's price will reflect that fact. If, subsequently, the value of the underlying drops to just $1 or increases to just $3, the price of the option isn't really going to move much at all - you're still massively out-of-the-money.

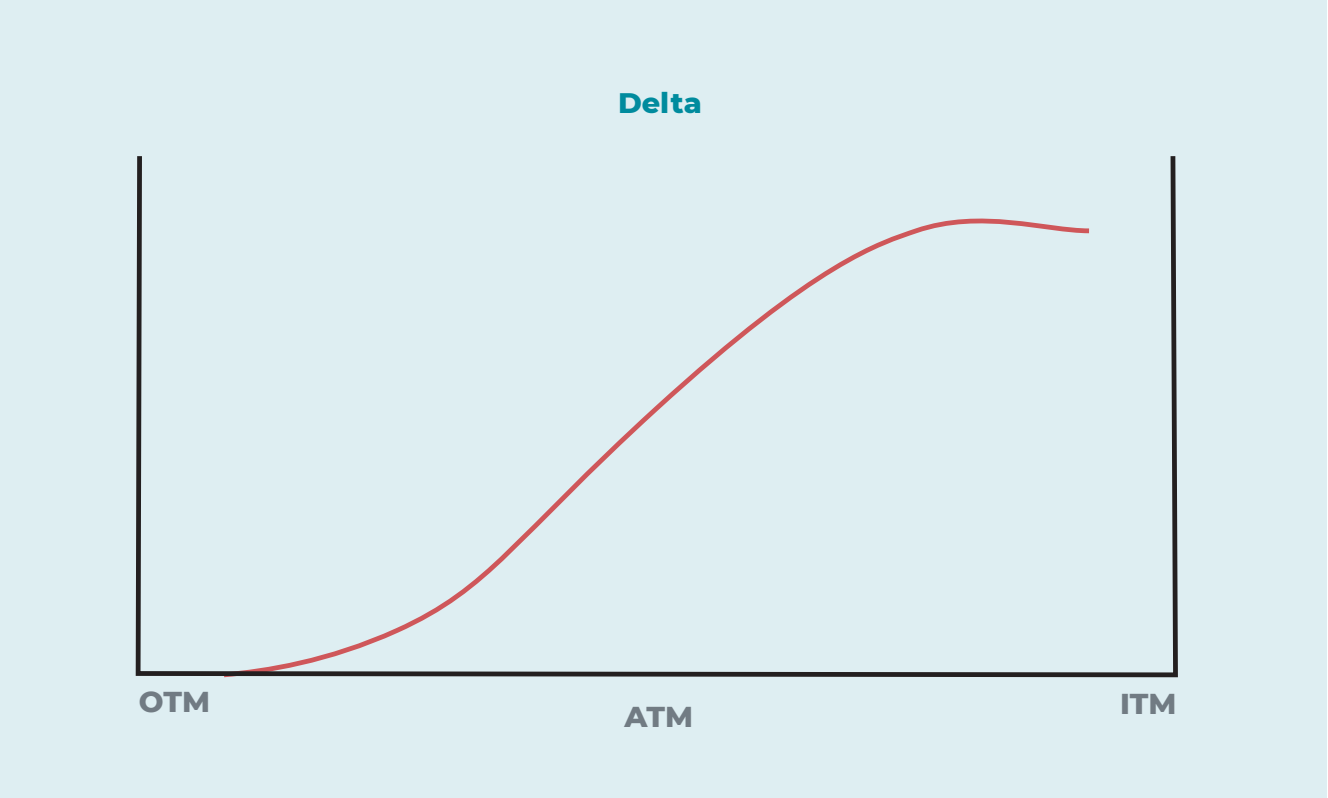
Contrast that to the position where you have a call option with a strike price of $200 and the share is currently trading at $199. As things currently stand, unless the price rises, the option will expire worthless (after all, you wouldn't spend $200 buying a share of Gamestop by exercising the option when you can buy it in the market for $199). However, if the price increases by just $2 then the option is suddenly in-the-money (you can now acquire an asset worth $201 for just $200)*.

So, where the price of the underlying is hovering around the strike price, a relatively small change in the price of the underlying has quite a significant impact on the option in terms of whether it finishes in-the-money or out-of-the-money. This fact is reflected in much bigger changes in the price of the option.

