

26th Annual Risk Management Conference

Fundamentals of Options: Part Two



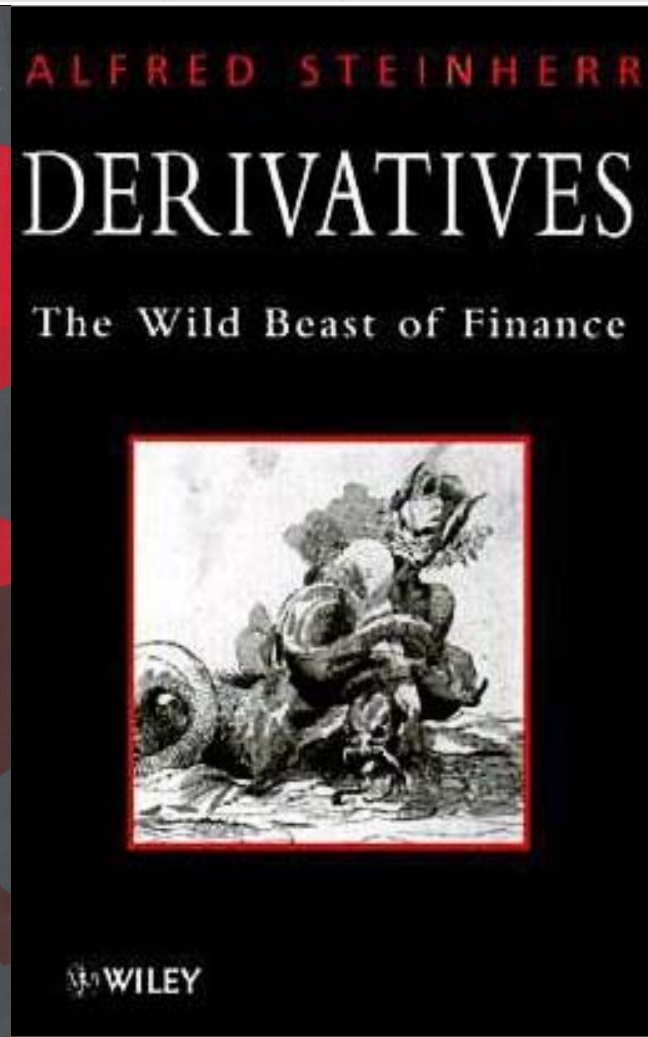
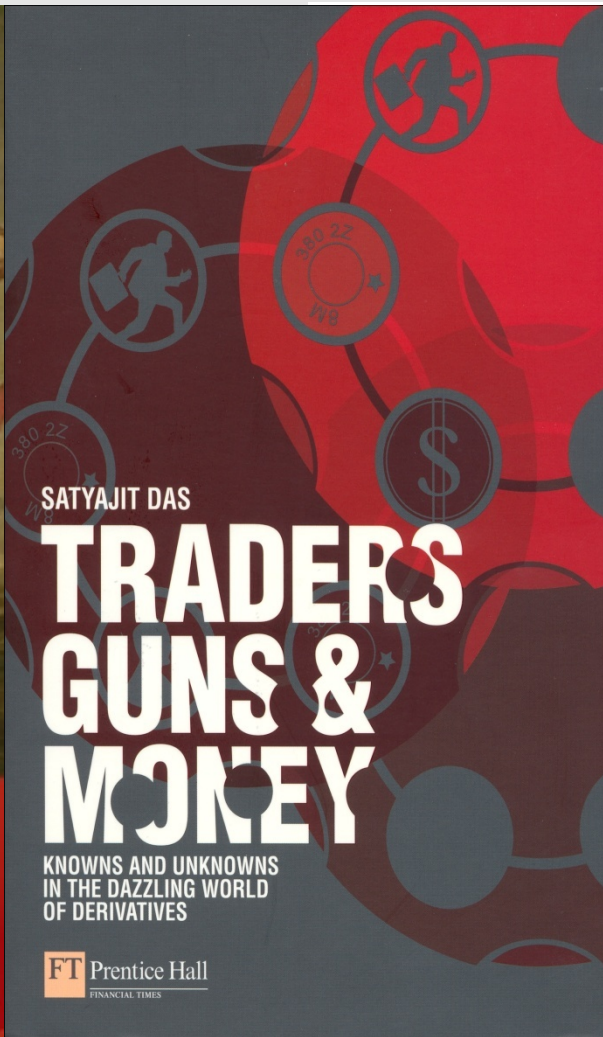
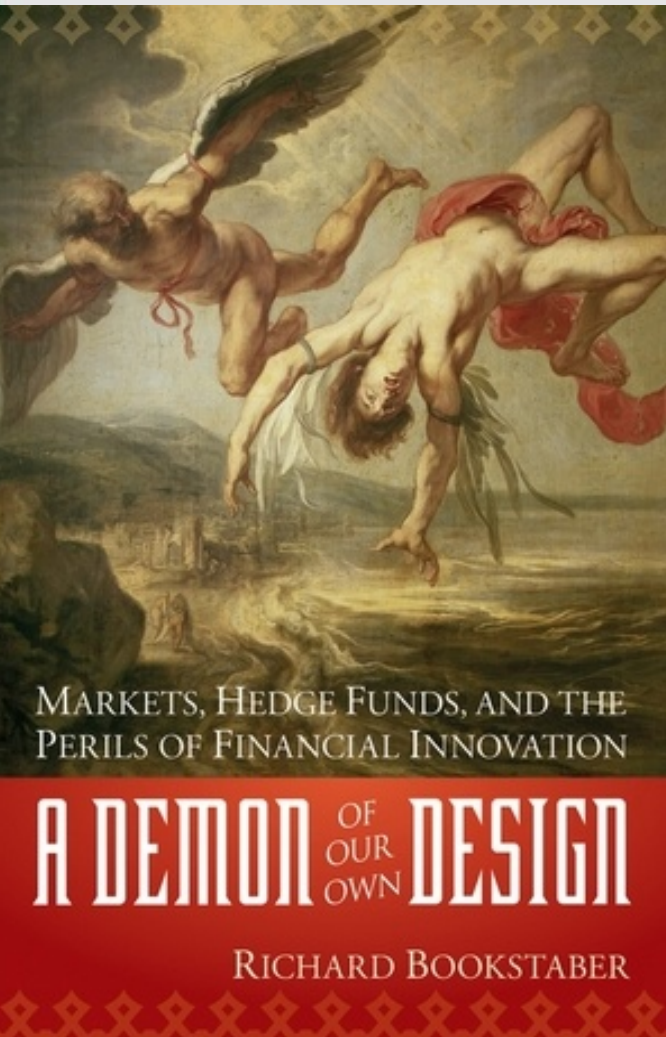
The Role of Market-Makers

Joseph E. Bonin

Agenda for this presentation

- The Role of Option Market-Makers
 - Misconceptions and Conceptions about Market-makers
 - Delta-Neutral and Volatility Trading
 - A Market-Maker's Perspective
 - Position Risks: Delta, Gamma, Vega, Theta
 - and their Relevance to Investors
- Questions and Answers

Options are often misunderstood



Market-Makers are often misunderstood

- It is you versus them (Texas Death Cage Match).
- Playing a zero sum game.
- They have better computers.
- Rocket scientists, everyone of them.
- They have an advantage over you.

What do Market-Makers want ?

- To Make Money
- To Manage Risks
- To Avoid “Surprises”
- To Live Happily Ever After

Trading versus Investing

- Who does what?
- How do they differ?
- Math(s)
- Hedging
- Understanding how other market participants think.

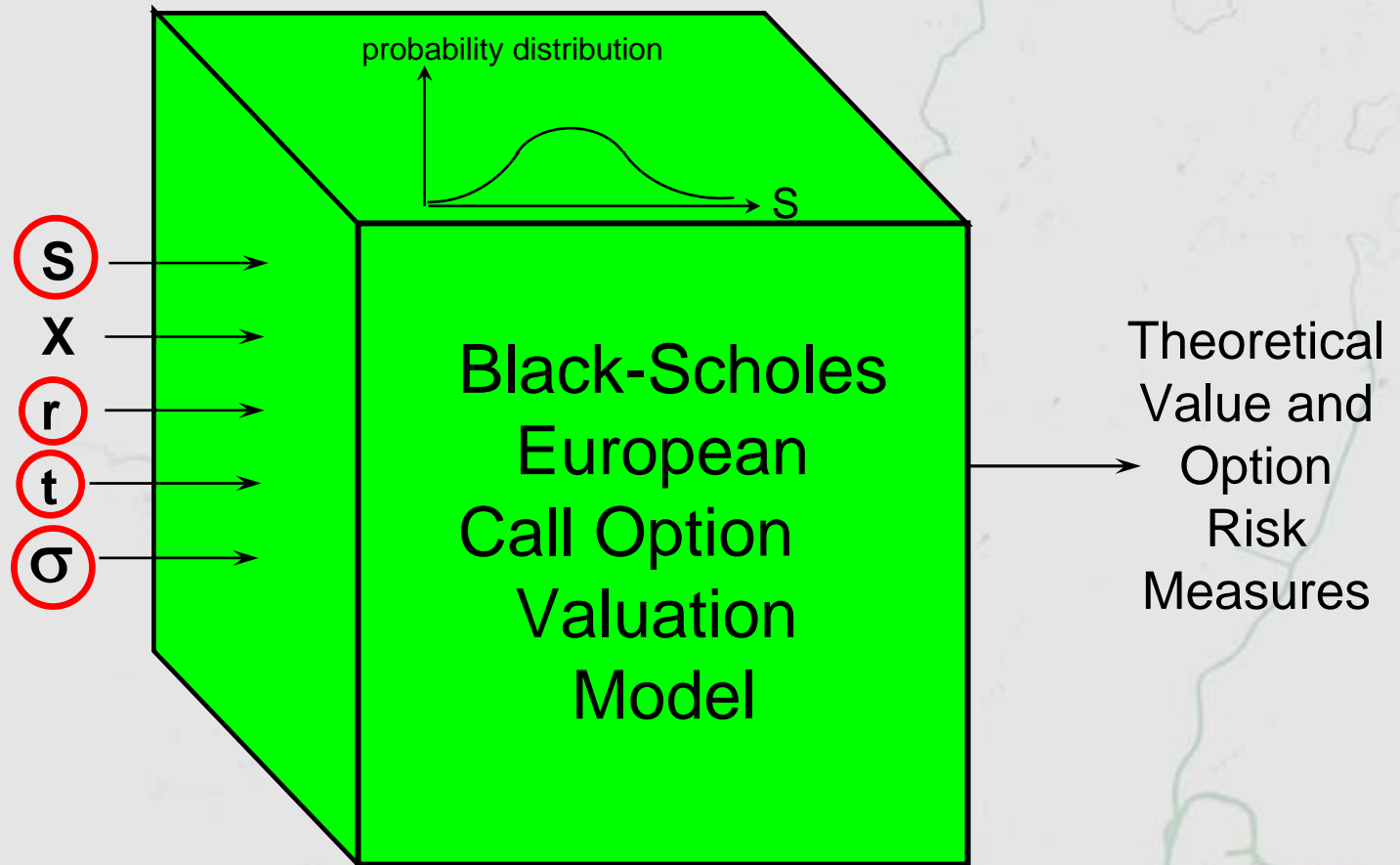
Risk

Options have several moving parts.

What will happen if there is a change in those things on which an option's value depends?

That's "risk".
Exposure to change.

What's in the Black(-Scholes) Box?



Option Valuation $C(S, X, r, t, \sigma)$

DELTA: Measures the Option Value's sensitivity
 Δ to changes in the Stock Price.

GAMMA: Measures the sensitivity of the option's
 Γ DELTA to changes in the Stock Price.

VEGA (TAU) : Measures the Option Value's sensitivity
 ν to changes in Volatility.

THETA: Measures the Option Value's sensitivity
 θ to the passage of Time.

RHO: Measures the Option Value's sensitivity
 ρ to changes in Interest Rates.

