Quantitative trading strategies:

Simplest form of trading:

→ Buy low sell high

Why it might not work always?

1) Stock may go down
2) Stock may not go up or not go down.

What are the prerequisites for it to work.

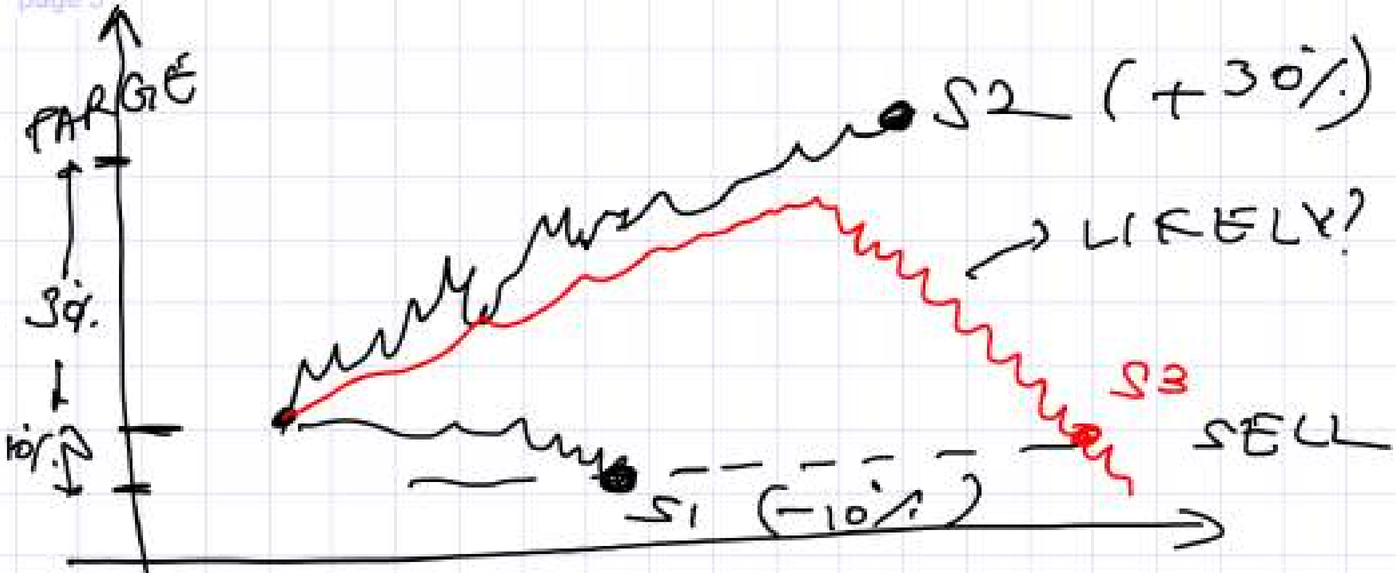
You may win —— ①
You may loose —— ②
You may waste time —— ③

① → happens then what
→ How far it will go up
→ Is it right time to sell
→ What if market suddenly goes down