We know that at either end of the spectrum, the price of the option isn't impacted much by changes in the price of the underlying. However, when the option is at-the-money, a change in the price of the underlying will have a much more profound effect on the price of the option. That impact becomes less exaggerated as we move away from the at-the-money price.

This is delta. It forms a curve which looks like this:

*For simplicity, in assessing profit and loss we ignored the premium you'd have to pay to acquire the option in the first place.



Now, remember, we were talking about deeply in-the-money call options, and deeply out-of-the-money call options. So, we are concerned with either end of this graph. We said that deeply in-the-money call options were trading below their intrinsic value, whereas deeply out-of-the-money call options were trading at multiple times their theoretical value.

We know that delta should not really be impacting the value of either option greatly at these levels. So what happened? Whilst changes in the price of the underlying may not have much impact at these extremes, if the price is going insanely up and down all the while (in other words, if it is very VOLATILE) that will hugely impact the value of the option because it will hugely increase the uncertainty faced by the person selling that option.

Remember - this is 'Vega.'

Vega is a measure of the impact of a change in the volatility of the underlying on the price of an option. More specifically, it expresses the change in price of the option for every 1% change in the volatility of the underlying. To calculate options prices, when volatility is going UP, we ADD Vega to our option price. Conversely, when volatility is going DOWN, we SUBTRACT Vega from our option price.

Broadly speaking, as volatility goes up, the price of an option goes up, and when volatility goes down, the price of an option goes down. Also, all other things being equal, the longer the maturity of the option, the higher the Vega number.

So, by way of example, let's imagine that Gamestop shares were trading at $200 in January and a March call struck at $300 was selling for $2. Let's also imagine that the Vega of the option is 0.15 and the underlying volatility is 20%.

If the underlying volatility increased by 1% to 21%, then the price of the option should rise to **$2 + 0.15 = $2.15.**

However, if the volatility falls by 2% to 18% instead, then the option price should drop to **$2 - (2 x 0.15) = $1.70**.

It was the huge volatility witnessed around Gamestop shares (up to 500%) which had the most immediate impact on the price of Gamestop options – not the actual changes in price of the underlying. So, whilst retail investors were fixated on the price, the dealers were more focused on the volatility – and that's one of the reasons why less experienced investors came to lose money.

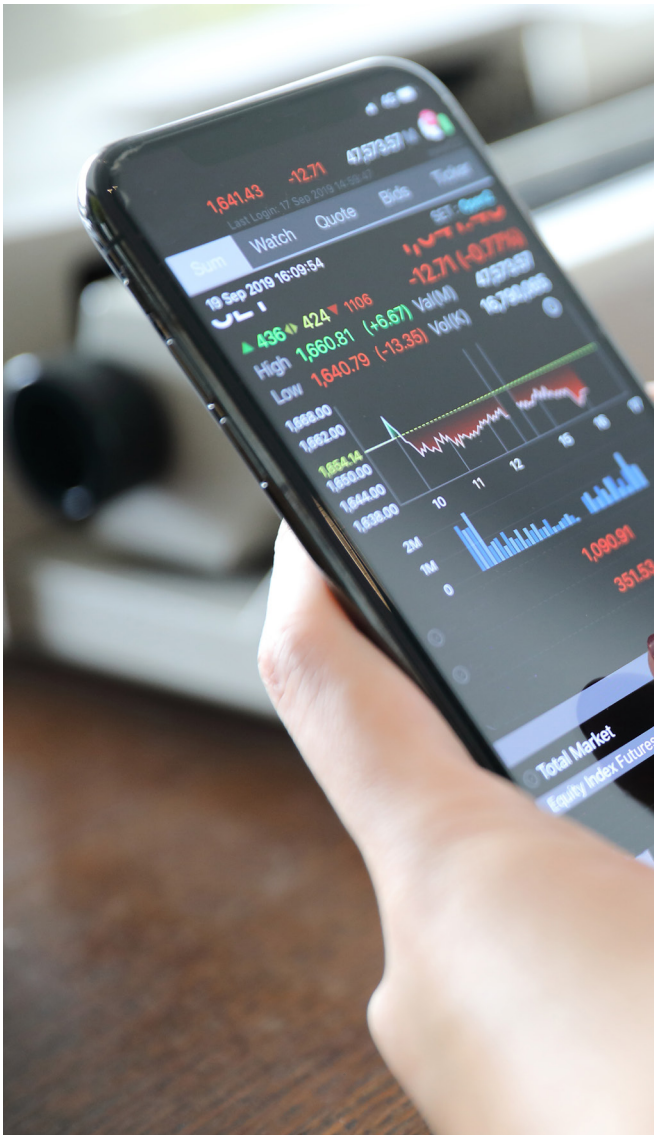
Put simply, the huge uncertainty in the market caused by the massive volatility in Gamestop shares was one factor which helps to explain why option prices became dislocated from their norms.

