OPTIONS 201 WORKSHOP

Spring '17

QUANTITATIVE
FINANCE
SOCIETY

BRAINTEASER

Let's say that you have 25 horses, and you want to pick the fastest 3 horses out of those 25. In each race, only 5 horses can run at the same time because there are only 5 tracks. What is the minimum number of races required to find the 3 fastest horses without using a stopwatch?

SOLUTION

The answer is 7. Race five horses five times. Eliminate 4th and 5th place horses. Race the fastest of each of the 5 heats. Eliminate horses that are slow. Race one last time to find 2nd and 3rd.

WELCOME!

Options 201

A quick review….from last workshop

EXPECTATIONS

1

INTELLECTUAL HONESTY

Raise your hand if you don't know what's going on – it's okay!

2

TAKE NOTES

I will go over a lot – and it is probably best to write some of the stuff down

3

PARTICIPATION

I will be sprinkling some questions between the slides – don't be afraid to be wrong (:

1

Typos / Misspeak

Please correct me if this happens – I will respect you more for that

2

Purposeful Approximation

Purposefully approximate definitions or teachings for the sake of simplifying tough concepts

3

Less Math / More Intuition

I'm not a math guy, and I know some of you aren't as well. If you are – come talk to me, I can teach you the math too.

THIS WEEK

PUT CALL PARITY

TIME AND VOL PRICING

BLACK SCHOLES

OPTION GREEKS

SKEW

OPTIONS PITCH

Definition of an Option

Option Definition:

An option is a contract which gives the buyer (the owner or holder of the option) the right, but not the obligation, to buy or sell an underlying asset or instrument at a specified strike price on a specified date.

BUY CALL

The right to buy underlying at a specific strike price for a specified time.

BUY PUT

The right to sell underlying at a specific strike price for a specified time.

WRITING (SELL OPTION)

You are selling the right to someone – which means you MUST take obligation. You can sell both a put and call.

USE OF AN OPTION

There are many reasons to buy an option instead of stock.

REASON 1

PROTECTION AND HEDGING

Used to protect downside (think of payoff)

REASON 2

LEVERAGE

Cheaper to buy calls/puts than stock

REASON 3

Volatility

More on this later (quant guys use options for vol)

MONEYNESS

Out of the Money

Out of the money (OTM) is term used to describe a call option with a strike price that is higher than the market price of the underlying asset, or a put option with a strike price that is lower than the market price of the underlying asset.

At the money

At the money (ATM) is a situation where an option's strike price is identical to the price of the underlying security. Both call and put options are simultaneously at the **money**. For example, if XYZ stock is trading at 75, then the XYZ 75 call option is at the money and so is the XYZ 75 put option.

In the money

In the money (ITM) is term used to describe a call option with a strike price that is lower than the market price of the underlying asset, or a put option with a strike price that is higher than the market price of the underlying asset.

Intrinsic Value: How much ITM the option is

Extrinsic Value: The rest of option’s value is attributed to extrinsic value (time value)

Value of an Option

There is something called the Black-Scholes options pricing model, but let’s divide the value in a simpler manner: intrinsic and extrinsic.