Option Risk Measures: European 50 Call Example

Underlying: Non-Dividend Paying Stock:

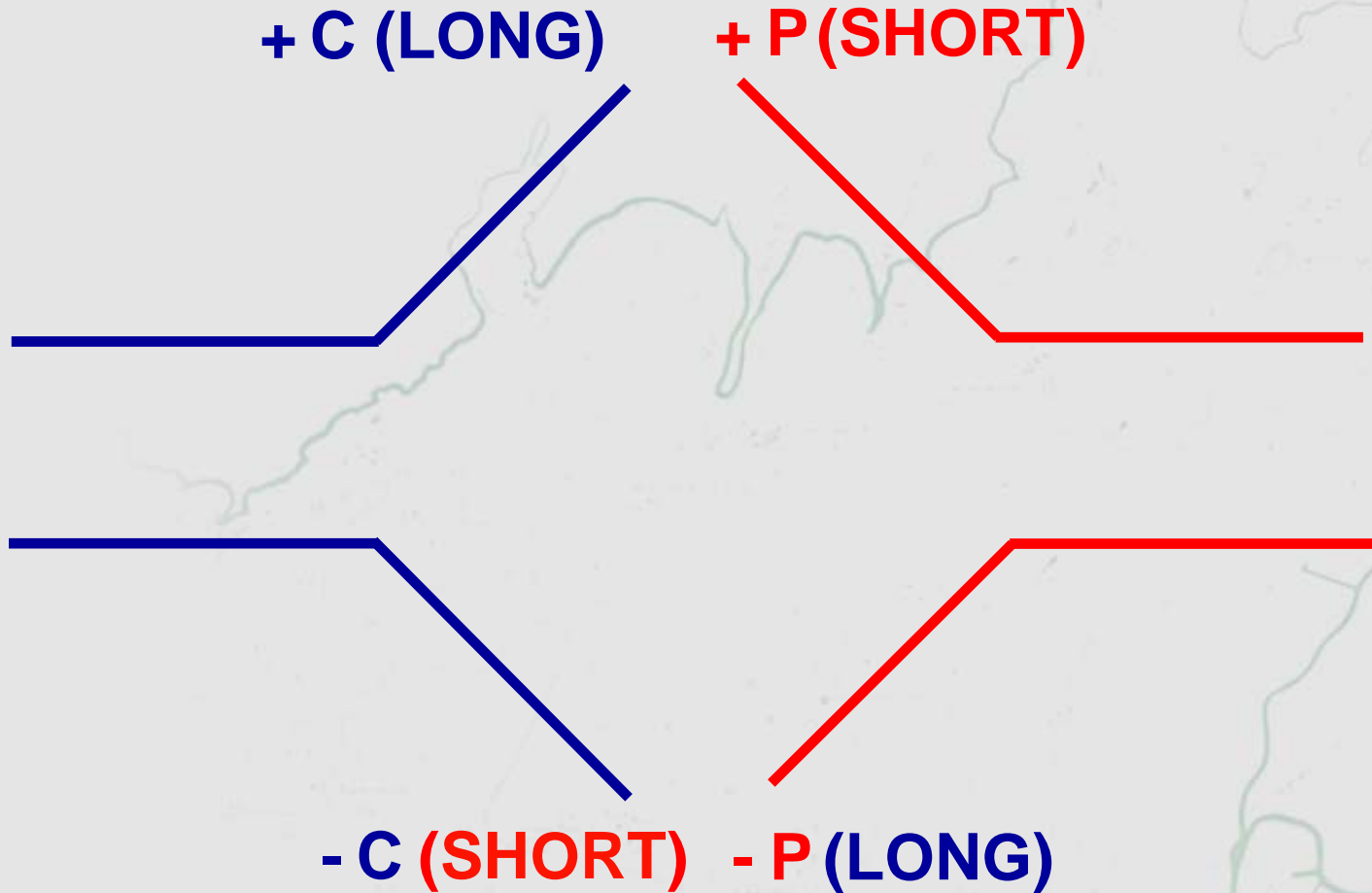
($r = 4\%$, $\sigma = 30\%$)

	t = 3 days	t = 90 days	t = 360 days
S = 45	50C = 0.00 $\Delta = .00$ $\Gamma = .00$ $\nu = .00$ $\theta = .00$	50C = 1.12 $\Delta = .29$ $\Gamma = .05$ $\nu = .07$ $\theta = .06$	50C = 4.16 $\Delta = .47$ $\Gamma = .03$ $\nu = .18$ $\theta = .01$
S = 50	50C = 0.55 $\Delta = .51$ $\Gamma = .29$ $\nu = .02$ $\theta = .11$	50C = 3.23 $\Delta = .56$ $\Gamma = .05$ $\nu = .09$ $\theta = .08$	50C = 6.88 $\Delta = .61$ $\Gamma = .03$ $\nu = .19$ $\theta = .01$
S = 55	50C = 5.02 $\Delta = .99$ $\Gamma = .00$ $\nu = .00$ $\theta = .01$	50C = 6.61 $\Delta = .78$ $\Gamma = .04$ $\nu = .08$ $\theta = .07$	50C = 10.23 $\Delta = .72$ $\Gamma = .02$ $\nu = .18$ $\theta = .01$

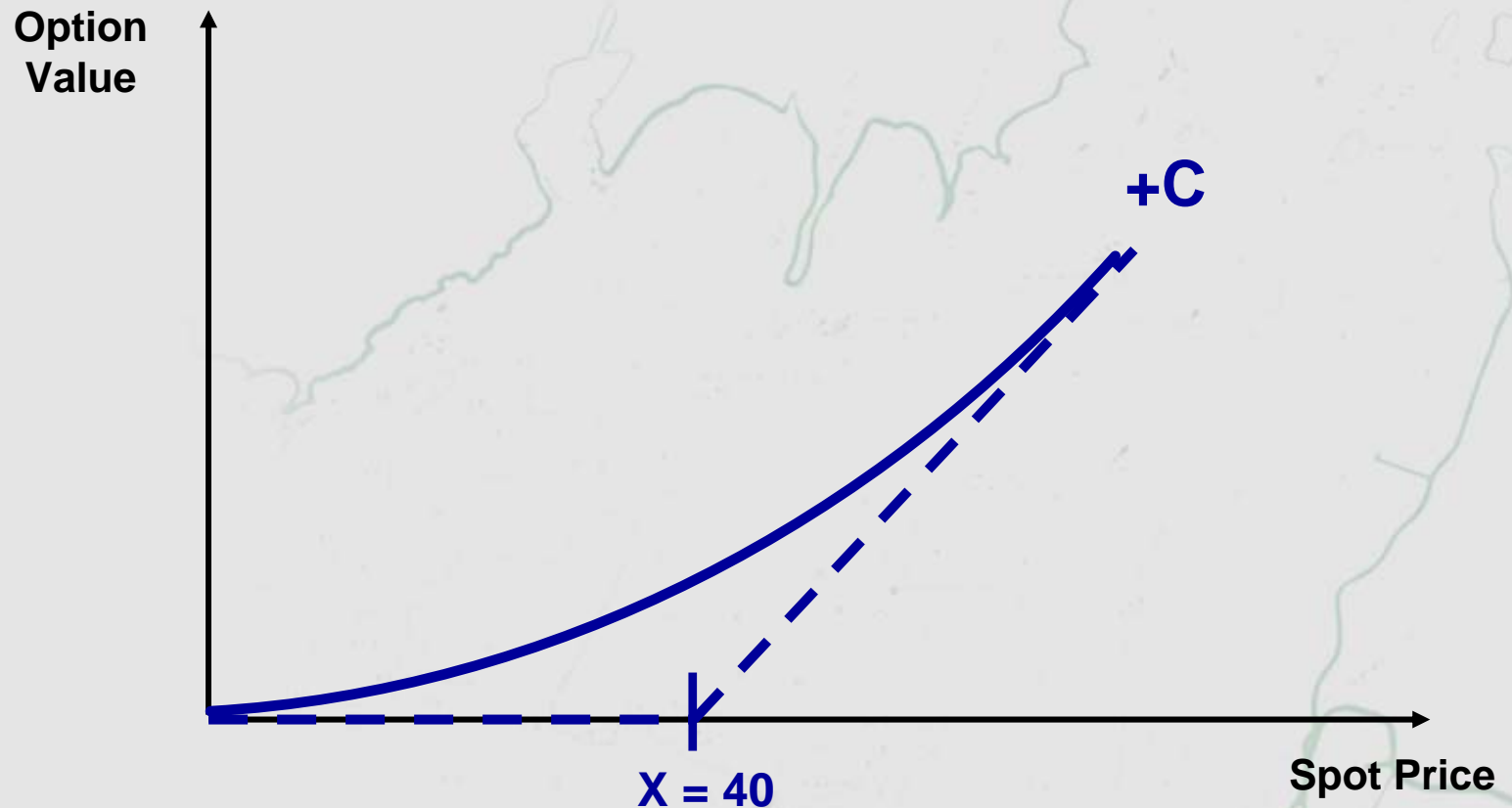
Delta

- How a Market-Maker Thinks About Delta.
- Measure of how long or how short you are.
- This is the risk most Option Market-Makers try to avoid like the plague.
- Why?
- Because you're smarter than he or she is.

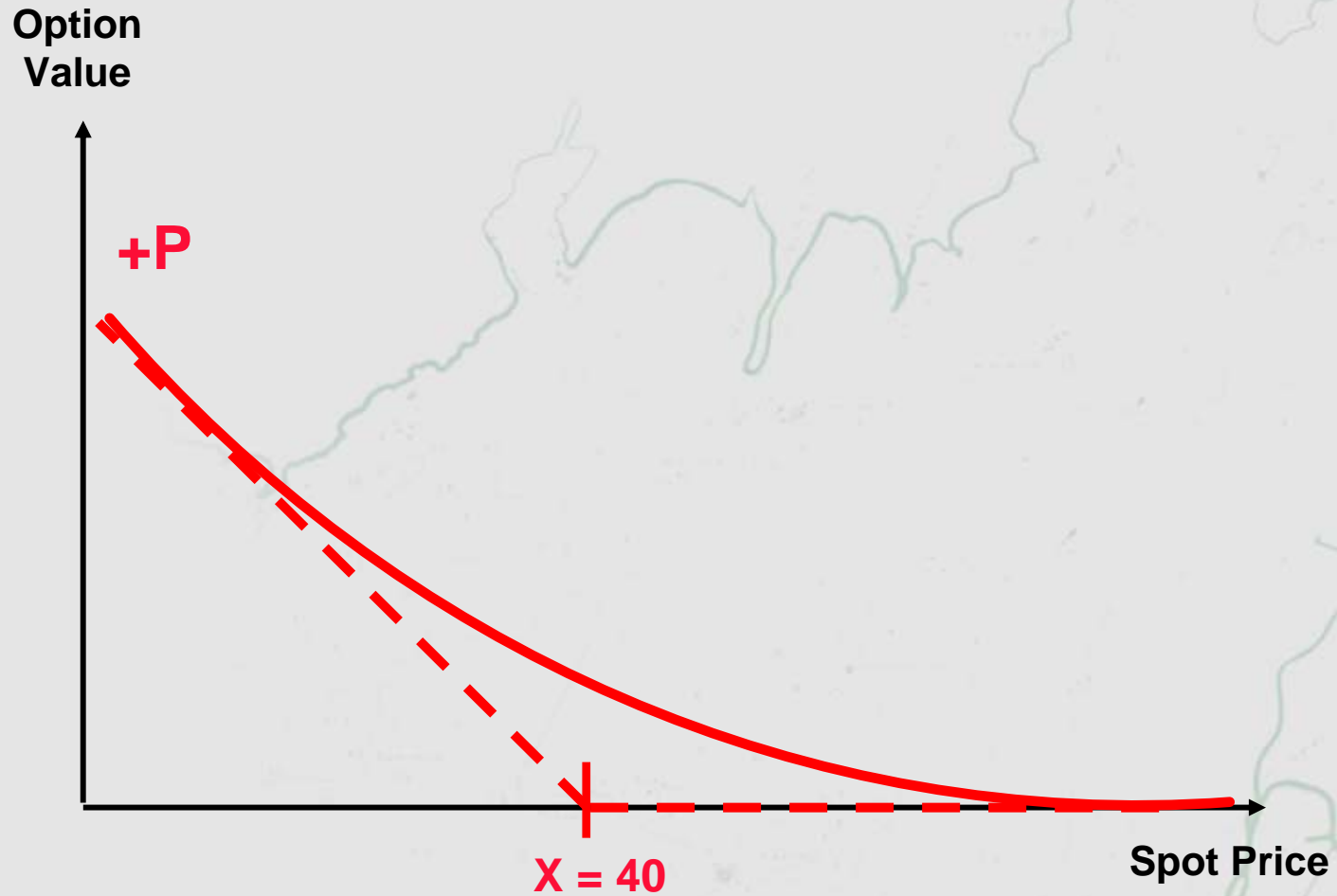
Graphical Exposition (at expiration)