Volatility is generally regarded as being mean-reverting. In other words, it will revert to its long-term mean. Therefore, if volatility has been very high (as was the case with Gamestop shares), the expectation is that it will fall in the future. If this was the expectation, it follows that the expectation was also that the value of deeply in-the-money call options would fall.

Perhaps this is one additional factor which helps to explain why deeply in-the-money options over Gamestop shares traded below their intrinsic value.

We also mentioned that deeply out-of-the-money call options were trading at multiple times their theoretical value. The huge volatility in Gamestop shares meant that – if prices spiked the next day – those options could well switch to being in-the-money.

Hence, they were more valuable than they would normally be, purely as a function of the volatility of the Gamestop share price.



The "infinite gamma squeeze"

At one point, the Reddit forum "r/WallStreetBets" was alive with chatter of whether we'd see a phenomenon known as the "infinite gamma squeeze" in relation to Gamestop shares.

It's worth spending a bit of time understanding what an "infinite gamma squeeze" is. However, first, we need to have an understanding of what "gamma" is. We've already looked at "delta" – the change in value of the price of an option for a $1 move in the value of the underlying.

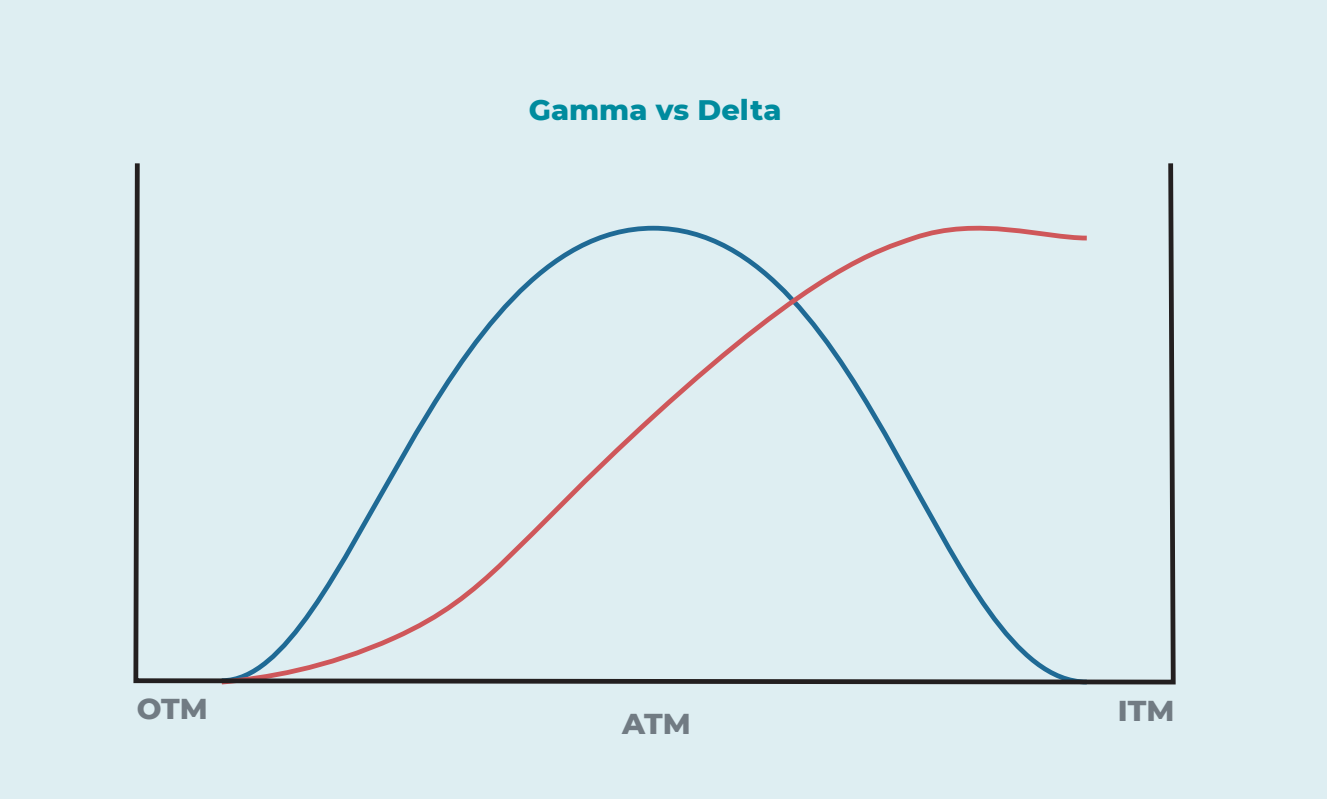
As we've seen, delta looks like this – like an "**S**". The gradient is shallow at either end (as we've already talked about, if you are massively in-the-money already and you go a bit further massively into-the-money, the price of the option isn't going to change much).