② You ~~…~~ loose
→ Stop loss
→

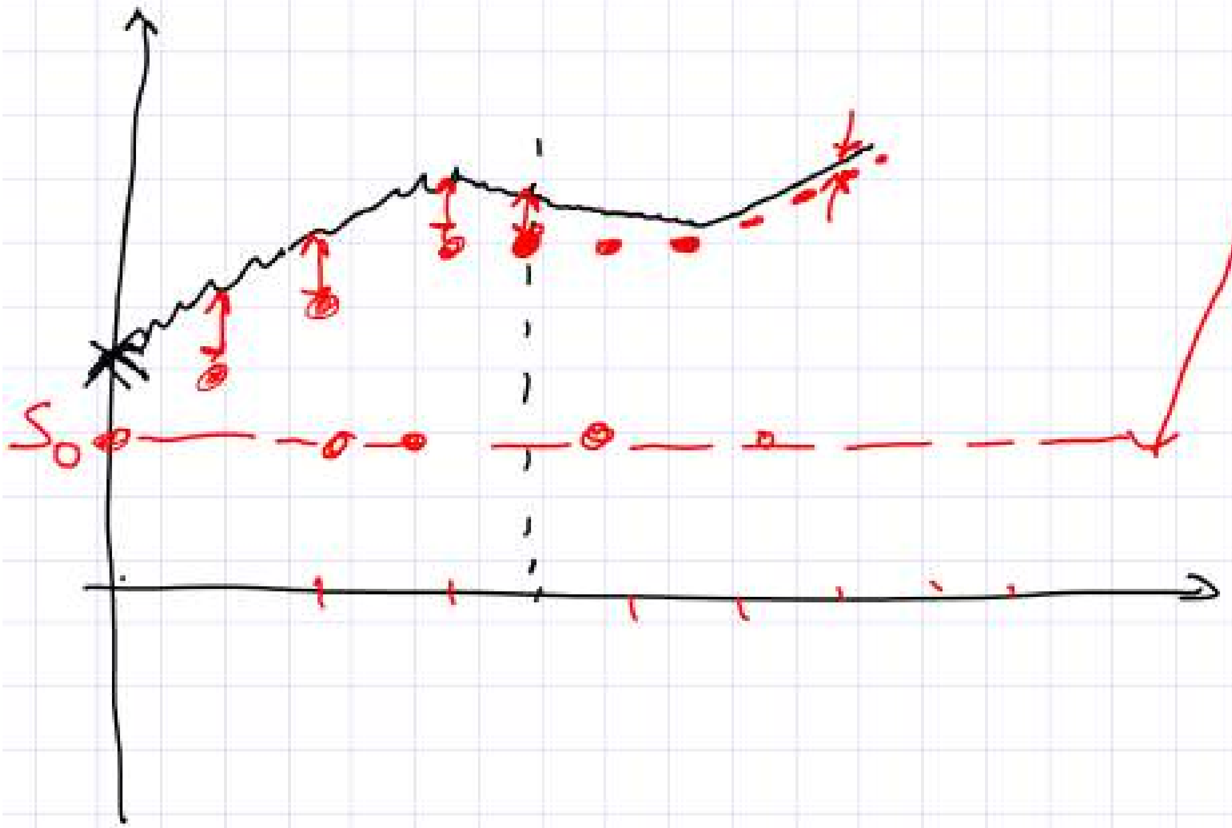
③ Time stop loss

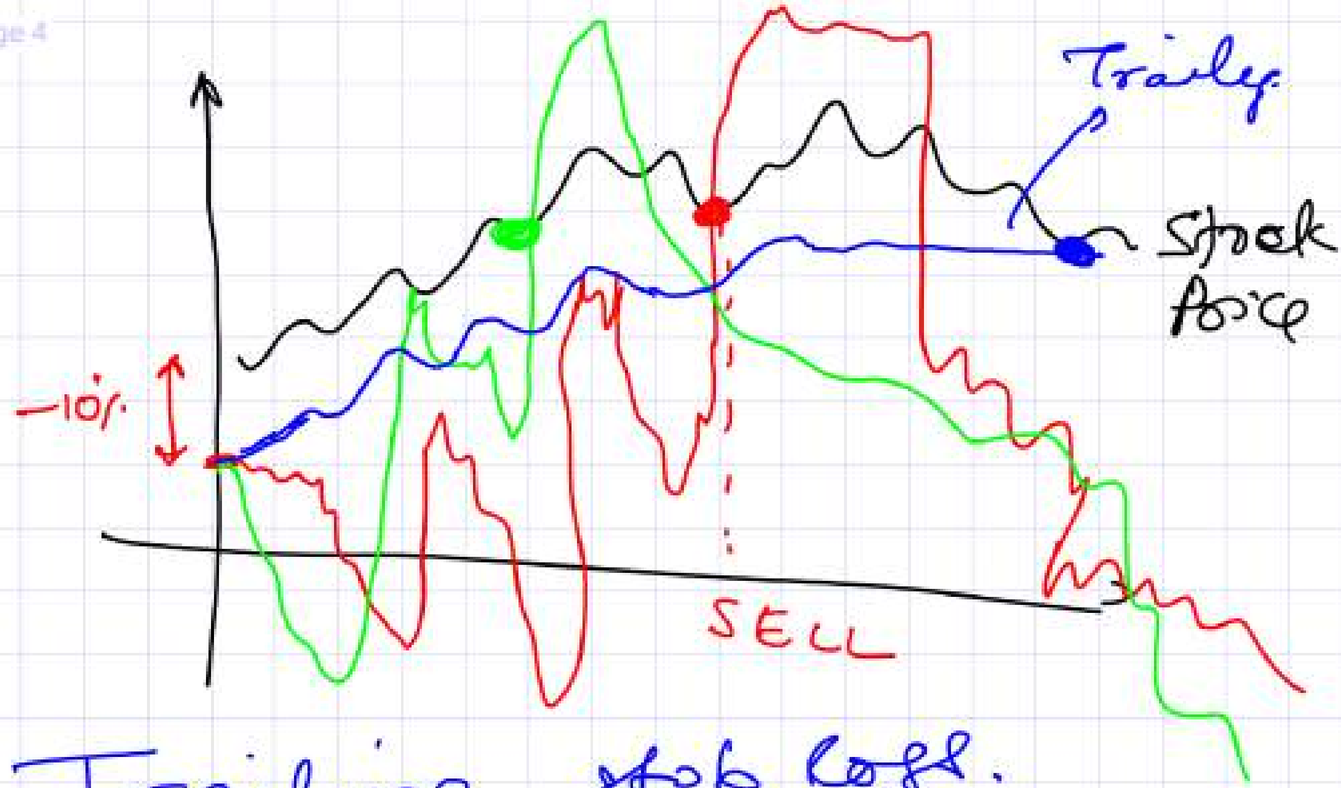
1) Stock will go up.
2) Stop loss.
3) Target