6 OPTIONS STRATEGIES

VARIETY OF EXPRESSIONS

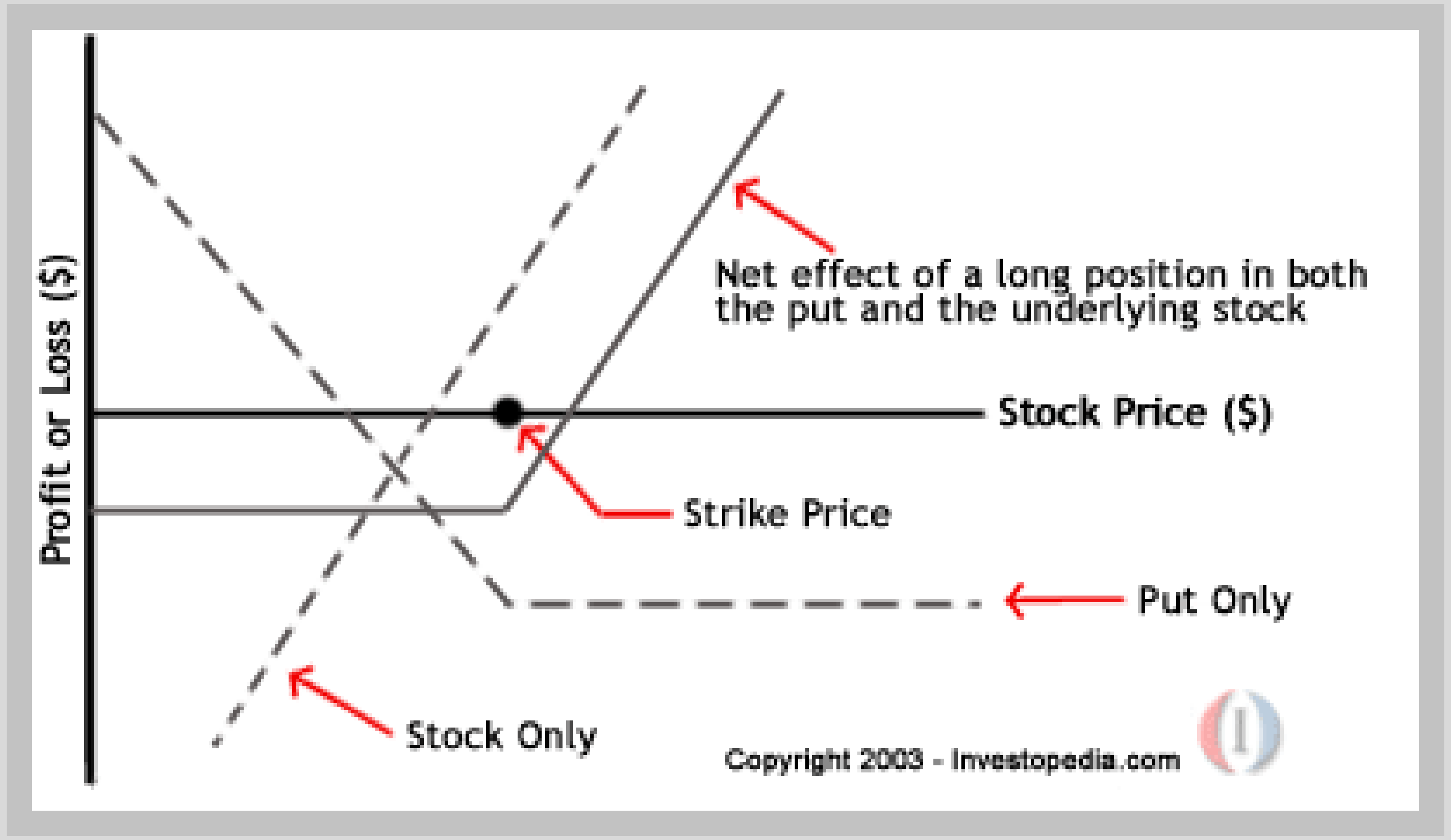
Different strategies allow to customize trade expression to cater any investors needs

WHAT RISKS DO YOU WANT?

Some strategies are riskier. We will go into risk sensitivities next lecture (1^{st} Derivative and 2^{nd} Derivative Greeks).

LETS DO THIS!

MARRIED PUT: BUY PUT AND BUY STOCK



Interestingly, when you buy a put and buy stock, the net effect of the options positions leads to the same payoff as buying a call.

PUT / CALL RELATIONSHIP

There is a relationship bounded by arbitrage called Put-Call Parity

STEP 1

Consider Call & Put w/ same:
Underlying Stock, S
Same exercise price, K
Same maturity date, T
Same Style (both European)

STEP 2

SCENARIO A:
Long Call & Lend at PV(K)
(I.E. Buy a T-Bill with Facevalue of K, Maturity at T)

STEP 3

SCENARIO B:
Long Put Option and Long 1 Share of Stock

STEP 4

If Call is ITM:
The Payoff is S
If Put is ITM:
The Payoff is K

STEP 5

Therefore,
P = C + PV(K) - S

AMERICAN EXERCISE

CALL NO DIVS

Call = [S – K] + [K – PV OF K] + INS
Would you exercise? What do you gain / lose

CALL WITH DIVS

Call = [S – K] + [K – PV OF K] – PV OF D + INS
Would you exercise? What do you gain / lose