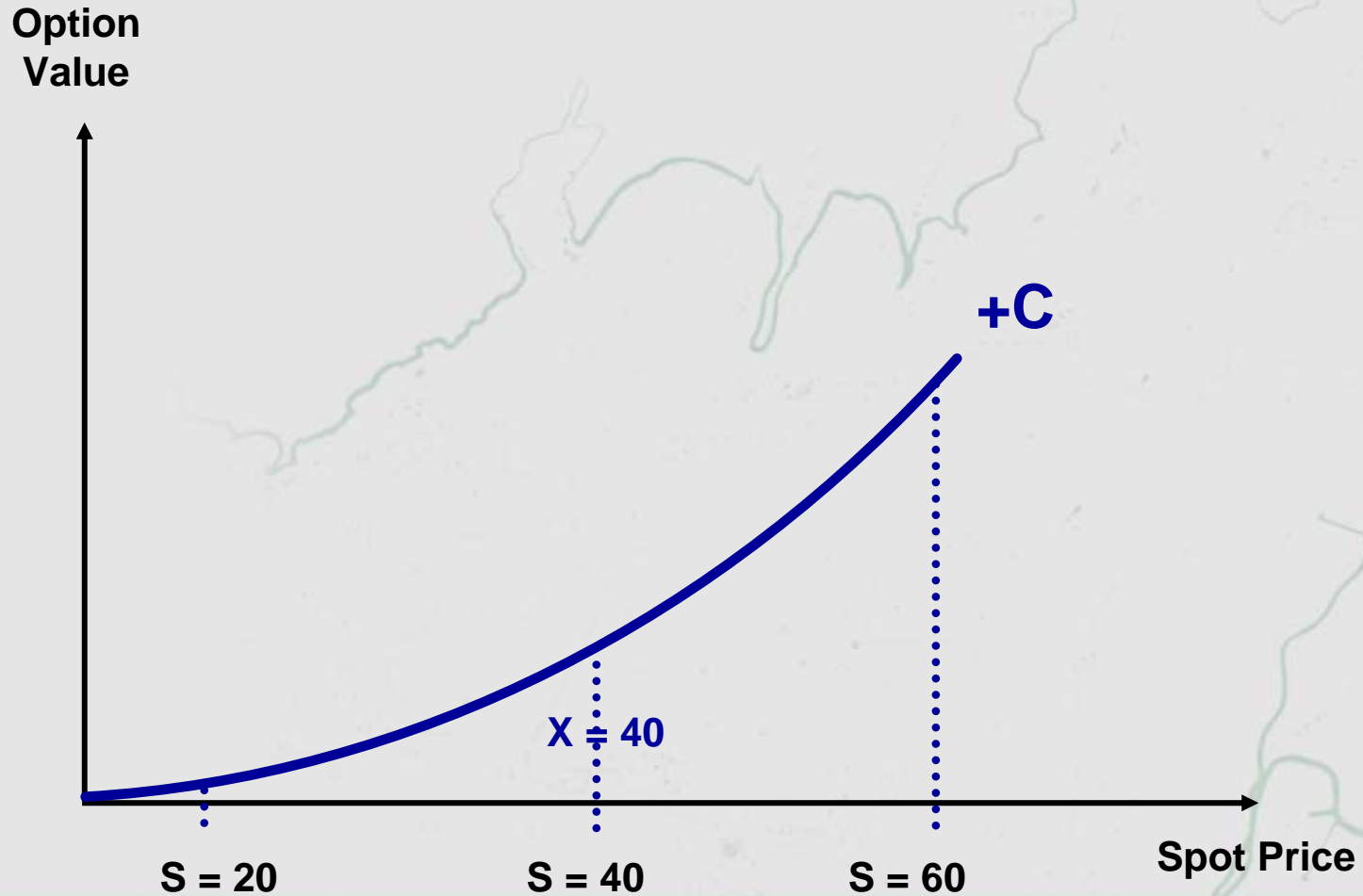
In reality, . . . what options look like prior to expiration



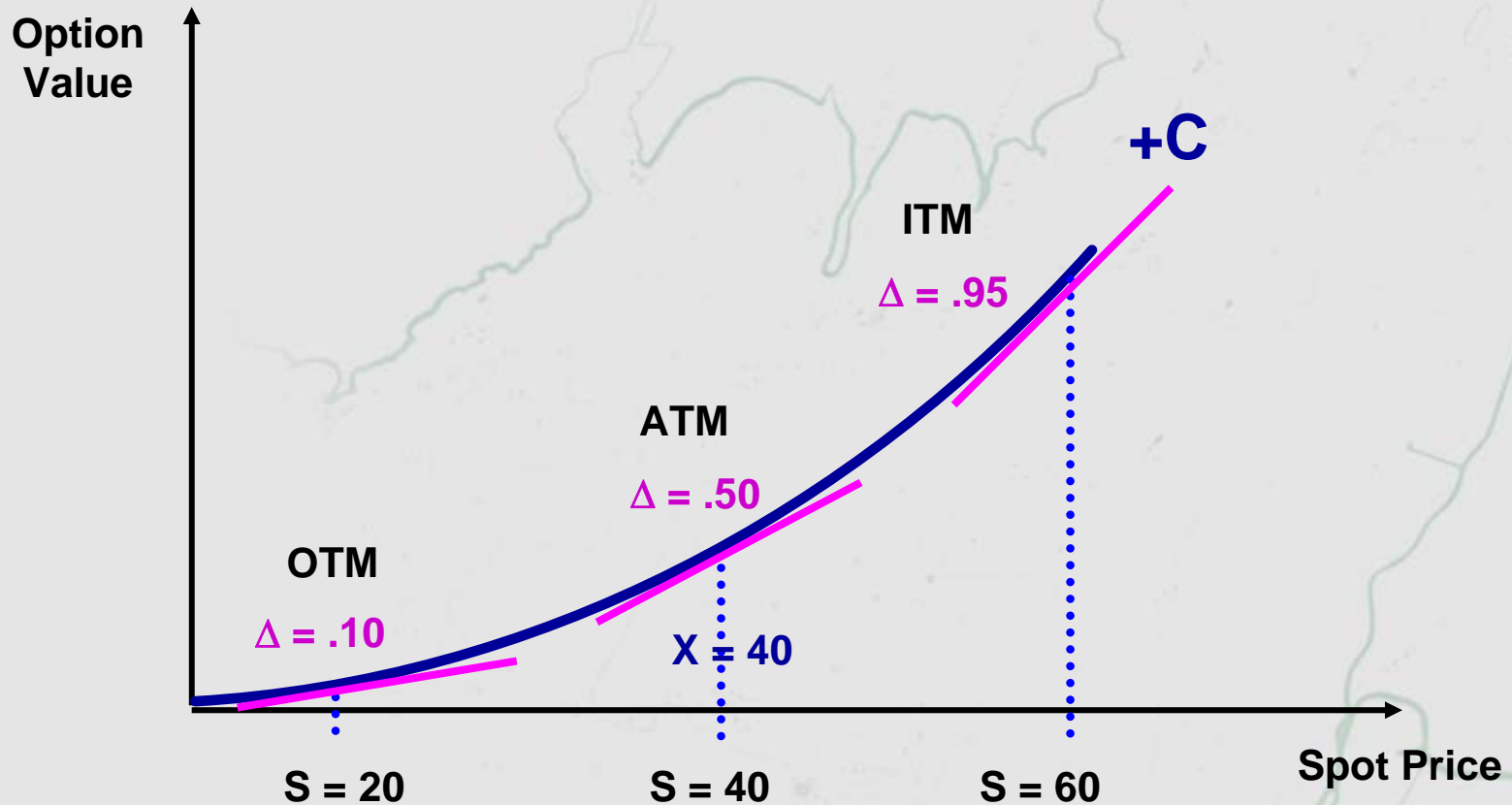
Options are “Curvy”.



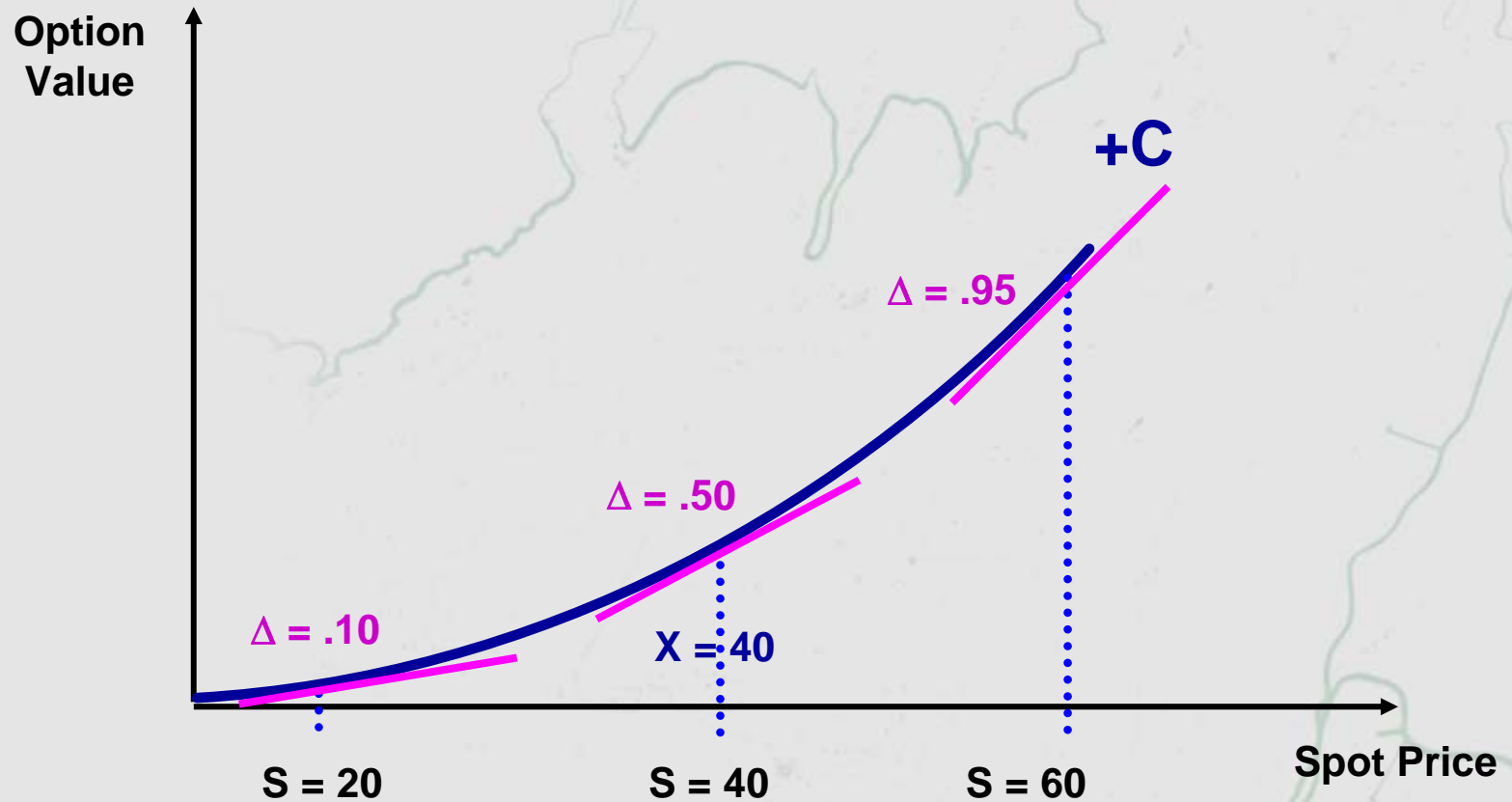
Long Call like long stock: How long are you?