The same applies to being massively out-of-the-money. If you go a bit further out-of-the-money, or even a bit less out-of-the-money, the price of the option isn't going to change much. But the price of the option – and hence delta – changes much more quickly as the price of the underlying approaches the strike price. This is why the gradient of the delta slope is steeper at this point.

So, how does this relate to gamma?

Well, gamma plots the rate of change of delta. More specifically, gamma is the rate of change in an option's delta per 1-point move in the underlying asset's price.

So, when delta is low, gamma is low and when delta is high, gamma is high. As such, gamma looks like a bell curve:



So, with that background on gamma, what is an "infinite gamma squeeze"?

Well, let's suppose that I've sold call options on Gamestop to you with a strike price of $100. This means that you have the right to acquire shares in Gamestop from me for $100 a piece.

Let's also imagine that I sold call options on Gamestop to Joe Bloggs with a strike price of $105. This means that Joe Bloggs has a right to acquire shares in Gamestop from me for $105 a piece – slightly higher than the price that you would have to pay.

Let's assume that all of the options expire tomorrow.

Let's imagine that yesterday, the price of Gamestop shares was $90. But today, the price has gone up to $99 – so it's dangerously close to being in-the-money as far as the options I sold to you are concerned. Tomorrow it may go up again leaving you in-the-money. If that were the case, you would exercise the option and I would have to deliver shares to you.

In order to hedge against the risk that I need to deliver shares to you I will go out and actually buy some shares in Gamestop. Roughly speaking, I will buy them in proportion to the probability that your option will end up being in-the-money. It's not quite that simple but for present purposes that explanation will do.

So, broadly, if I think that there is a 90% chance of me having to deliver 100 shares to you tomorrow, I'll make sure that I own 90 shares in order to cover the risk. This is called "delta hedging". It's actually a dynamic process. As the price of the underlying approaches the strike price, I'll buy more shares. As the price of the underlying falls away from the strike price I'll sell some of those shares. Obviously, the process of buying and selling shares costs money – which eats into my profit of having sold the option in the first place – but that's a different conversation for a different day.

The point is that the very act of me buying the shares in order to delta hedge the option that I have sold to you PUSHES UP the prices of the shares. In turn, this increases the chances that the options I sold to both you – and to Joe Bloggs – will end up in-the-money. As such, I have to buy MORE shares in order to delta hedge the options I sold to Joe Bloggs as well as the options that I sold to you...

...which pushes up the price of the shares again, and so on and so on.

This phenomenon is known as the "infinite gamma squeeze".
It may well be that the "infinite gamma squeeze" is more theoretical than actual, but members of "r/WallStreetBets" were speculating that it could push the price of Gamestop shares over $1,000. Of course, hindsight tells us that the price of Gamestop shares never got anywhere near those sort of levels.