PUT NO DIVS

Put = [K – S] + [PV OF K – K] + INS
Would you exercise? What do you gain / lose

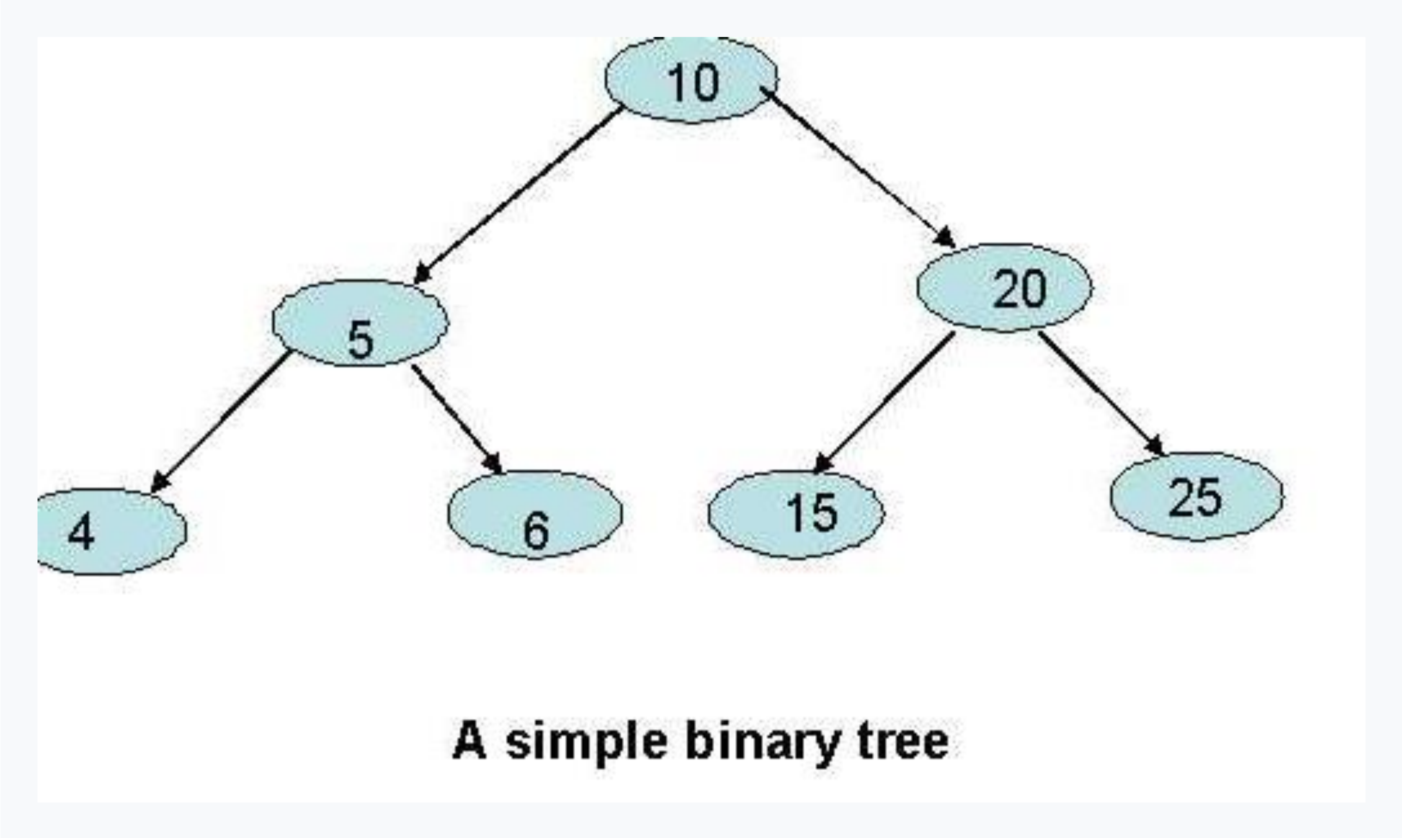
PUT WITH DIVS

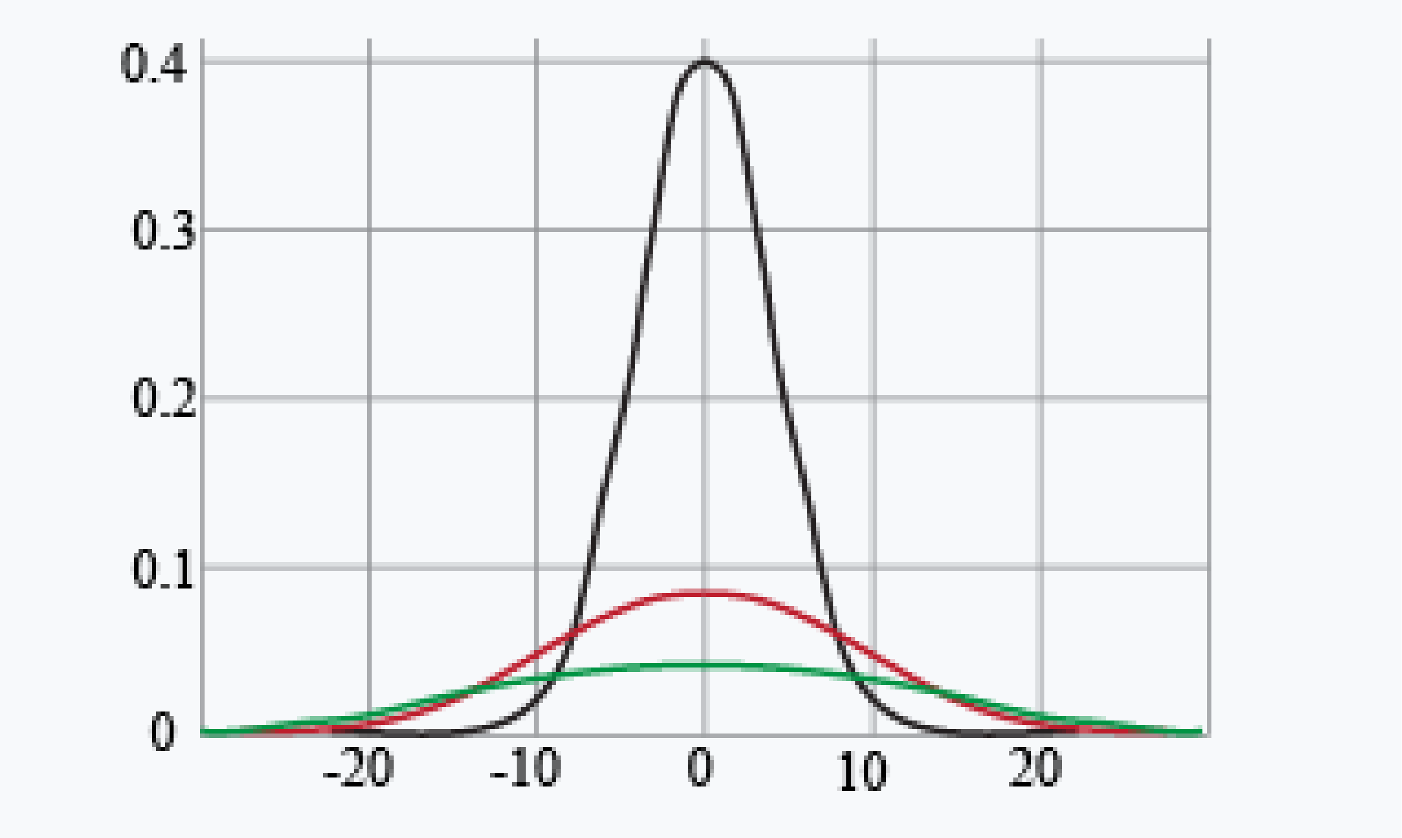
Put = [K – S] + [PV OF K – K] + PV OF D + INS
Would you exercise? What do you gain / lose