Trailing stop loss S_0

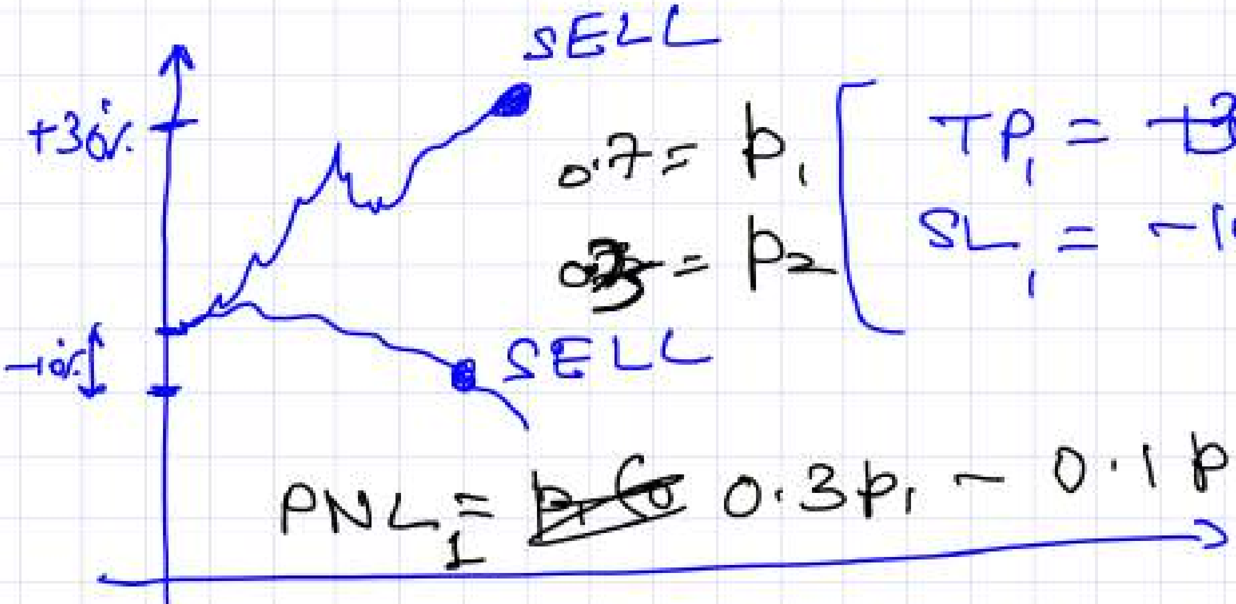
$\underbrace{S(B(t))}$





Trailing stop loss.

$$SL(t_0) = p_1$$



$0.7 = p_1$

$\cancel{0.3} = p_2$

$TP_1 = +30\%$

$SL_1 = -10\%$

$PNL_1 = 0.3p_1 - 0.1p_2$

$p_1 + p_2 = p_1' + p_2' = 1$

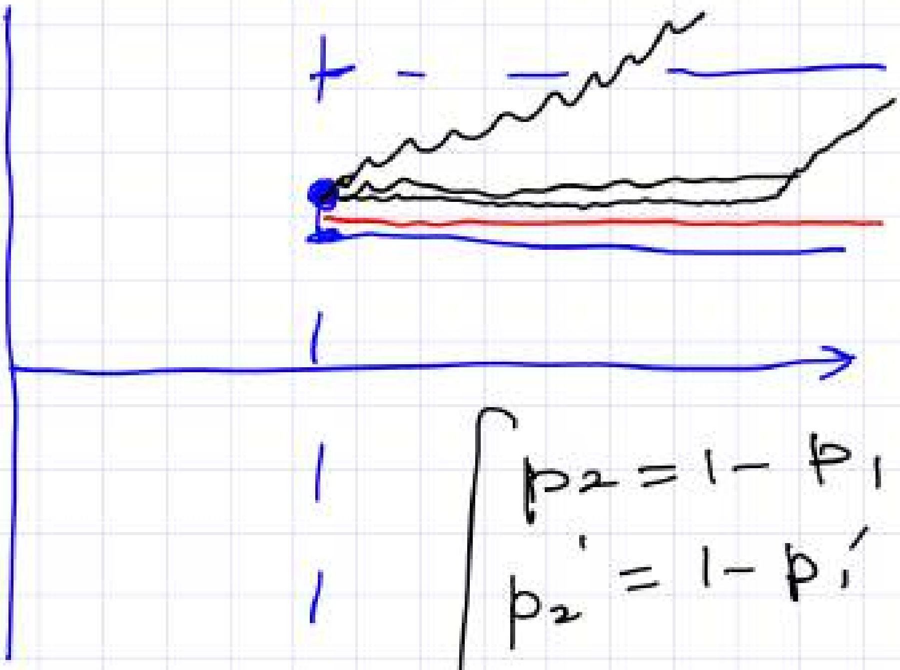
p_1'

p_2'