The role of time-decay

Whilst we are considering various aspects of options pricing, let's look at the role of something called "time decay".

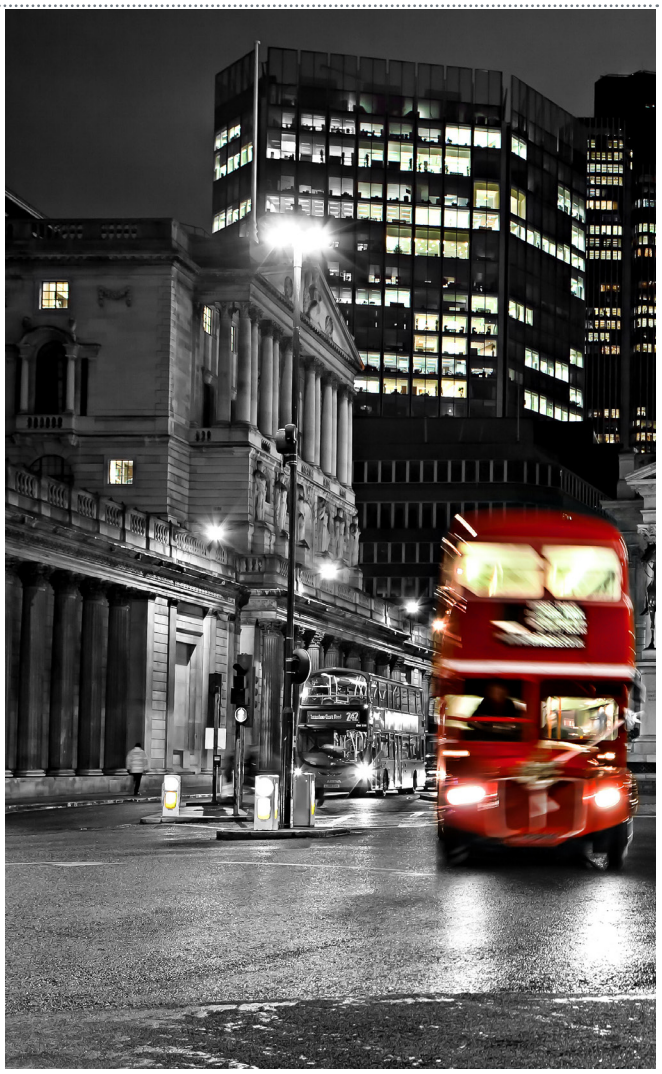
This is not something that was a particular discussion point in relation to Gamestop, but it's useful to know