CONCLUSION

Early exercise is dependent on change in interest rates (time value) & change in dividends.

TIME & VOL EFFECTS





INCREASE DAYS TO EXPIRY

Increasing days aka Increasing greater "states"

Is greater time good for longing a put / call?

INCREASE VOLATILITY

Volatility defined as standard deviation of returns of the underlying asset.

Is greater volatility good for longing a put / call?

BLACK SCHOLES MODEL

MARK TO MARKET CHANGES

We know the options payoff at expiry, but how does the option change over time?

If underlying goes up one unit, does the option price go up one unit? Nope, not that easy.

Need a pricing model to model day-to-day sensitivities.

BLACK SCHOLES

There are five inputs to the B-S Model

Stock Price
Part of Intrinsic Value

Strike Price
Part of Intrinsic Value

Time
More Time = More Extrinsic Value

Interest Rates
More IR = Affects Puts and Calls differently

Implied Volatility
Volatility is good. But what does implied mean?

ASSUMPTIONS OF B-S

LogNormal Prices / Normal Returns

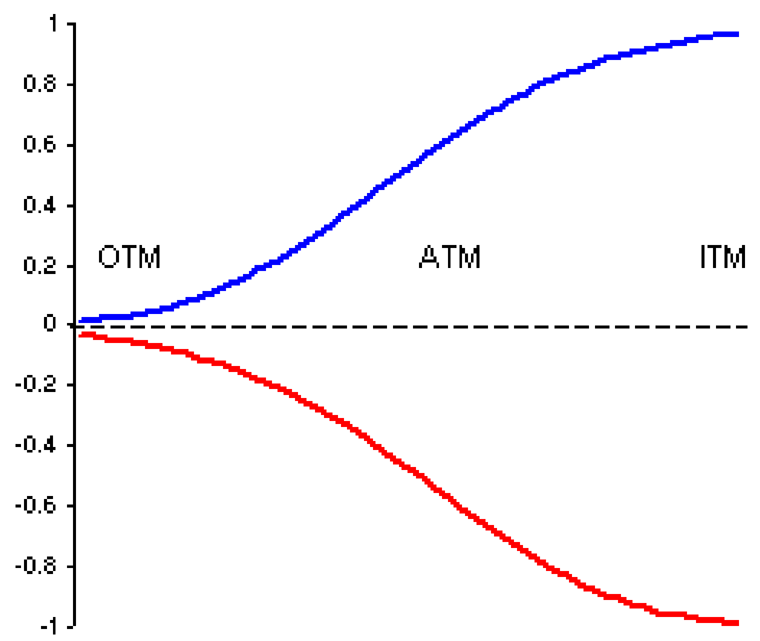
Perfectly Liquid Markets

Constant Volatility

Why are these bad assumptions that the model makes?

Like any model, the Black-Scholes is not perfect…..

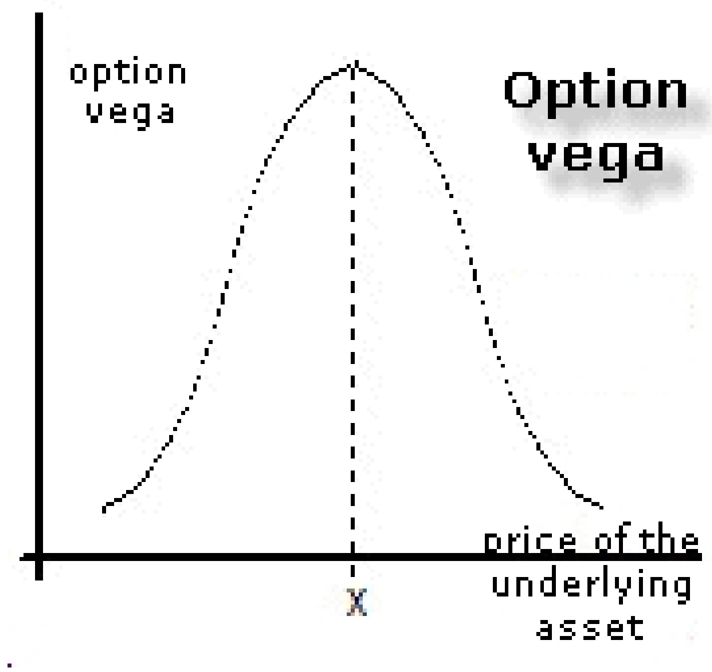
More on this discussion, when Skew is explained.