Delta: A measure of how long or how short you are

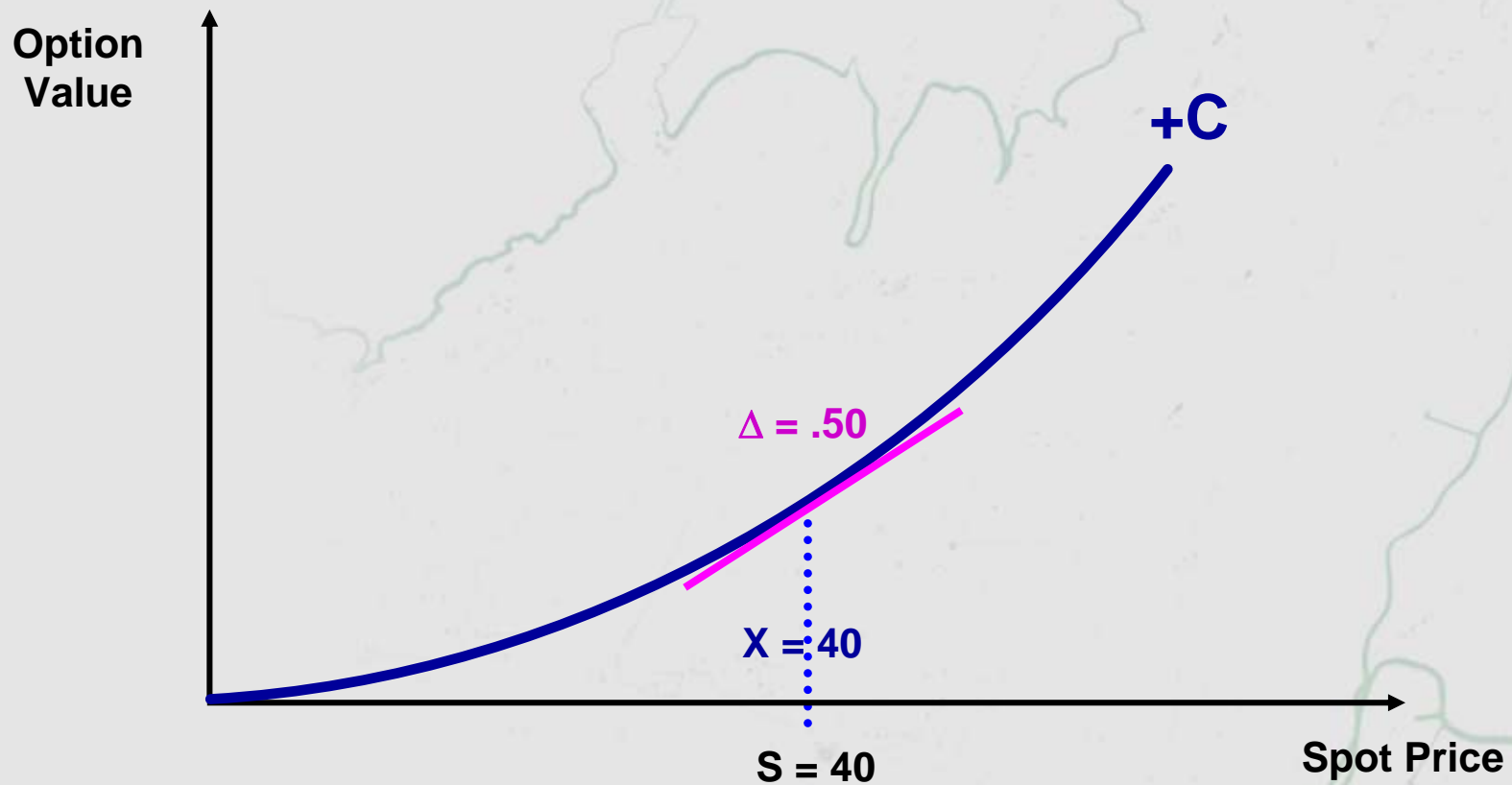


Option Delta changes as stock price moves: Gamma



Delta as a hedge ratio

If a Trader buys 600 of the 40 Strike Calls (each option covering 100 shares), that makes him “long”. He doesn’t want to be long; he doesn’t know where stock will be trading tomorrow. What will he do? He will hedge his position.

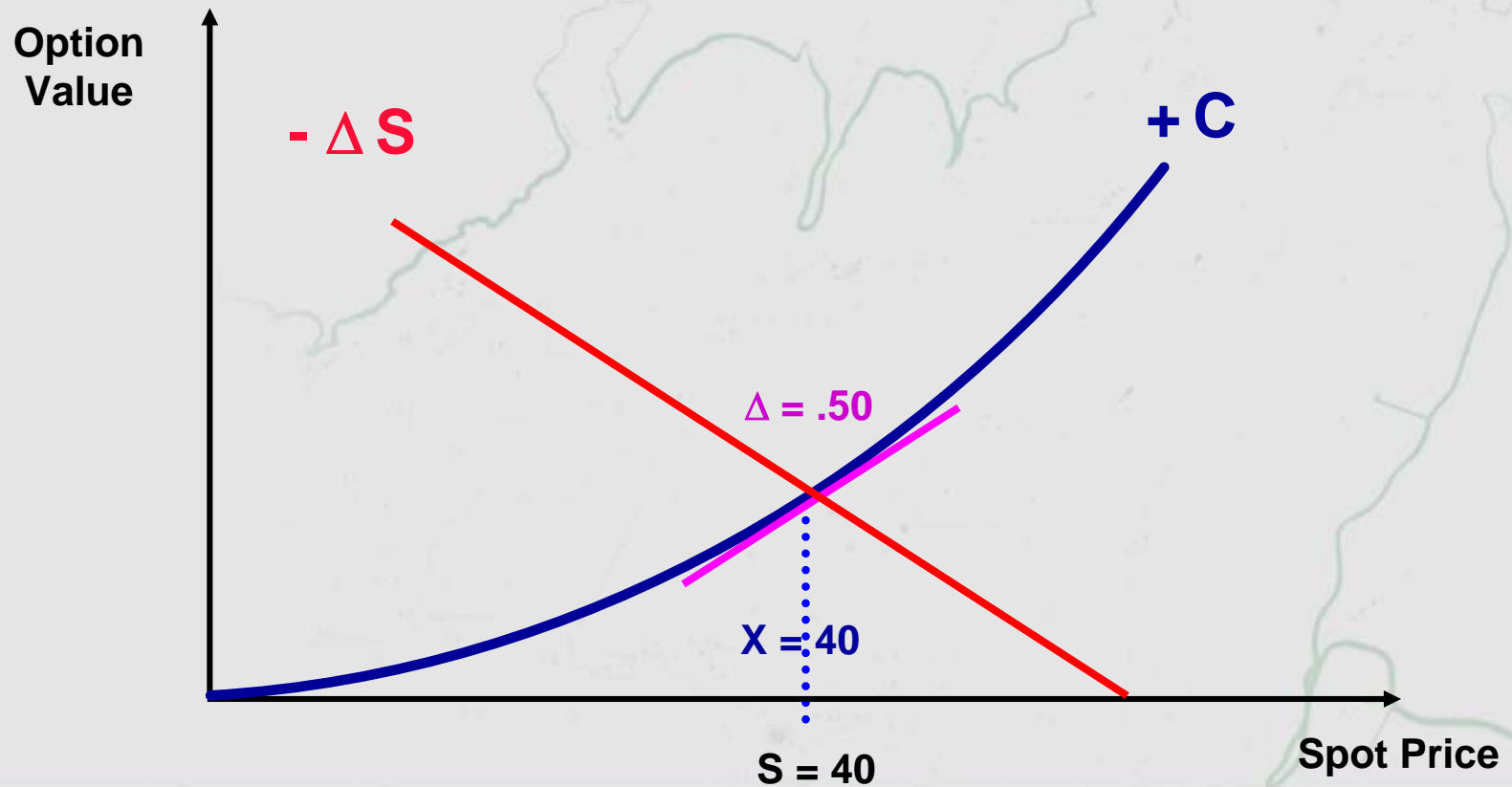


Delta as a hedge ratio

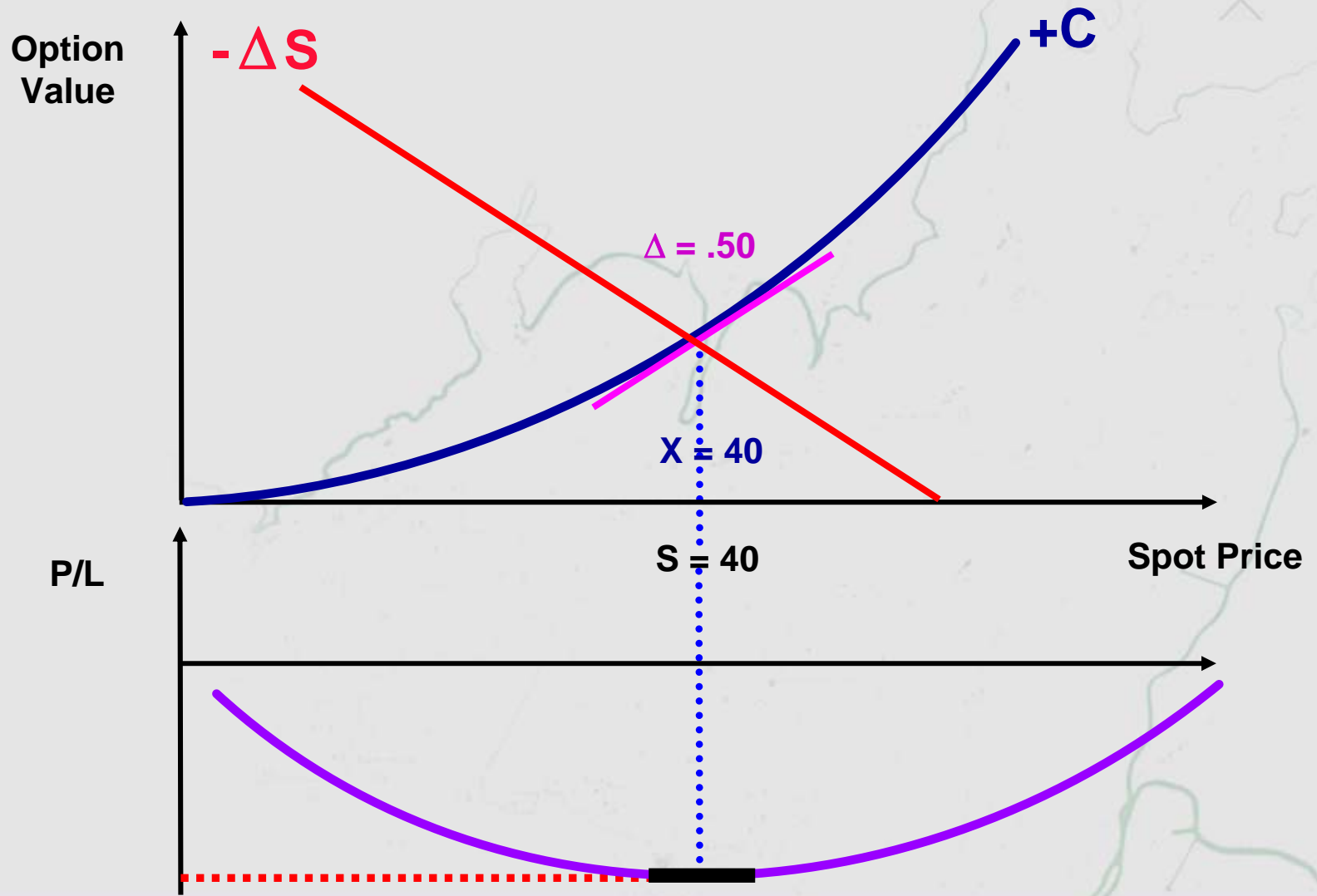
What is the Trader's Δ (Delta)? How long does he perceive himself to be?

Long: 600 options x 100 shares x 50 delta (.50). Like he's long 30,000 shares.