$TP_2 = 30\%$

$SL_2 = -5\%$

$PNL_2 = 0.3p_1' - 0.05p_2'$



$p_2 = 1 - p_1$

$p_2' = 1 - p_1'$

Unless

$\cancel{p_2' > 2p_1}$

$0.3p_1 - 0.1p_2 < 0.3p_1' - 0.05p_2'$

$$0.3p_1 - 0.1(1-p_1) < 0.3p_1' - 0.05(1-p_1')$$

$$0.4p_1 - 0.1 < 0.25p_1' - 0.05$$

$$0.4p_1 < 0.25p_1' + 0.05$$

$$0.4(1-p_2) < 0.25(1-p_2') + 0.05$$

$$0.4 - 0.4p_2 < 0.25 + 0.05 - 0.25p_2'$$

$$\overset{0.1}{\cancel{0.4}} - 0.4p_2 < \cancel{0.3} - 0.25p_2'$$

$$0.1 + 0.25p_2' < 0.4p_2$$

$$0.25p_2' < 0.4p_2 - 0.1$$

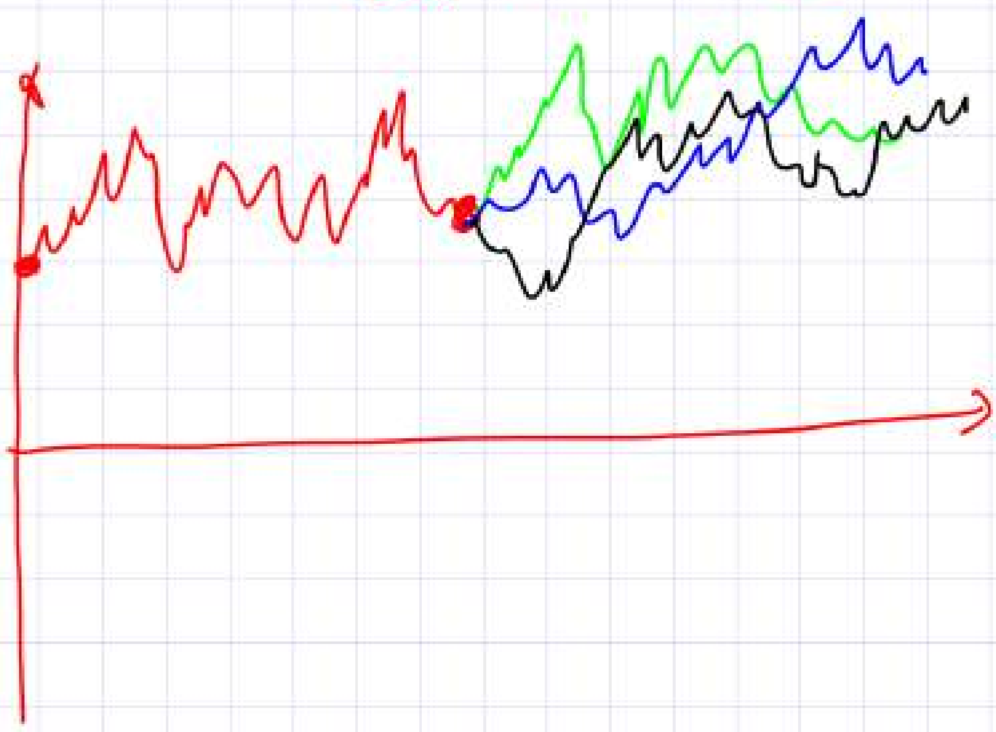
$$p_2' < 4(0.4p_2 - 0.1)$$

$$\boxed{p_2' < 1.6p_2 - 0.4}$$

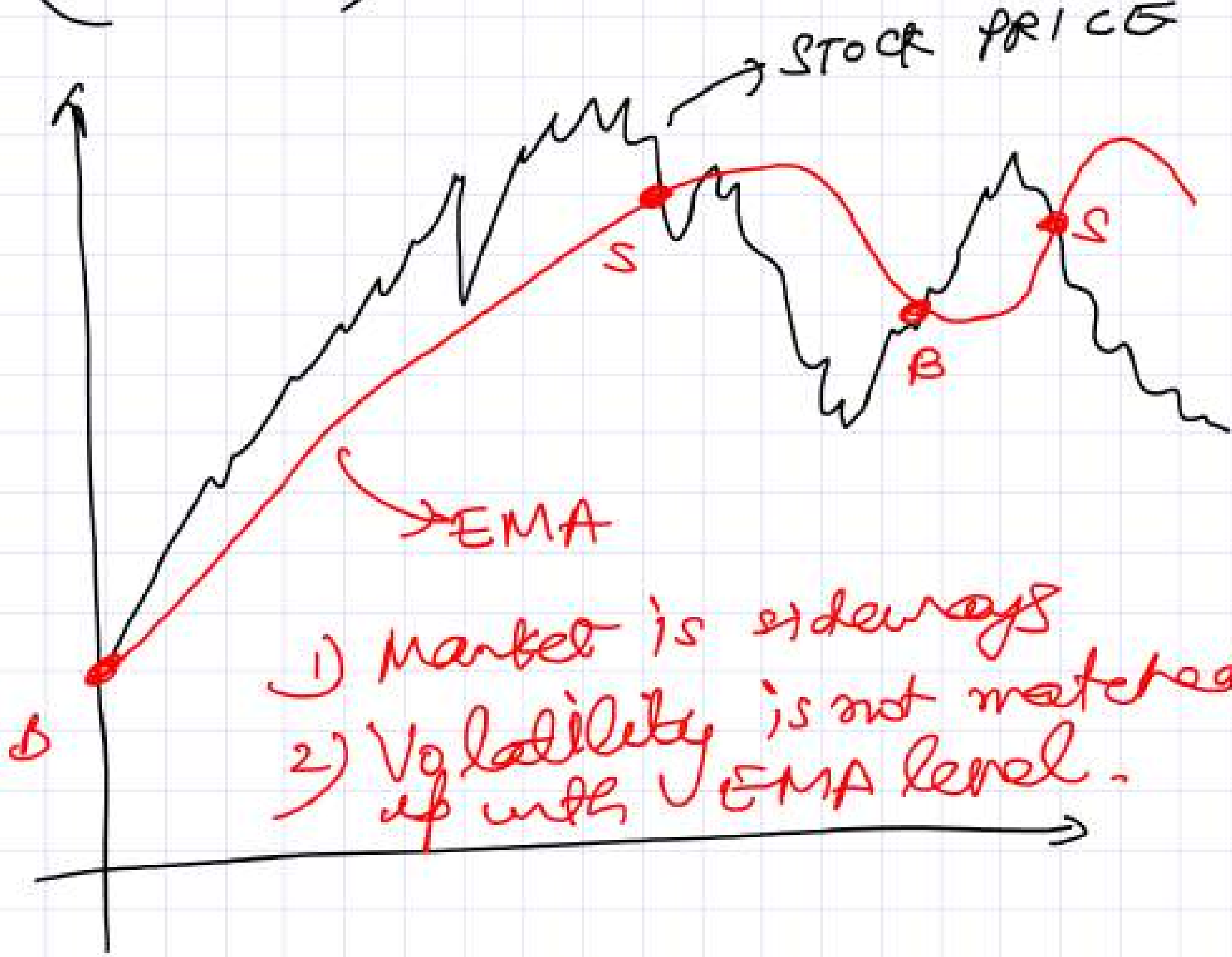
VOL $\uparrow$ $\qquad$ $p_2, p_2' \uparrow$