Gamma

$$\frac{\Delta Delta}{\Delta S}$$

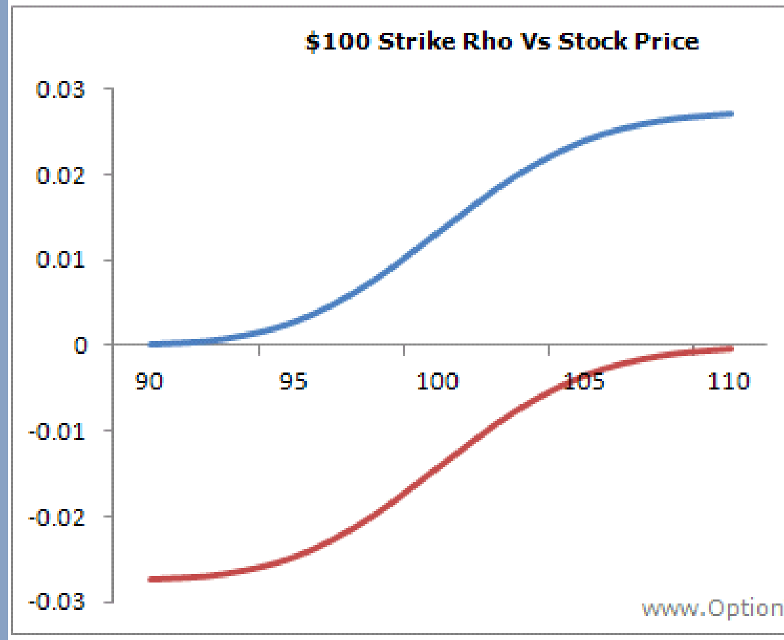
Derivative of Delta



Theta

$$\frac{\Delta V}{\Delta T}$$

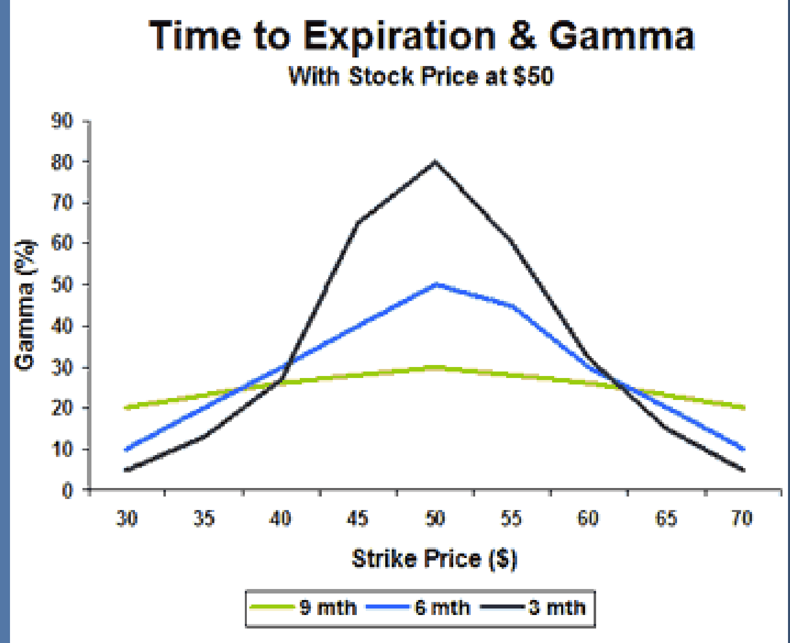
where V = Value of Option
and where
T = Time (in days)