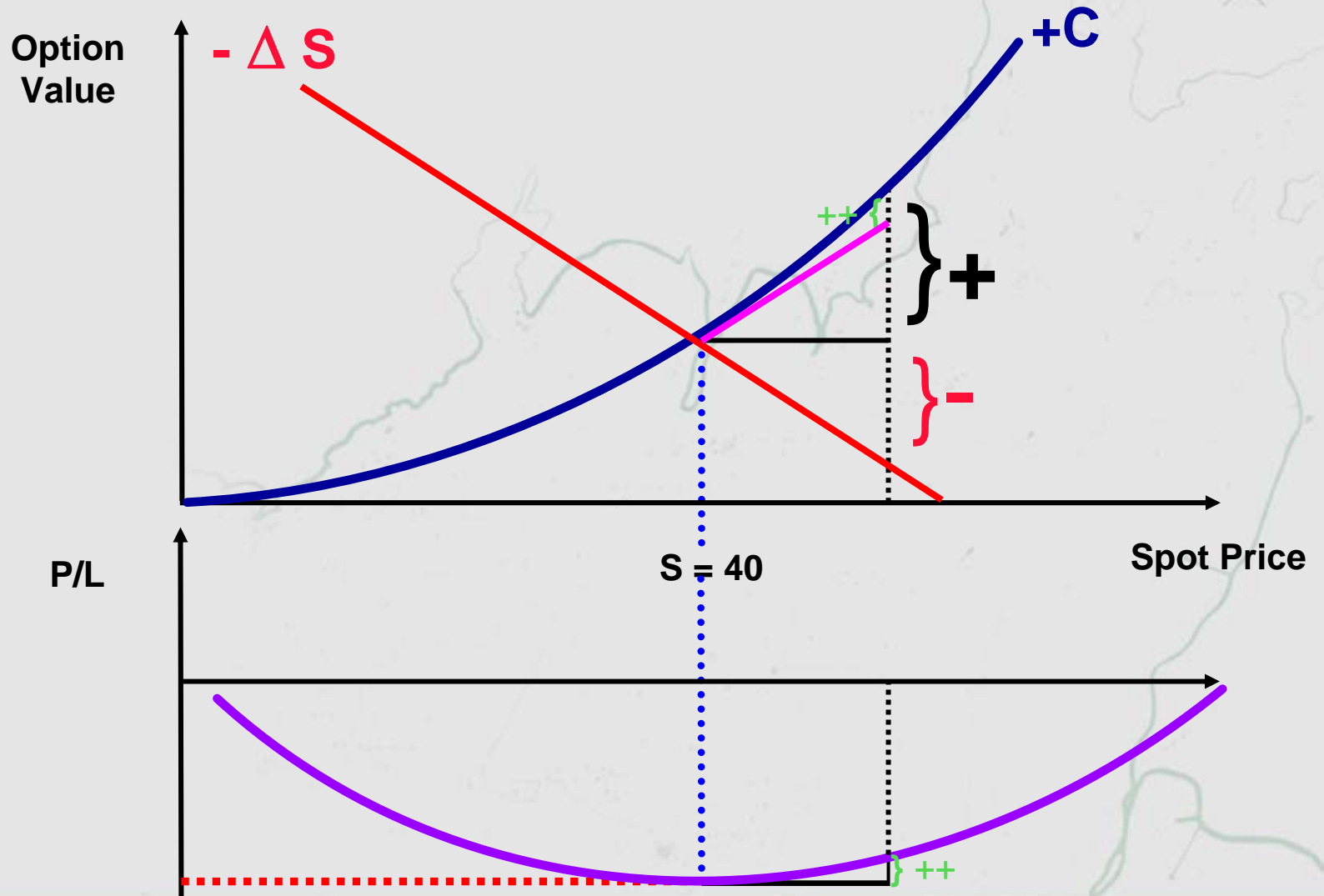
He will go out and sell 30,000 shares of the stock. He'll be "Delta Neutral".



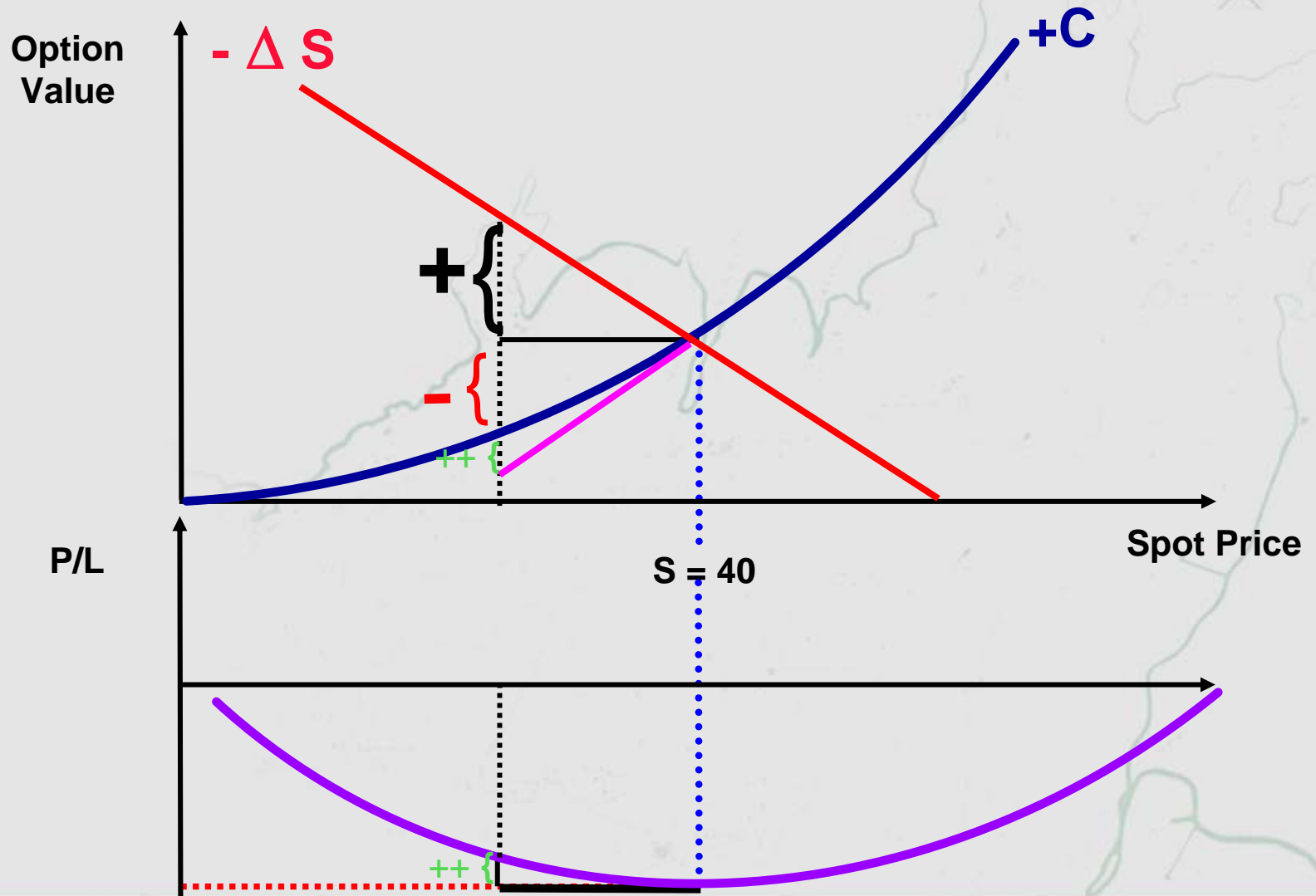
Delta Neutral = Flat



What if the stock price goes up?



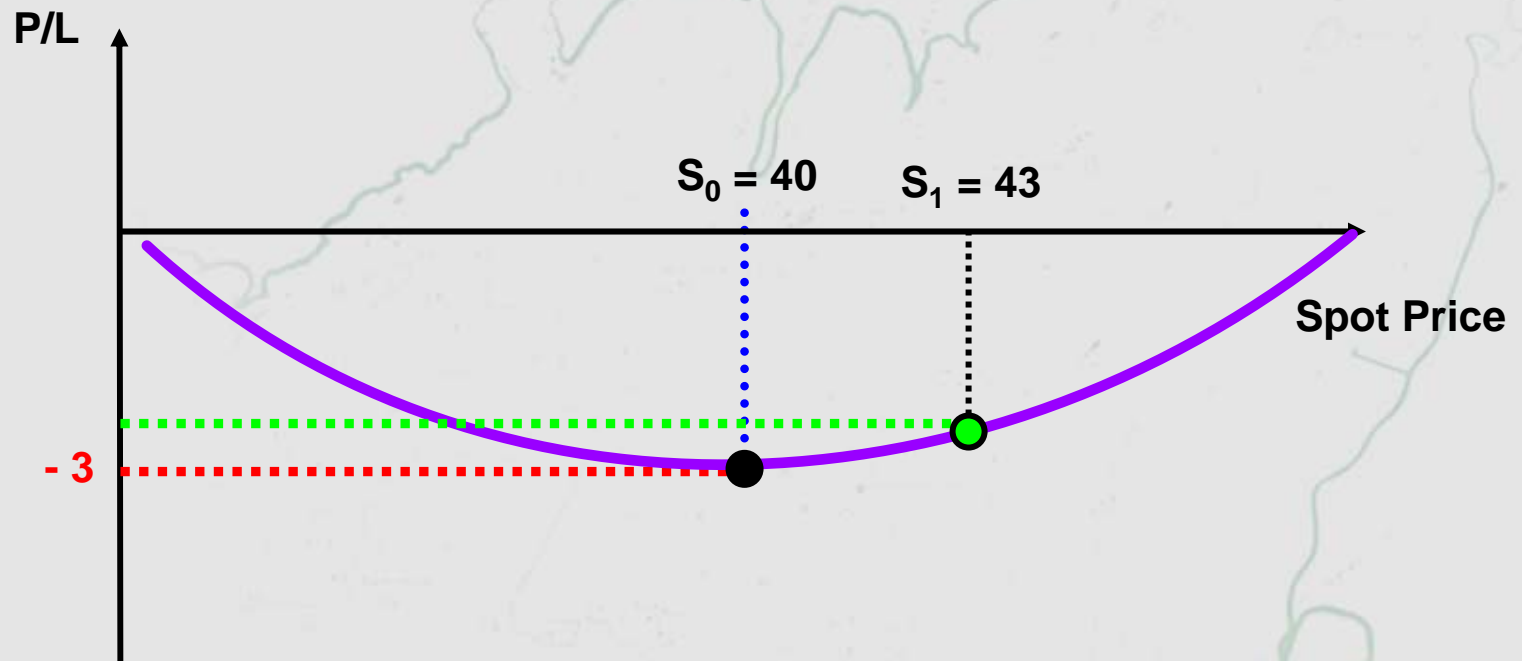
What if the stock price goes down?



So, what do the options guys do?

As the market moves, the Trader is becoming “unhedged”.

Is it good to be unhedged?

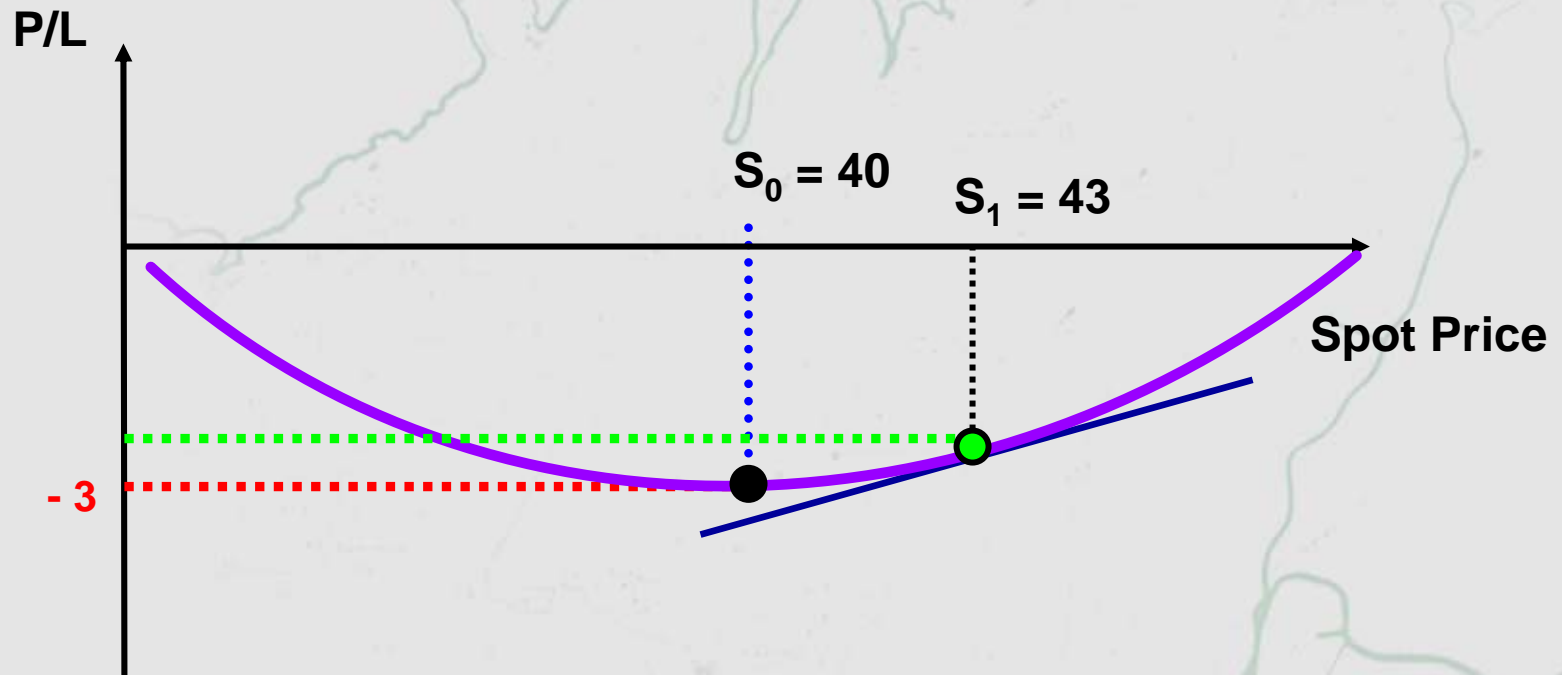


Getting long as the stock price moves up

Does the Trader want to be long? No.