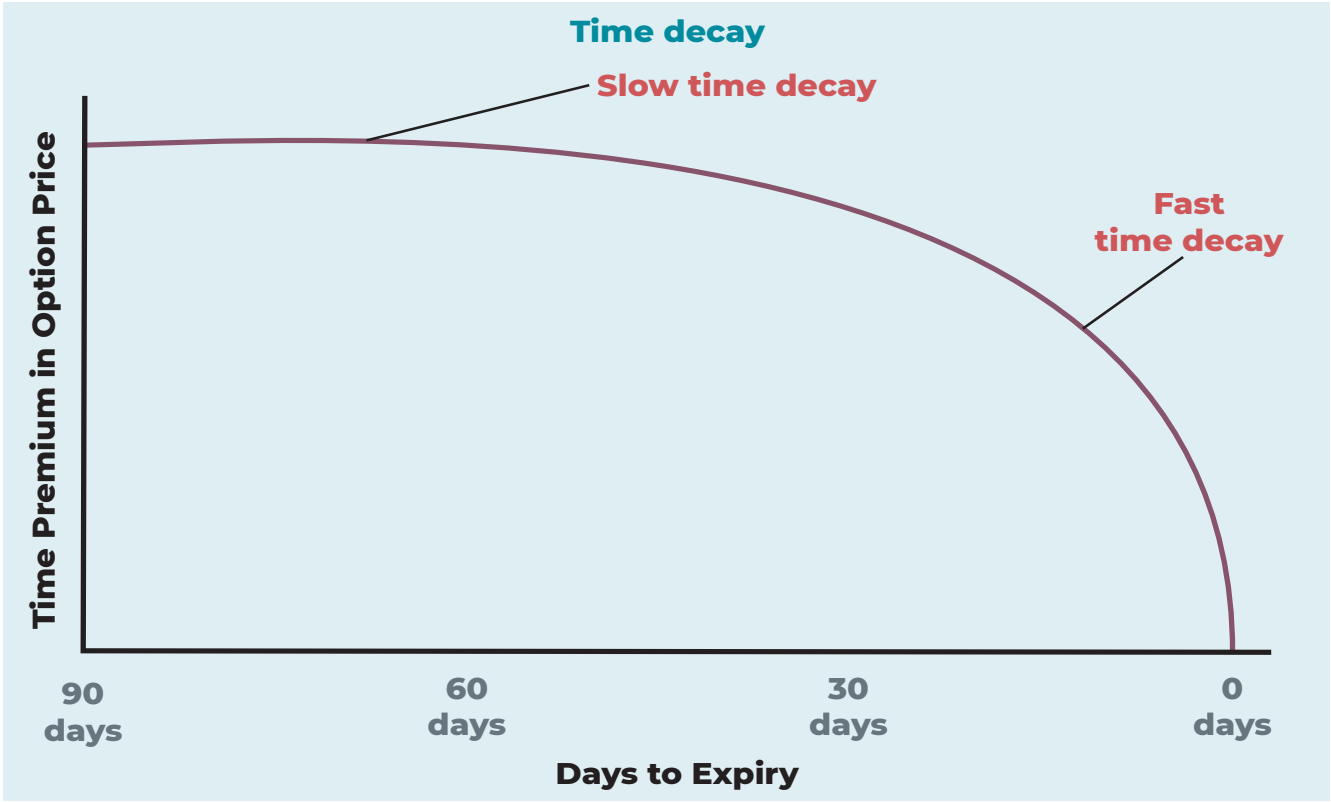
about in any event.

We've previously discussed how one of the inputs required in order to calculate the price of an option is its time to maturity. Put simply – all other things being equal – an option loses value as it moves closer to maturity. This rate at which the value of an option erodes simply as a function of the passage of time in known as "theta".

Due to the fact that theta erodes the value of an option over time, it is always working FOR someone who has sold an option and AGAINST someone who holds an option – because the option is losing some value every day that it sits there in the hand of the holder.

Theta is expressed as a negative number. That number can be thought of as the amount by which an options value declines every day. But Theta is not a CONSTANT. It actually looks like this:





Theta (the rate of loss in value of the option) actually accelerates as the option gets nearer to its maturity.

This is actually quite easy to make sense of. Consider the case of an option with a year to maturity. Let's imagine that this option is currently out-of-the-money – so as things stand, it's not profitable and would not be exercised.