Delta

$$\frac{\Delta V}{\Delta S}$$

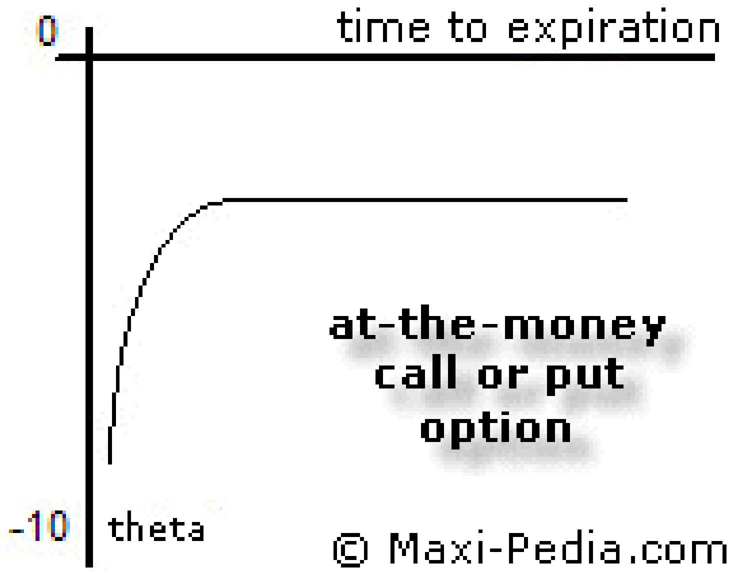
where V
and where
S = Spot Price



Vega

$$\frac{\Delta V}{\Delta \sigma}$$

where V
and where σ =
Implied Volatility



Rho

$$\frac{\Delta V}{\Delta R}$$

where V
and where
R = Interest Rate

2^{nd} Derivative Vol Exposures

There are also two more important Greeks:

$$Volga = \frac{\delta Vega}{\delta Vol}$$

$$Vanna = \frac{\delta Vega}{\delta Spot}$$

Won't go into it – feel free to ask me about them after / how to trade these exposures

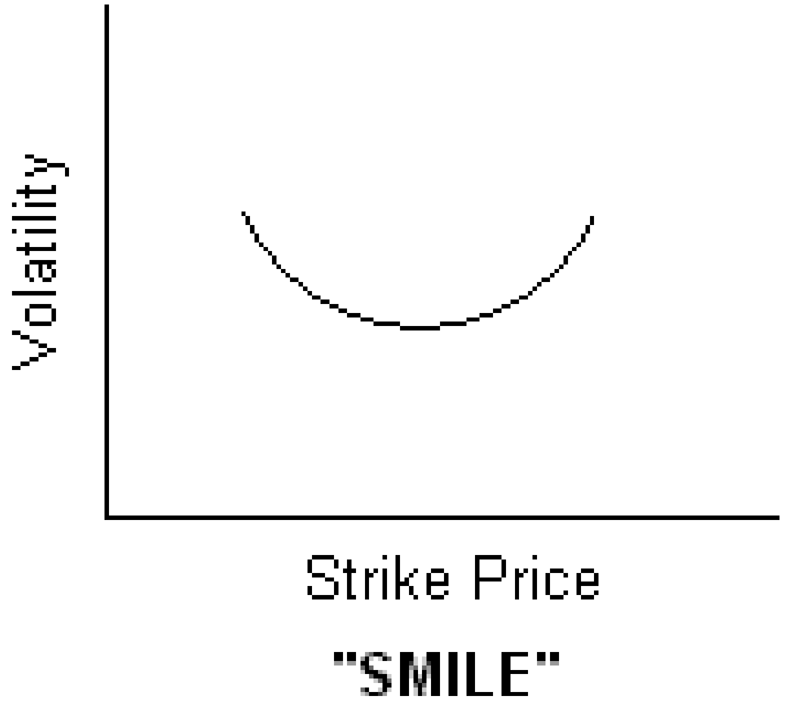
OPTION SMILE / SKEW

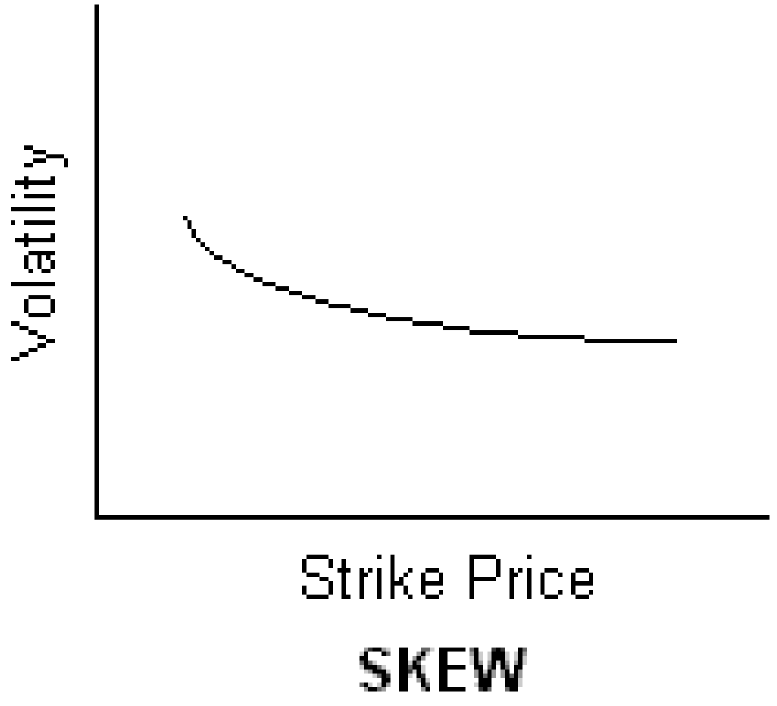
Implied Vol vs. Strike Price / Moneyness

Black Scholes assumes no skew across strike prices…why is this wrong?

OPTION SKEW

What does it mean?