$$\boxed{p_2' >> p_2}$$

Calculating p_1, p_2, p_1', p_2'
difficult

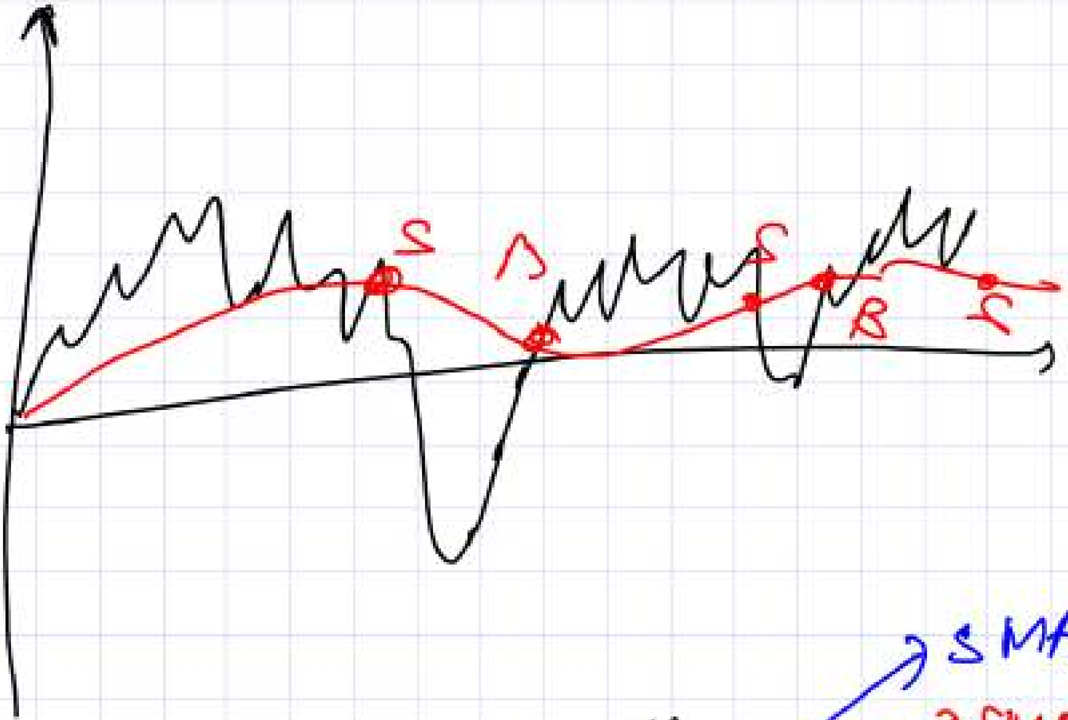


(EMA) (SMA)



1) Market is sideways
2) Volatility is not matched up with EMA level.

RSI



There are Technical analysis books where we can find these strategies

General book :

1. Technical analysis of Financial markets.

    — John Murphy

2. Encyclopedia of chart patterns

    — Bulkowski

Bollinger band
RSI
MACD

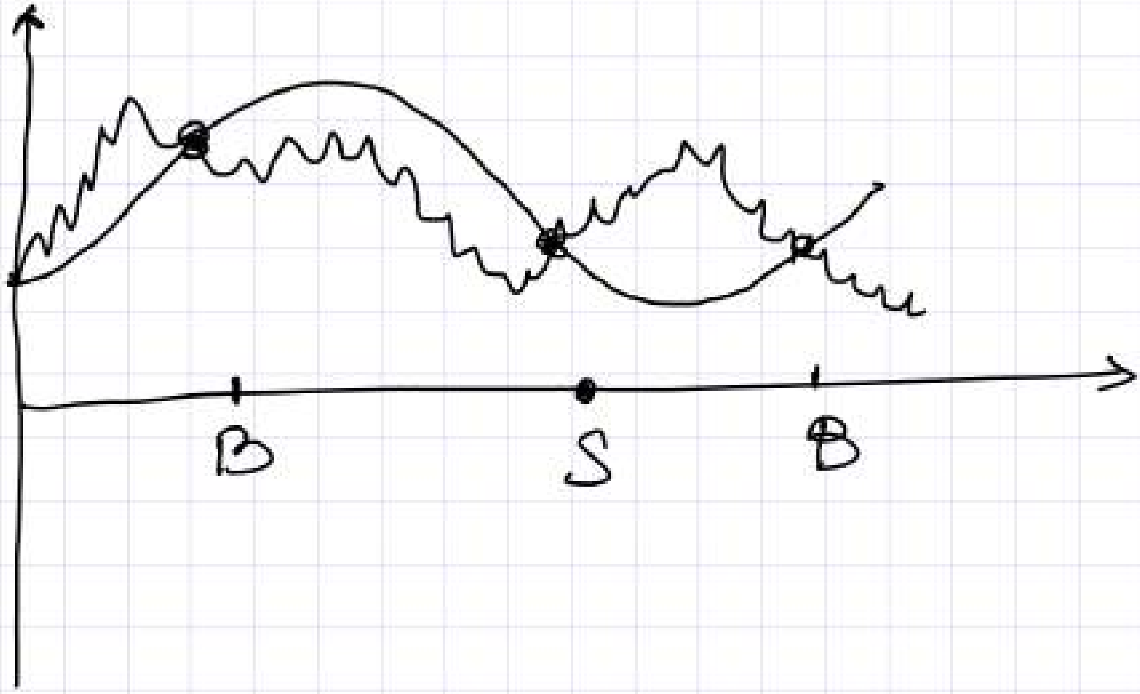
Chaikin money flow

VWAP

Keltner Channel

KST (Know Sure thing)

Directional trading strategies:



EMA (Exponential moving average)

SMA (Simple moving average)