How does he keep from being long?

Sells some more stock (at the higher price).



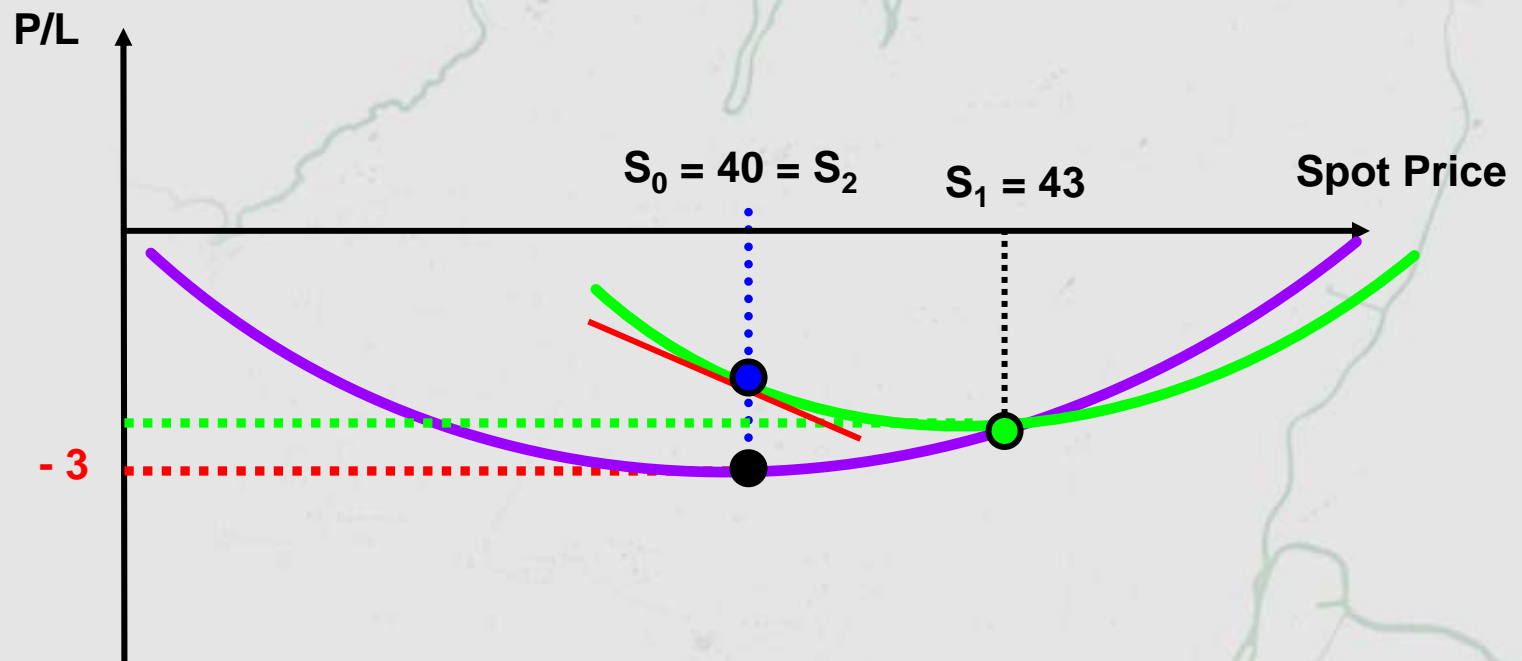
Rehedge the position

If, after rehedging, the stock price falls, now the Trader gets short.

Do you like to be short as the market falls?

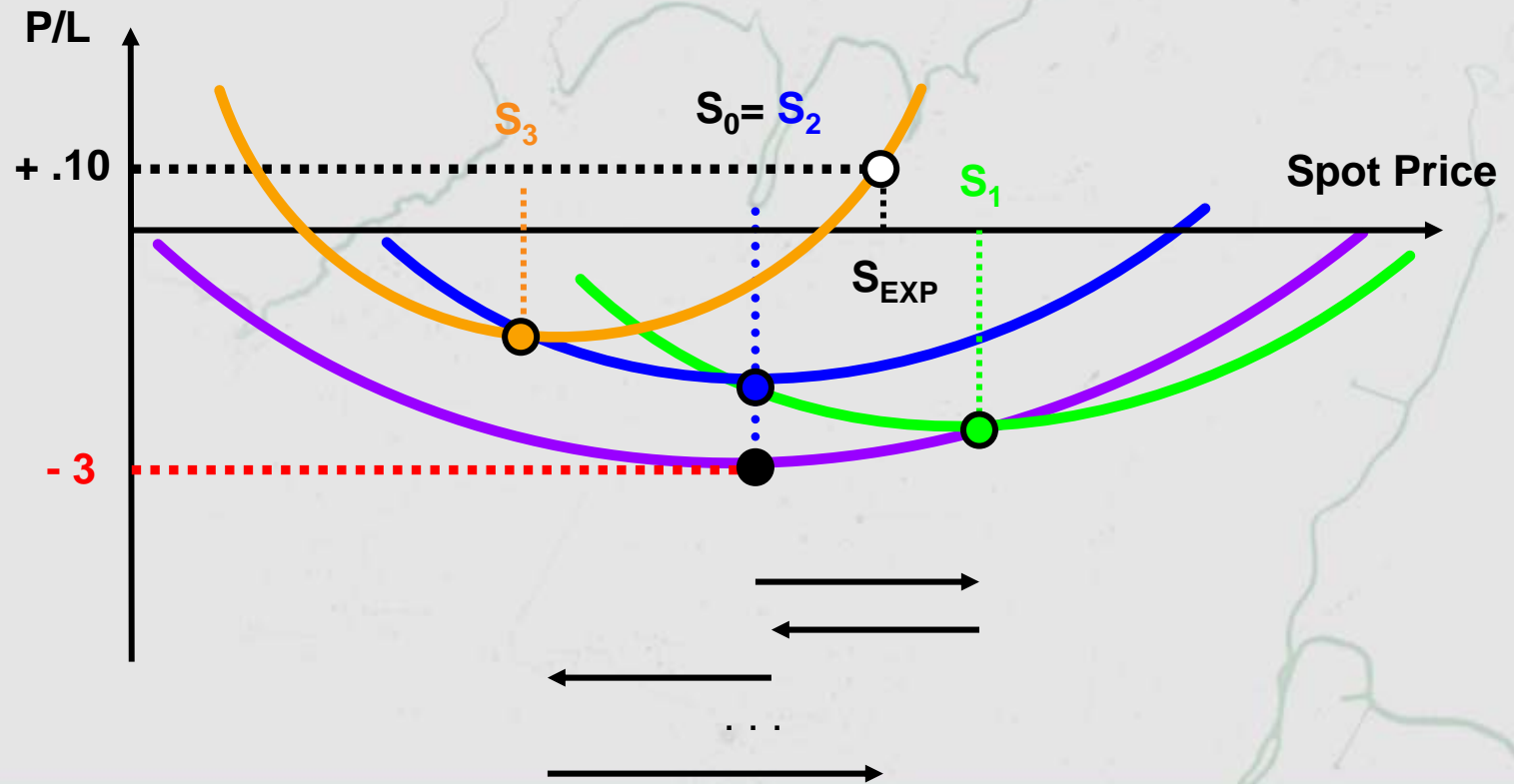
How does he keep from being short?

Buy some Stock back (at the now lower price).

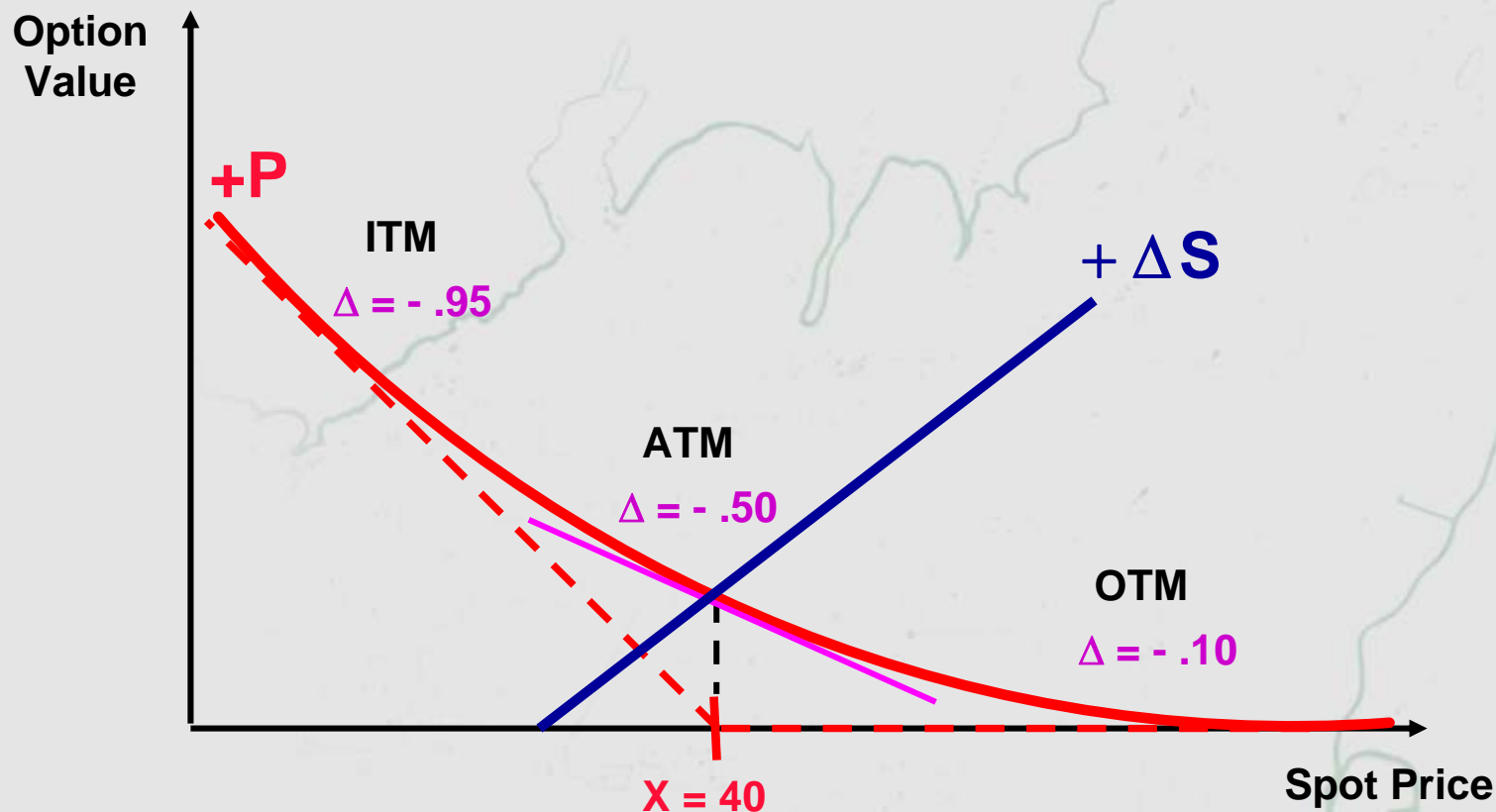


How do option market-makers make money?

If you ask the option market-makers what they do, they will say we trade volatility.