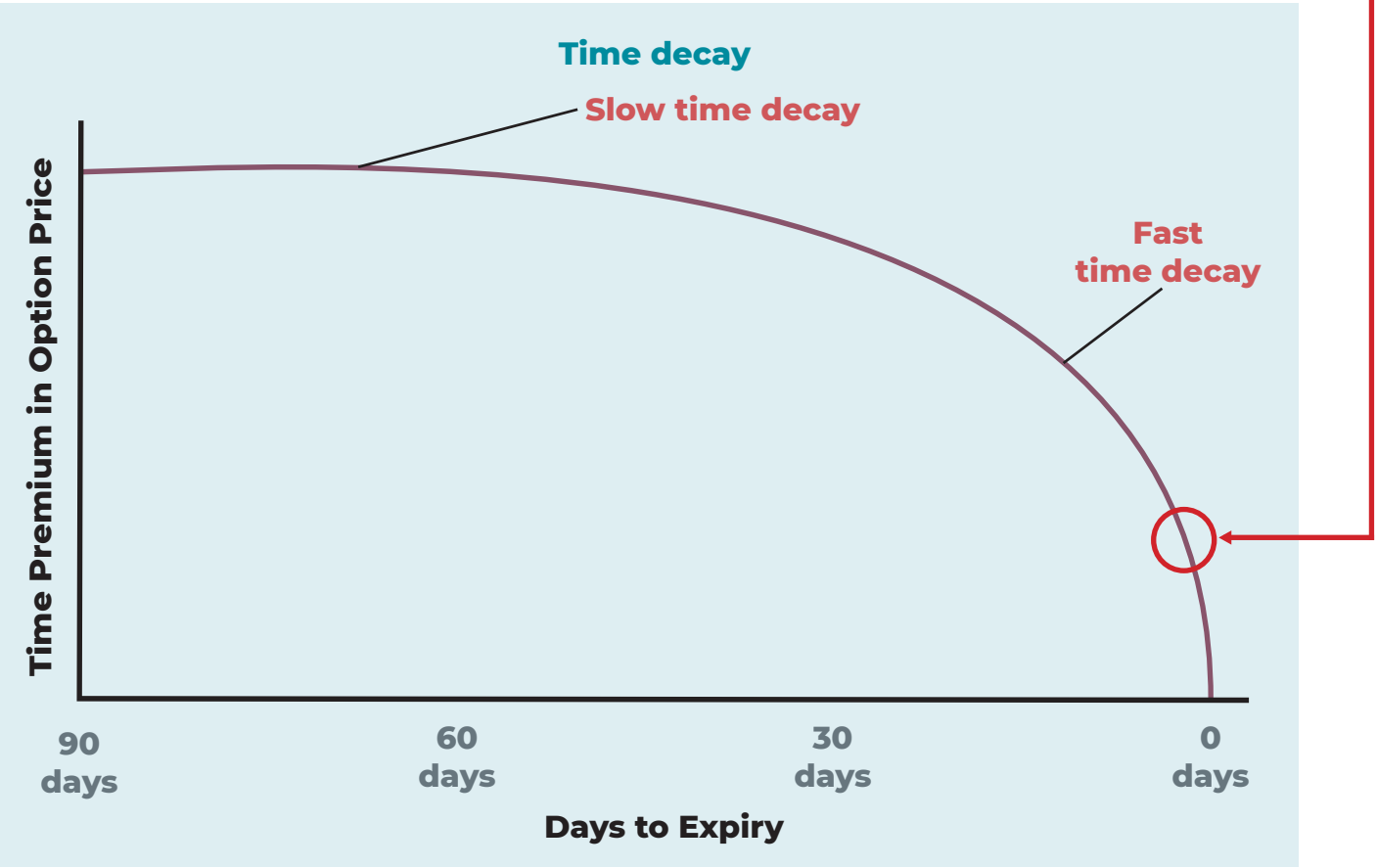
Tomorrow, that option will have 364 days left until maturity. There is still plenty of time left for the option to end up in-the-money. One day will have passed, but that only represents 1/365 = **0.27%** of the maturity of the option. So, very little by way of value of the option has been lost to time decay – it really isn't a significant factor at this point.

Now, let's fast-forward to day 363. At this point the story changes. There are now only two days left before the option matures. Let's imagine that we are still out-of-the-money on day 363. By the time we reach tomorrow (day 364) we've still only lost one more day, but that now represents a loss of **50%** of the remaining maturity of our option. So, there's now far less chance that our option can end up in-the-money and theta bites far harder as a result.

How might this be relevant to the Gamestop story?

Well, we've already mentioned the fact that a lot of the retail investors in Gamestop were buying super short-dated call options on the stock.

So, they were down here on the theta curve:



Theta was always working hard against them. Viewed in this light, perhaps it is no wonder that they were losing money when they were looking to sell their options back to a dealer (You remember? The ones they didn't have the cash to exercise?)

A final word on volatility

In hindsight, in theory at least, it might have made more sense for some of those retail investors in Gamestop to trade the volatility associated with Gamestop shares, rather than Gamestop shares themselves. In other words, rather than seeking to gain an exposure to the ACTUAL PRICE of Gamestop shares, they may have been better served by seeking to gain an exposure to the FLUCTUATION IN PRICE of Gamestop shares.

There are a couple of ways in which this can be done.

Trading options to gain exposure to volatility

One way to gain exposure to volatility is by trading options. Let's take a high-level look at how this might work.