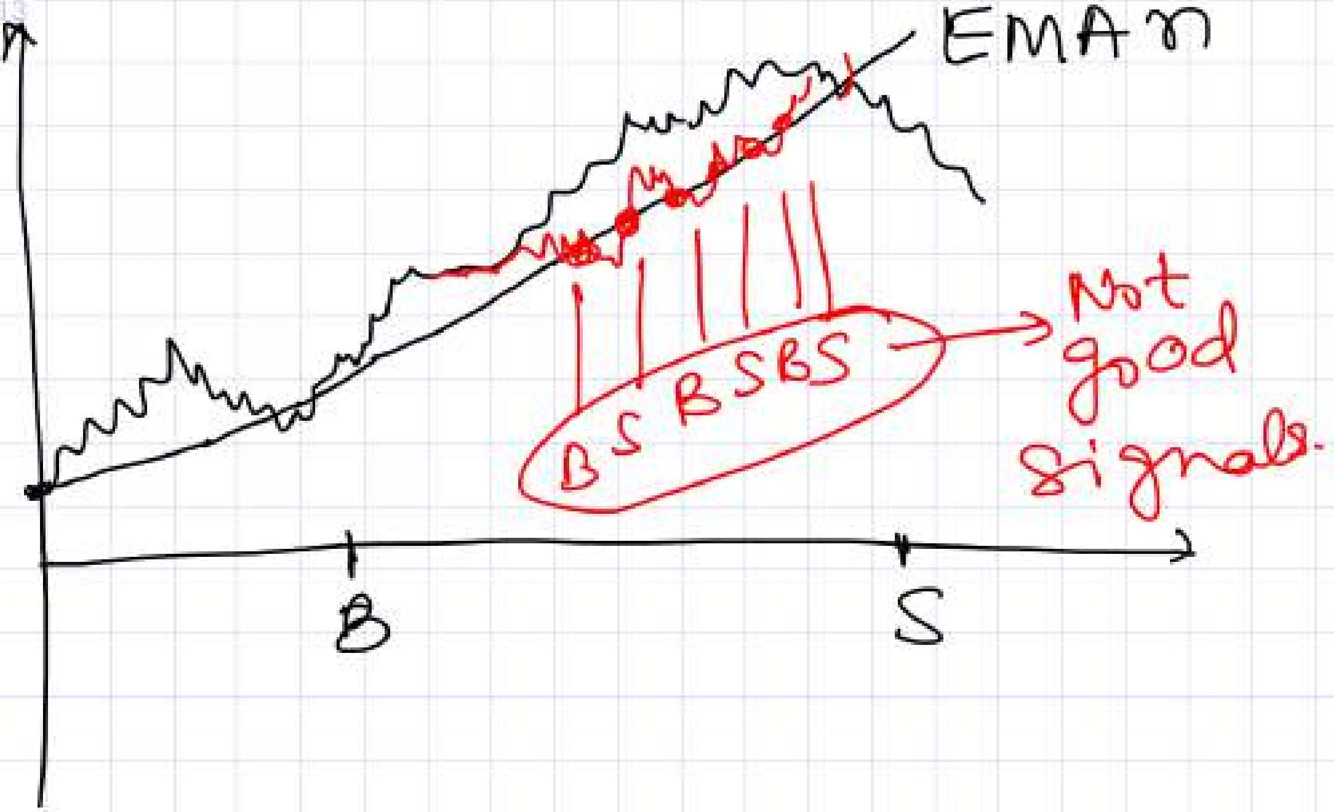
~~We can~~
EMA gives more weightage to latest values.

EMA

- EMA 10 → Less lag, less smooth
- EMA 20
- EMA30 → More lag with stock price, More smooth

n can be 10 or 20 or 30

We take higher values of n when we are tracking a longer term trend.