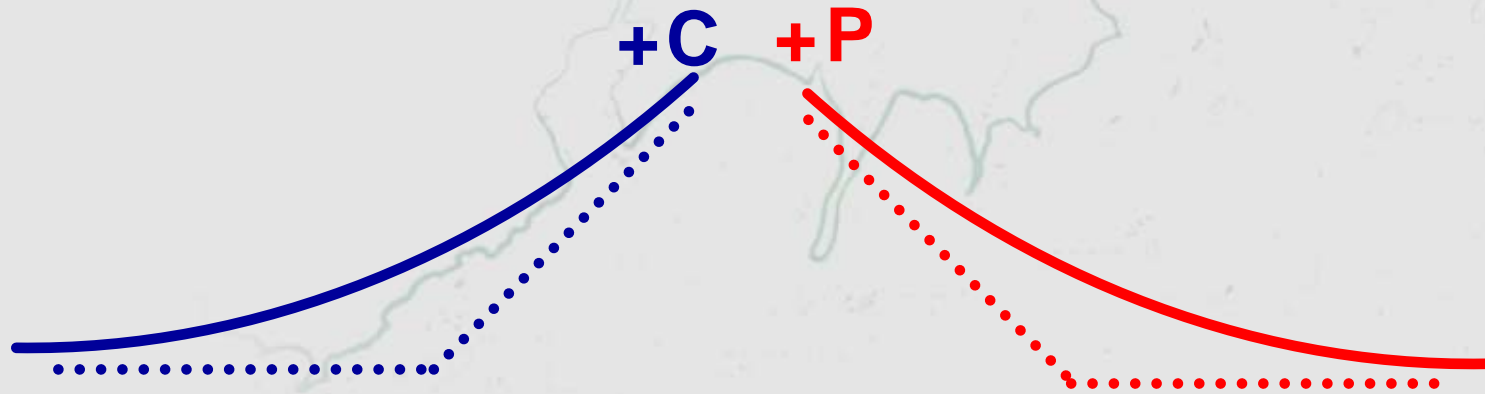
Long Put: long Gamma or short Gamma?



Long Options

Upward Curvature

Long Gamma



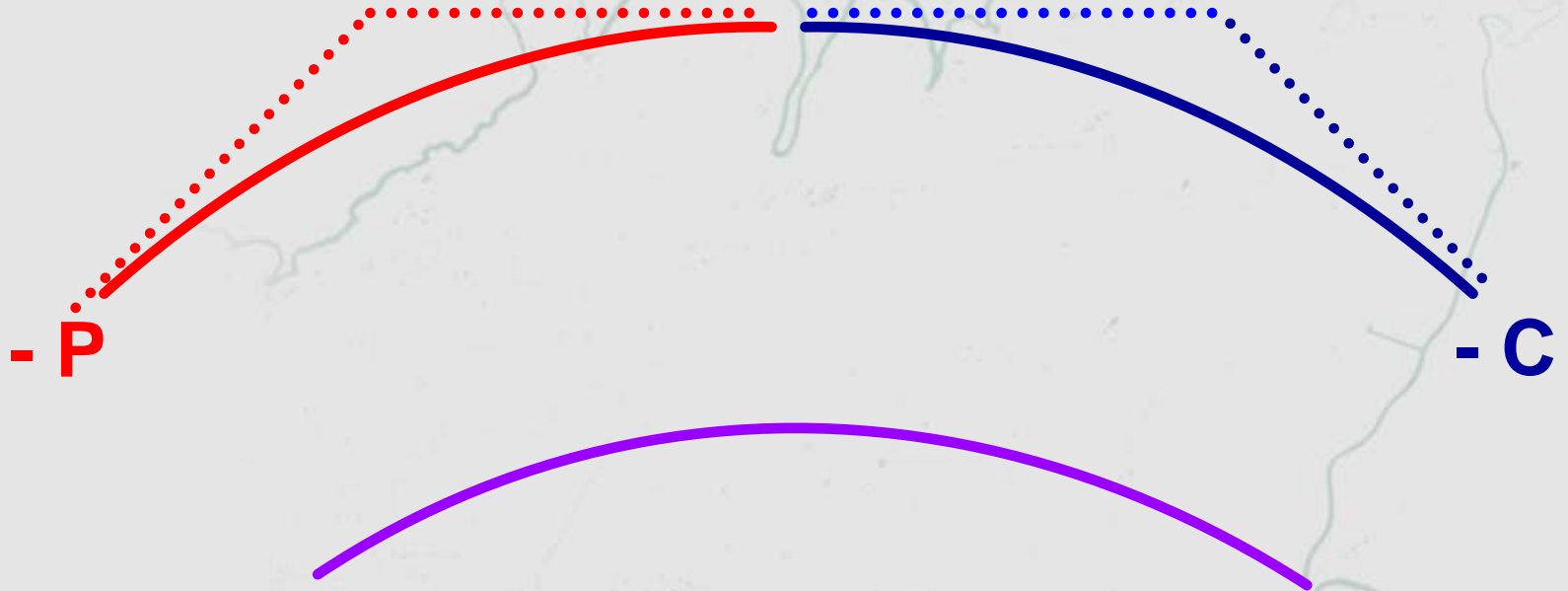
Once the Option is Hedged,



LONG GAMMA if you think the STOCK PRICE will be VOLATILE.

Short Options Downward Curvature Short Gamma

If you are **SHORT OPTIONS**, you are **SHORT GAMMA**.



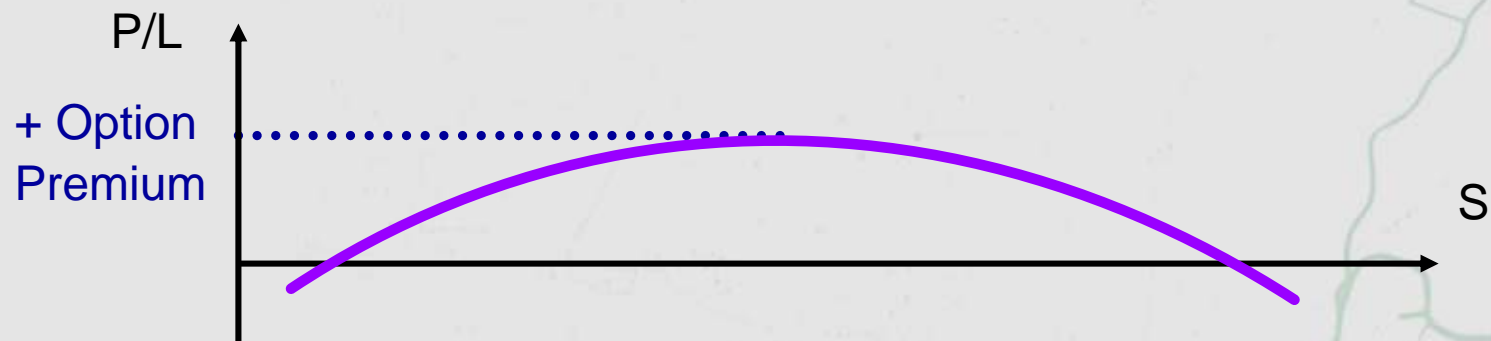
SHORT GAMMA if you think the STOCK PRICE will NOT be VOLATILE.

Gamma

LONG GAMMA = LONG OPTIONS = WANT VOLATILITY.



SHORT GAMMA = SHORT OPTIONS = DO NOT WANT VOLATILITY.



Long Gamma

- Looks too good to be true.
- Don't try this at home!
- “Do not attempt. This was done by a professional driver on a closed track.”
- Not a magic black box.
- No free lunch.

Option Risk Measures

One of the nice features of Option Risk Measures is that they are additive.

At the end of the day,
we have one IBM Delta and one S&P 500 Vega.

$$\mathbf{C}(S, X, r, t, \sigma)$$

$$\Delta(S, X, r, t, \sigma)$$

$$\Gamma(S, X, r, t, \sigma)$$

$$\mathcal{V}(S, X, r, t, \sigma)$$

$$\theta(S, X, r, t, \sigma)$$

$$\rho(S, X, r, t, \sigma)$$

Delta Risk

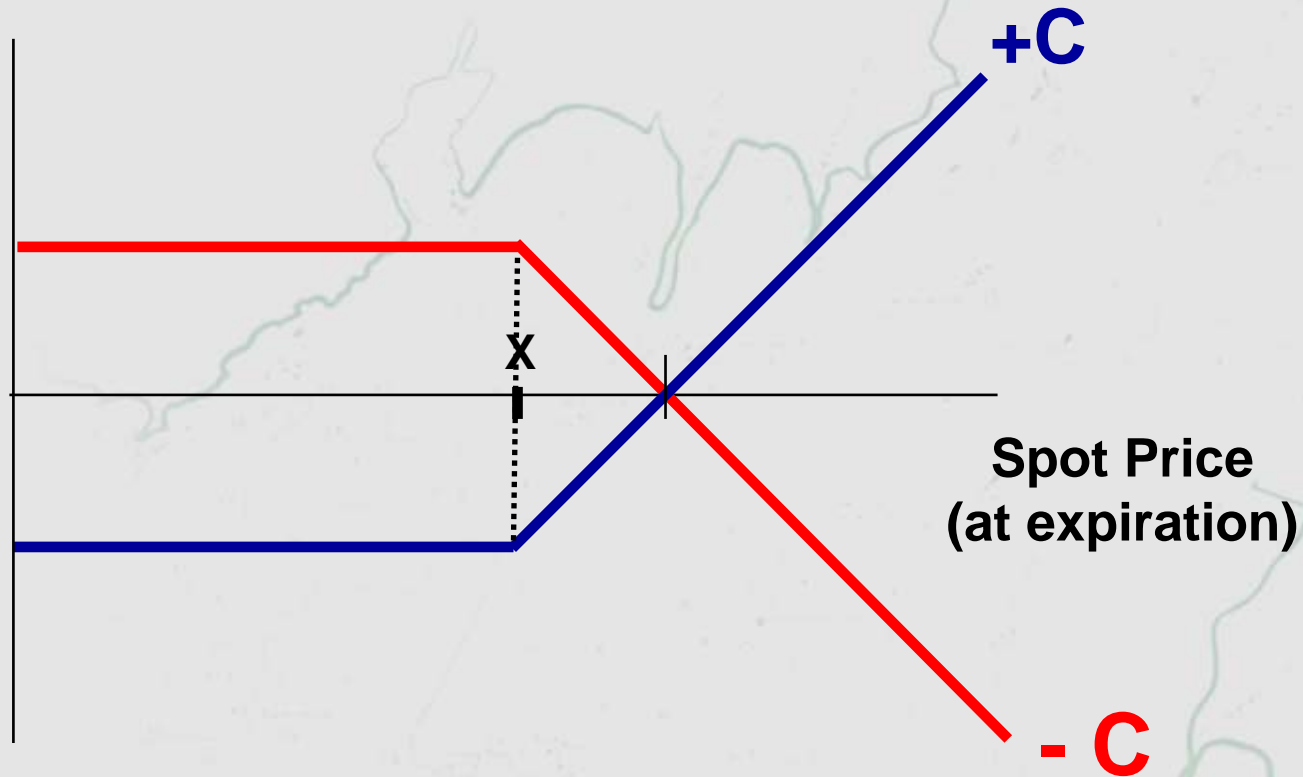
- If you trade the hedge with your option market-making counterparty, that is a risk he/she doesn't need to take.
- Doesn't guarantee better pricing, but it may.
- Tied Trades

Different Strokes

- Options are valued in a strange world (the “risk neutral” world).
- As if you think a stock price will grow over time at the risk free rate of interest.
- Absurd (but true), who would buy a stock that was expected to grow at the risk free rate.
- Don't fear the reaper (or option market-maker)!

Are options zero-sum vehicles?

Can an option market-maker and his counterparty both win? Sure!