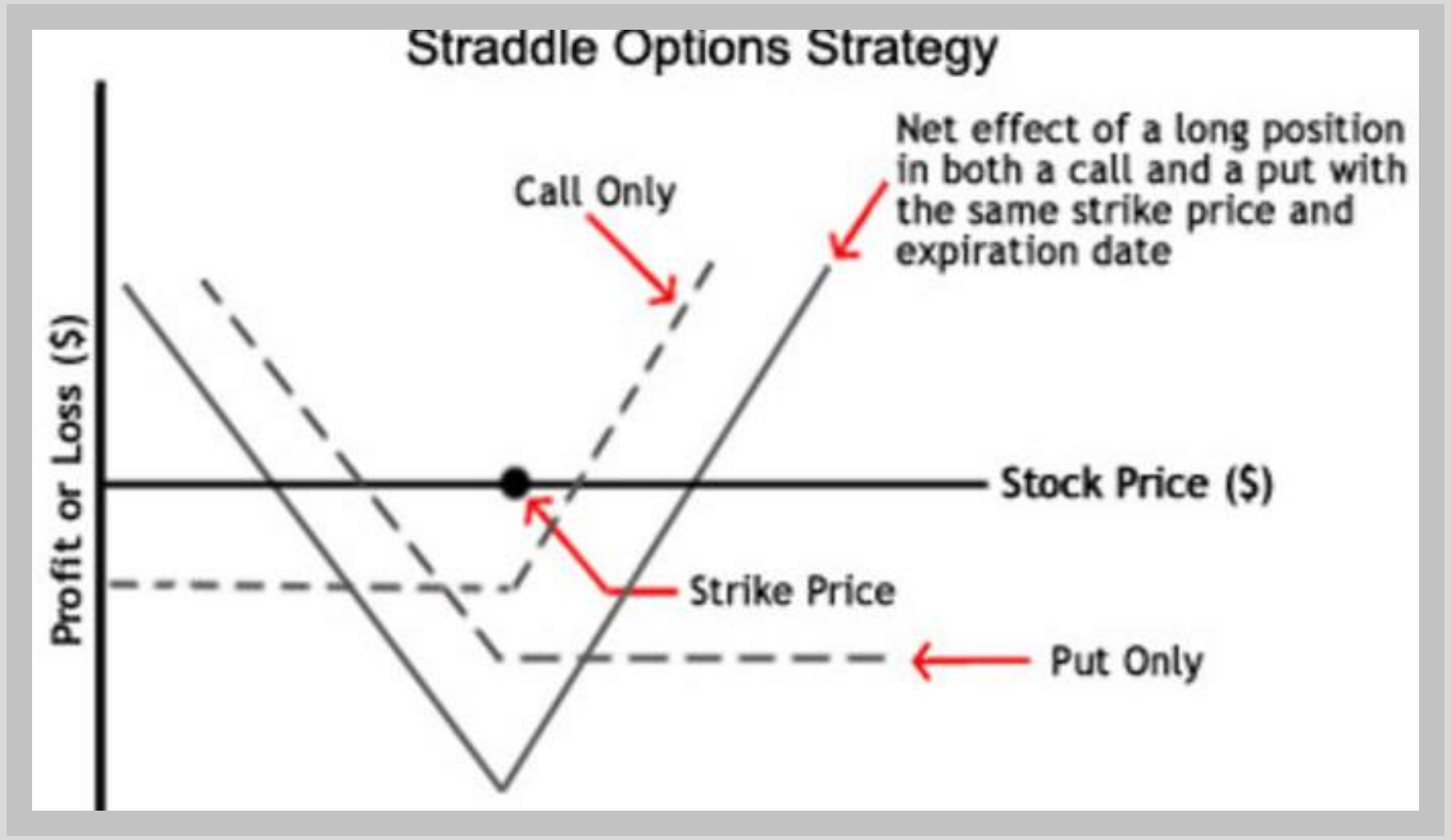


1. **Black-Scholes Failure**
   Normally Distribution of Returns not True
2. **Define IV as Function of Price**
   Just means OTM Puts and Calls are relatively more expensive
3. **Put Skew Persists in some Markets**
   Why are puts generally more expensive than calls?
4. **Spot-Vol Correlation**
   Market makes assumptions about volatility behavior

OPTIONS PITCH…

Who remembers Straddles from last workshop?