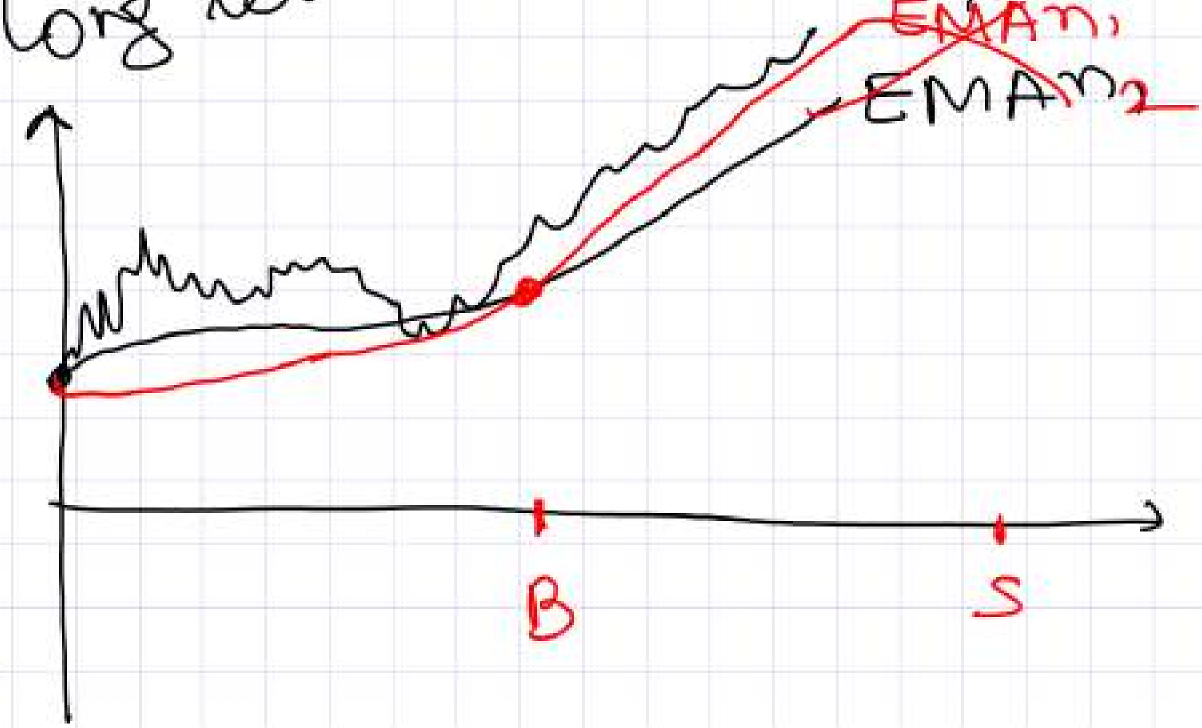
Then we take two EMA's

$EMA\,n_1$, $EMA\,n_2$

$n_1 < n_2$

Long term trend

Intermediate trend



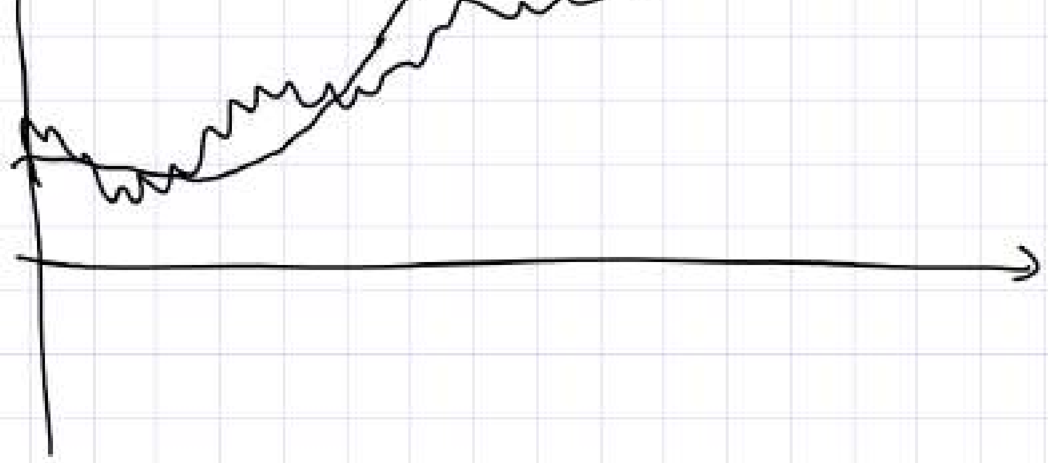
S → When

EMA n_1 crosses EMA n_2 from above.

Intermediate trend has changed

SVM, linear regression, etc.

{Machine learning techniques.}

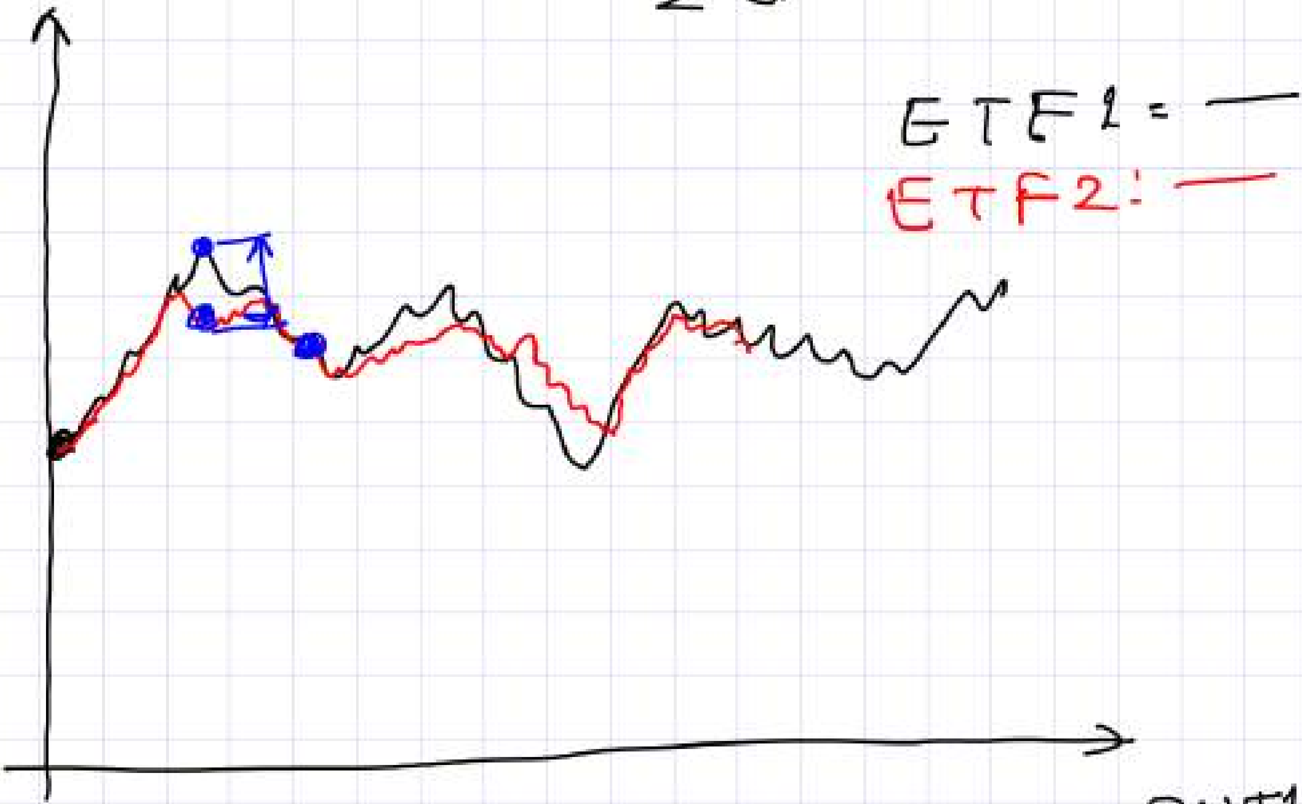


If future predicted value is high (low) → we buy (sell) or we retain our long (short) positions

Arbitrage strategies:

Arbitrage is short term move-ment of an 'instrument from its natural position.