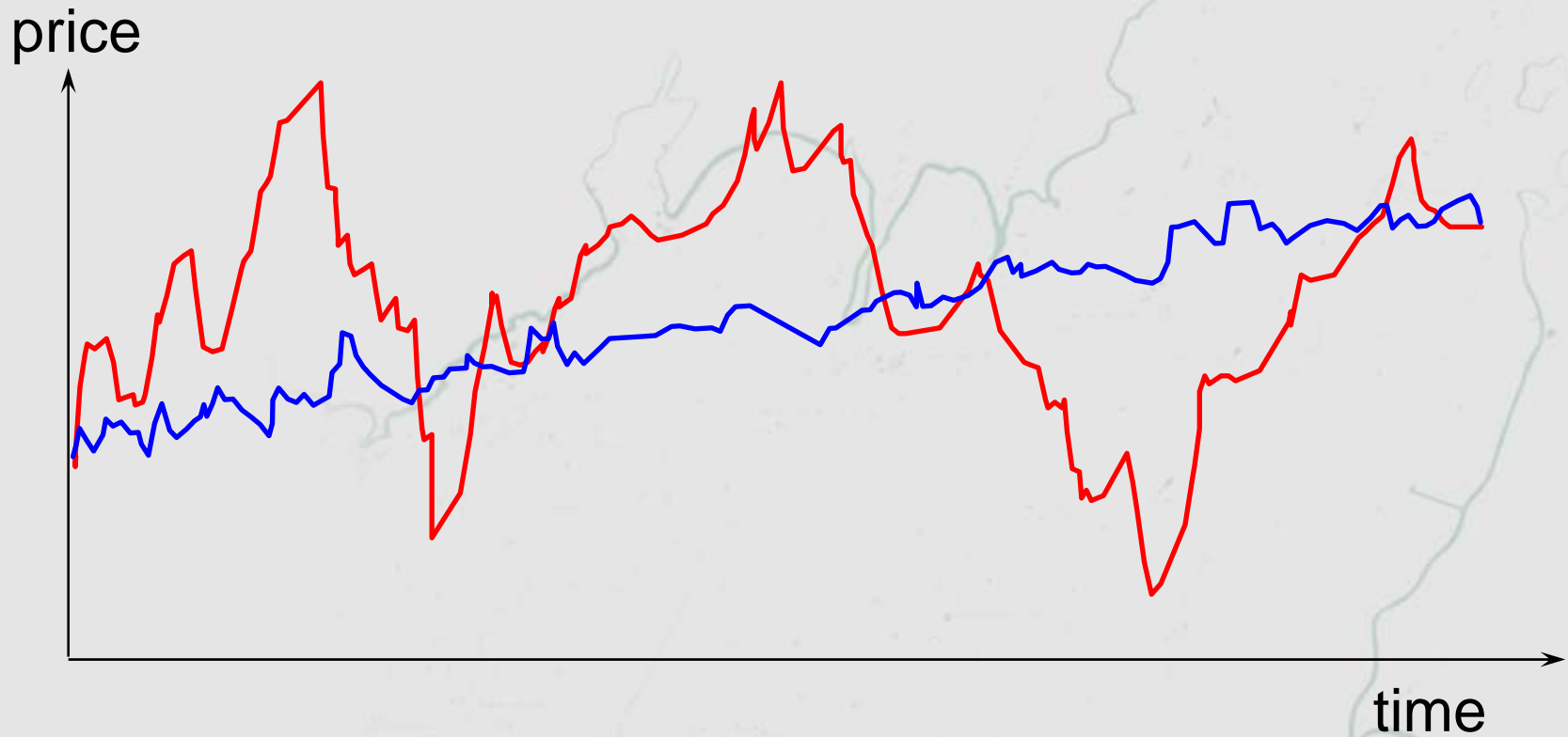


And they could both lose, too!

Volatility

- The formal definition of volatility (for the purpose of option valuation) is the annualized standard deviation of logarithmic price ratios.
- To be precise, option valuation models make assumptions about the returns to an asset (not about prices or rates).
- Returns are generally assumed to be normally distributed; the implication is that prices are assumed to be lognormally distributed.
- What exactly is a “25 vol”?

Paraphrasing Potter Stewart, "... but I know it when I see it."



Intuitively

Consider a stock trading at $S = \$40$

If its volatility is 25%, what does this mean?

This implies that there is a 2/3 chance that this stock will lie between
 $S = 31.15$ and $S = 51.36$
(= $40 \times e^{+(\.25 \times 1)}$) in 1 year.

This implies there is a 95% chance that this stock will lie between
 $S = 24.26$ and $S = 65.95$ in 1 year.

This implies that there is a 2/3 chance that this stock will lie between
 $S = 35.30$ and 45.33 in 3 months ($t = 1/4$).

The “rule”: future S “boundaries” based on $S \times e^{\pm (\sigma \times \text{Sq. Root}(t))}$.

Worth noting, 3-month vol risk is half of 1-year vol risk.

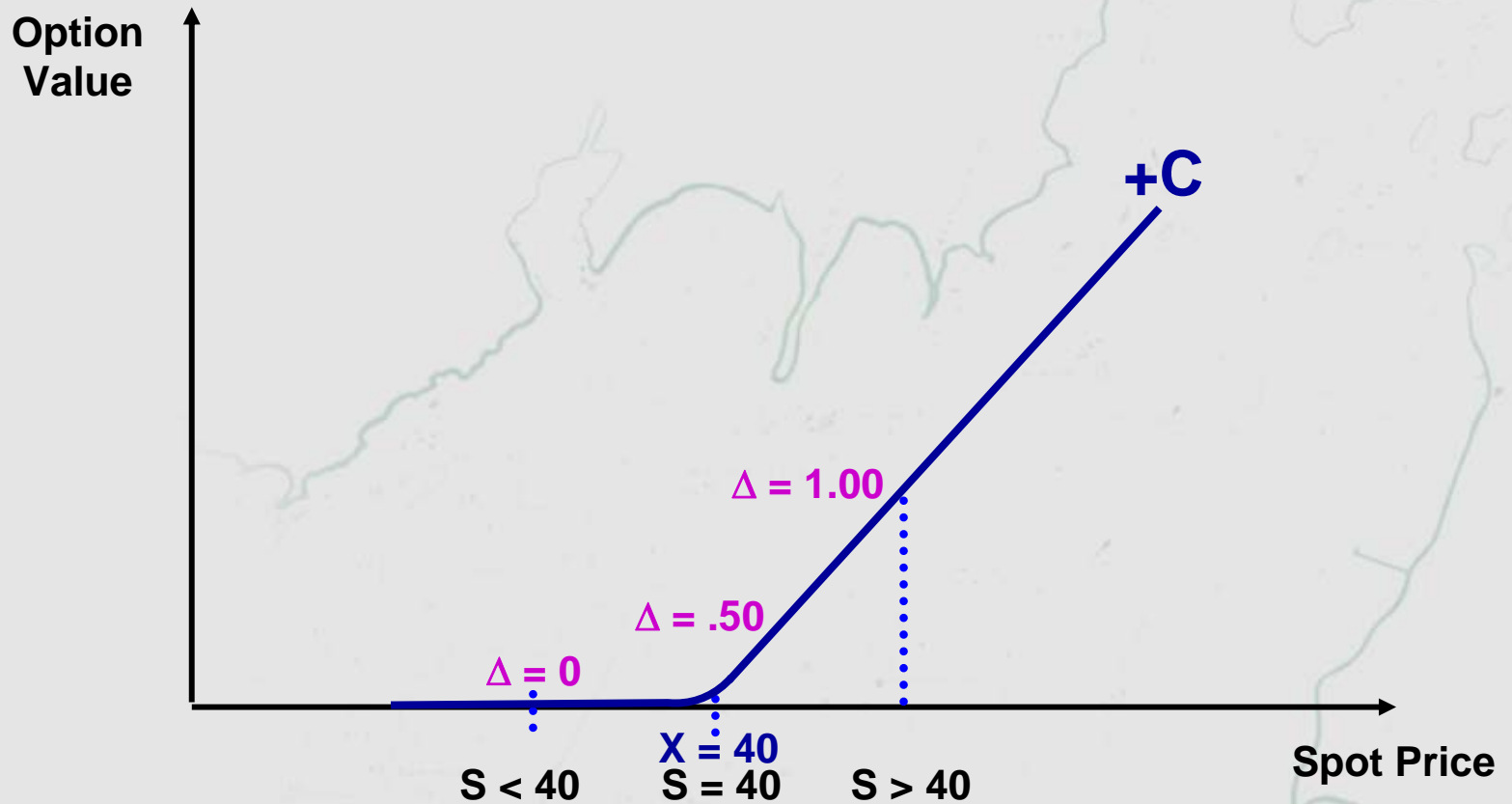
Volatility Risk

- Option market-makers often take on volatility exposures.
- There are many reasons for this.
- There are many ways to handle this risk:
 - Vertical Spreads (Call Spreads, Butterflies)
 - Horizontal Spreads (Calendar/Time Spreads)
 - Trading options in related product areas

Other Risks

- Interest Rate Risk
- Dividend Risk
- Liquidity (in the Underlying Asset) Risk
- Market Gap Risk
- Regulatory, OCC, Legal, . . . Risks
- and more (like Pin Risk).

Graphically just prior to expiration



Pin Risk

- At expiration, seems single stocks tend to trade at/around some strike.
- Given the number of strikes and the difference between strikes, it often makes sense that stock will be trading close to some strike.
- One of the factors that can influence a stock being “pinned” is the open interest (number of listed option contracts outstanding at that moment in time) and proportion that is hedged.
- As we just saw market-makers hedge and re-hedge in an attempt to profit from the movement in the underlying security.
- If the open interest is large, particularly in relationship to the average daily volume of the underlying this hedging and re-hedging can dampen volatility and “pin” the stock price around strike.

Pin Risk: From The Wall Street Journal (2009)

Pinning Down Stock Prices Using Options

BY TENNILLE TRACY

NEW YORK—Shares of **Intuitive Surgical** have a better-than-average chance of closing Friday's session near \$280, according to a recent analysis of the company's options.

Because of a phenomenon known as "pinning," shares of Intuitive Surgical and a handful of other stocks could end Friday's session at predetermined prices, due in part to professional market makers who own large amounts of options at those levels.

In the case of medical-equipment maker Intuitive Surgical, market makers appear to hold positions in November \$280 calls and November \$280 puts, according to an analysis by Société Générale. As a result, they could buy and sell large amounts of the company's stock to hedge those positions, increasing the odds that Intuitive Surgical closes Friday at that price. Intuitive shares ended Thursday at \$278.68, down 95 cents, or 0.3%.

There are several other companies whose stocks could be affected by pinning, according to Société Générale. Among them are **Oshkosh**, whose stock could close near \$40; **Southern Co.**, whose stock could close near

'Pin Risk' for Some Stocks

Because of a phenomenon known as "pinning," a handful of stocks could end Friday's session at predetermined prices.

Company name	Pin price*	Thursday's closing price
Intuitive Surgical	\$280.00	\$278.68
Oshkosh	40.00	39.16
Carter's	22.50	21.84
Aflac	45.00	43.84
Southern Co.	32.00	31.49
Plains Exploration & Production	28.00	27.06
Celgene	55.00	54.55
M&T Bank	65.00	65.33
Research In Motion	60.00	58.84
Deckers Outdoor	100.00	95.49

*The 'pin price' is the one inadvertently caused by market makers' hedging activities.

Source: Société Générale

\$32; and **Plains Exploration & Production**, which could end the session at \$28. **Research In Motion** could close at \$60, and **Celgene** could close at \$55.

Pinning, or "pin risk," has existed for years. But its effect on the stock market has grown as options have become more popular. Pinning refers to situations in which market makers inadvertently push a stock toward a certain price—or "pin" the stock to a certain price—as a result of their hedging activities.

Here's how it works: When market makers buy options, they often hedge themselves using stock. When they buy call options, for example, they sell

stock. And when they buy put options, they buy stock.

When the options are about to expire, as they will on Friday, market makers buy and sell thousands of shares of stock to adjust those hedges. In doing so, they inadvertently push the stock toward the strike price of the options they hold. In other words, they "pin" the stock to a certain price.

There are various reasons why options traders keep track of pin risk. Some try to use the information to make money. Armed with knowledge of where a stock could close on expiration day, they sell "straddles" in a company—selling equal amounts

of both calls and puts—hoping to make money on options that could expire worthless.

Other traders use the information to make more informed decisions about their holdings.

"Everyone who has an options position going into expiration could be impacted by this phenomenon," said Vincent Danre, a quantitative analyst at Société Générale who composes the monthly report on pin risk.

Attempts to determine which stocks could be pinned, however, are far from flawless. When Mr. Danre scans for possible candidates, he doesn't know whether market makers are long or short the at-the-money options, a factor that plays a huge role in determining whether pinning will occur.

What's more, Mr. Danre notes that he can't account for external events—such as quarterly earnings or ratings changes that might affect stock prices on any given day.

Summary

- Room for everyone
- A difference of opinion is what makes markets work.
- Understanding how the other guy thinks can help you in your investing/trading.



Questions