STRADDLE



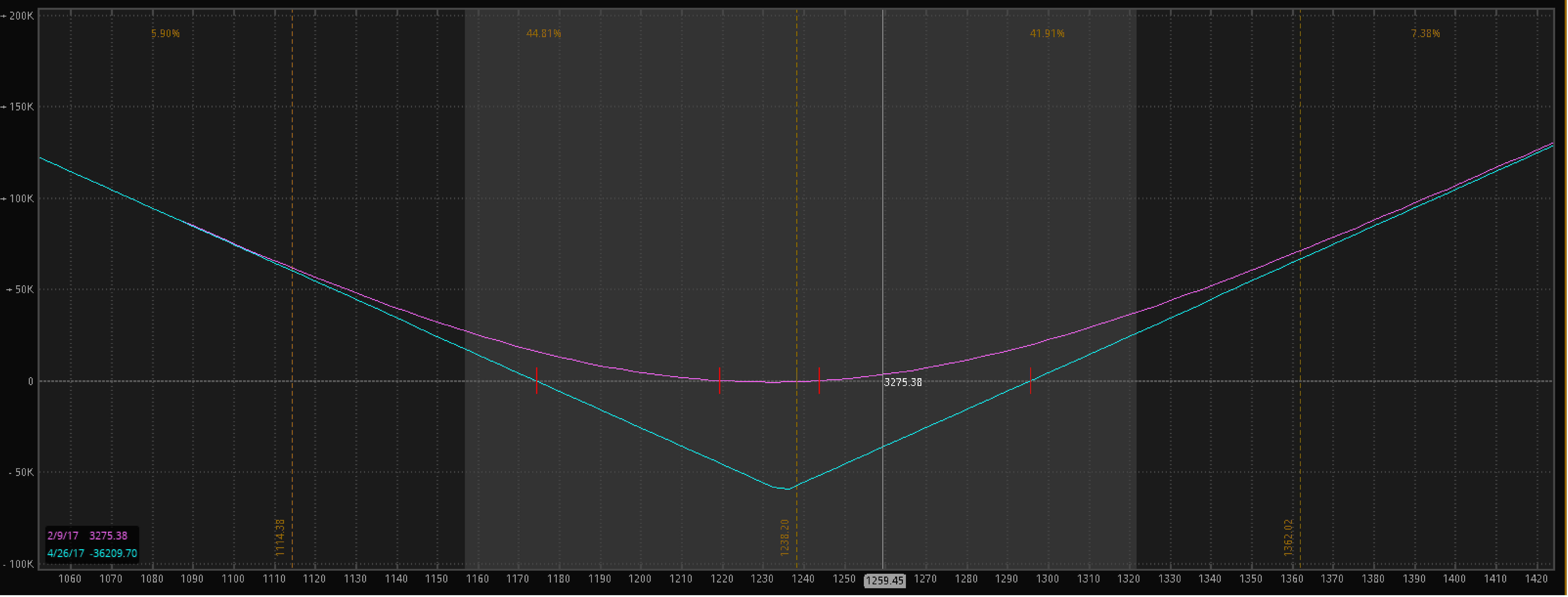
Buy ATM Call and ATM Put = Straddle

What is Delta Position? +,0,or -

Gamma? +, 0, or –

Vega? +,0, or –

Theta? +,0, or –



Cost $60 for the option:

Need Gold to go up 60 or down 60 (4.85%) in 70 days.

Directionally Agnostic…but only at initiation because of Gamma

DELTA CHANGES

GAMMA IS POSITIVE

Positive Gamma because bought both calls and puts

As a result, Delta changes as spot moves…

AS PRICES GOES UP

Call Delta increases from .5 to a higher level to >.5

Put Delta increases from -.5 to a higher level to >-.5

Net Delta = Positive Delta (now you have long exposure)

AS PRICES GOES DOWN

Call Delta decreases from .5 to a lower level to <.5

Put Delta decreases from -.5 to a lower level to <-.5

Net Delta = Negative Delta (now you have long exposure)

GAMMA SCALPING

HEDGE DELTAS

Gamma Scalping is the idea of hedging your deltas so that you are directionally agnostic at all points in time.

Instantaneous hedging = costly and hard to do…so hedging is also an art.

HEDGE WITH STOCK

As prices go up, Deltas go up, so hedge the Deltas by shorting the stock (negative deltas). As prices go down, Deltas go down, so hedge the Deltas by buying the stock (positive deltas)

CONSTANT ADJUSTMENTS

As a result, you are buying stock as underlying moves down and selling stock as underlying moves up. Gamma Scalping always buys at lows and sells at highs.

SCALPING – FREE MONEY?

GAMMA

Gamma is always good. As you are correct you accelerate your gains from the convexity and as you are incorrect you decelerate your losses.

FREE MONEY?

Nope. You are paying with Theta (time). You want to look at Gamma/Theta to see risk rewards. As IV is low, Gamma/Theta looks more attractive.

HOW TO LOSE

Burn more theta than you gain Gamma. Theta by definition is the amount of gamma you expect to scalp.

$$\frac{Gamma}{Theta}\,daily\ breakeven = IV/\sqrt{252}$$

GOLD STRADDLE (GAMMA SCALPING) THESIS: I think Gold Volatility is cheap given various macro risks that could drive investors to flight to safety. Since Gold is a Risk Off asset, period of Risk Off could drive Gold Higher (Trump, China, General EM Risks, Populism in EU, Brexit Implications). On the flipside, Trump leading to market euphoria can also drive Gold significantly lower. As a result, uncertainty over markets should drive Gold Vol higher. All I need to breakeven when Gamma Scalping = $\frac{13\%}{\sqrt{252}}$ = .82% daily move in Gold. Delta neutral, Long Gamma, Long Vega, Short Theta.