As a reminder, we've mentioned the fact that there are 7 inputs required to price an option as well as the fact that 6 of these inputs are known:

Input	Known or unknown
Current price of the underlying	Known
Strike price of the option	Known
Type of option (call or put)	Known
Maturity of the option	Known
Risk-free interest rate	Known
Dividends on the underlying	Known
Volatility	**Unknown**

Volatility is a measure of the extent to which prices change. The greater the change, the greater the volatility (and vice versa). There are basically two types of volatility:

1. **Historical volatility** – obviously, this is backward looking and is calculated using historic prices; and
2. **Implied volatility** – this is the level of volatility that is implied in the current price of an option.

In a sense, implied volatility is the market's sense of what volatility will be like over the life of the option. To that extent, it can be viewed as forward-looking.

All other things being equal, the higher the volatility, the higher the price of an option. Why? Well, there is more uncertainty as to where the price will finish (because the price is swinging around to a greater extent). That being the case, the seller of an option with high volatility will want a higher price to compensate it for the higher risk that the option will end up being in-the-money to the purchaser.

Also – remember the classic investment mantra of "buy low, sell high". This applies equally to volatility trading using options.

Lastly, bear in mind that we previously talked about how volatility is generally regarded as being mean-reverting. In other words, it will revert to its long-term mean. Therefore, if volatility has been very high (as was the case with Gamestop shares), the expectation is that it will fall in the future.

So, if volatility is high (meaning that the price of options is HIGH) and you expect that volatility to reduce, you might want to SELL options (you can buy them back for less if volatility reduces).

More specifically, if you expect the price of the underlying stock to FALL as volatility recedes, you may want to SELL call options. If the price does fall, the options should end up out-of-the-money to the purchaser so you can bank the premium. As an example, if I have sold you the right to buy shares from me for, say, $100 a piece, but the shares have fallen in value and are only now only trading at $25 each, you aren't going to exercise your right to buy them from me for $100.

Conversely, if you expect the price of the underlying stock to RISE as volatility recedes, you may want to SELL put options. Again, if you are right, the options shouldn't end up being exercised against you. To put some numbers on this, if I've sold you the right to sell me shares for say $100 each, but they are currently trading at $150 each, you aren't going to sell them to me for $100 each – you would sell them into the market for $150 instead.
Obviously, in both cases, you can close the position out by trading an 'opposite' option. If volatility has fallen – all other things being equal – it will cost you less to buy this option then you made when selling the original option so you'll end up with a profit.

But beware. Writing call options is risky as you have (theoretically at least) unlimited losses if the price of the stock goes up (contrary to what you thought). Writing put options isn't quite so risky as the price of the stock can't go below zero, so losses are limited (although they can still be significant).

Entering into a volatility swap

Another way to gain exposure to volatility is by entering into a volatility swap. Let's take a look at how this might work.

A volatility swap is basically a forward contract – they aren't quite like traditional swaps as they don't involve an exchange of payments. The payoff under a volatility swap is

Notional amount x (Realised Volatility – Volatility Strike).

Remember, notional amounts are not exchanged. They are just used to perform calculations.

The Volatility Strike is a fixed number. It reflects the market's expectation of future volatility - assessed at the time the swap is executed. In some ways, it's quite similar to implied volatility (i.e. what the market thinks volatility will be in the future). In reality, the Volatility Strike is usually set at whatever value makes the net present value of the swap zero (remember – all swaps should have a zero value when executed otherwise we open ourselves up to arbitrage opportunities).

Realised volatility is just that – the actual level of volatility that was observed in the market over the relevant period. Obviously, this can only be calculated at the end of the period. This is the final input needed to calculate the payoff of the volatility swap.

Volatility swaps allow investors to trade volatility without owning the underlying assets. In other words, it allows investors to trade the DEGREE TO WHICH THE PRICE FLUCTUATES without being worried about the actual PRICE.

Options also carry directional risk. In other words, they are impacted by the price of the underlying AS WELL AS its volatility. This isn't the case with a volatility swap. They are a pure volatility play.

Remember the basic principle of "buy low, sell high".

If you think that volatility will RISE, you should BUY the volatility swap. If it turns out that Realised Volatility is HIGHER than the Volatility Strike (in other words, the level of volatility that the market projected at the outset of the swap), then you will stand to receive the difference between the two.

Conversely, if you think that volatility will FALL, you will SELL the volatility swap. If it turns out that Realised Volatility is LOWER than the Volatility Strike then you will stand to receive the difference between the two.

About the Author

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