2 GOLD ETFS



Market book:

- BID → Price willing to buy
- ASK → Price willing to sell

ASK3

ASK2

ASK1 (Lowest ask)

BID1 (Highest bid)

BID2

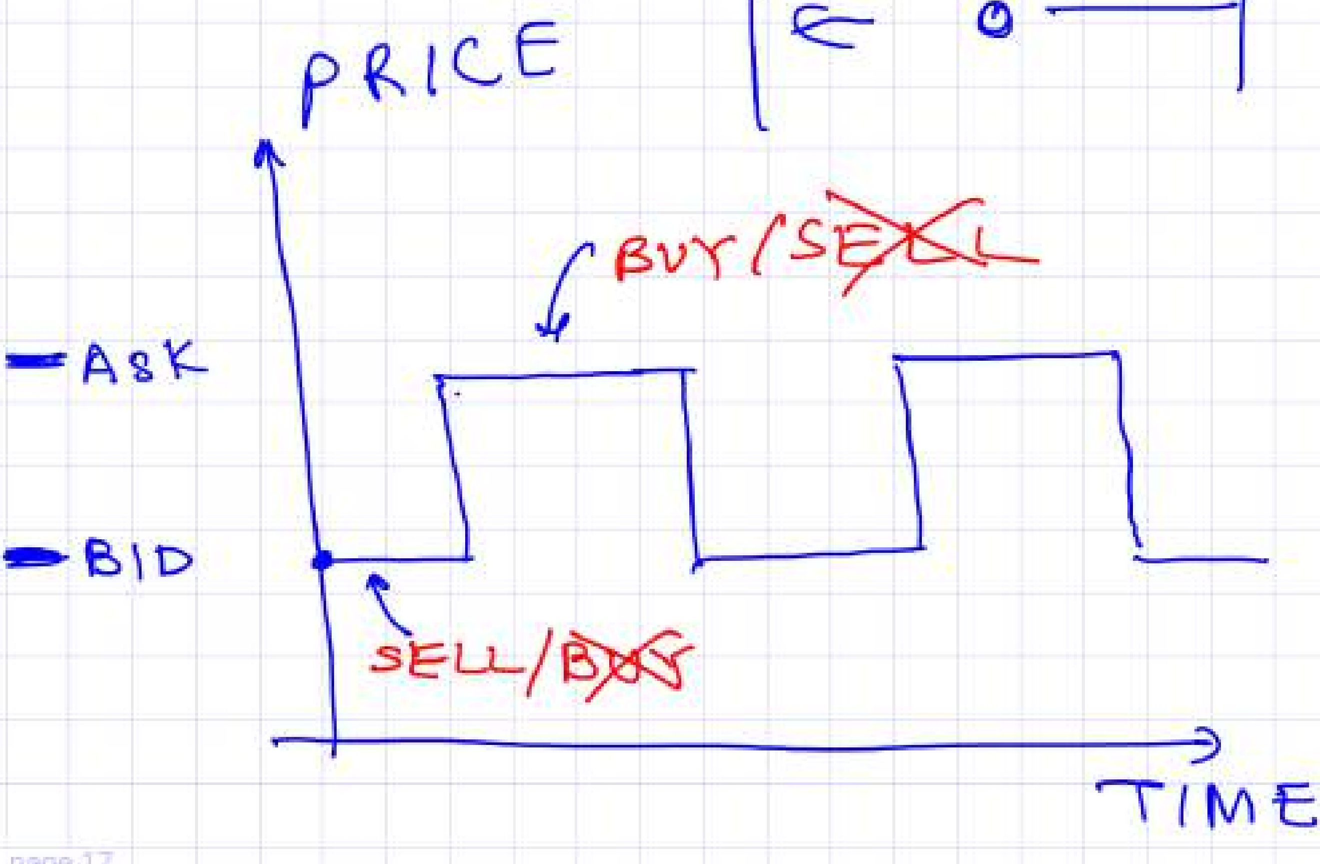
BID3

BID4

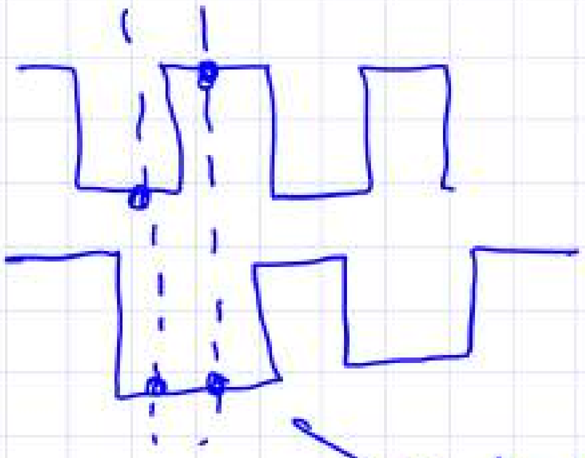
⋮

Bid-ask spread

Bid-ask bounce:

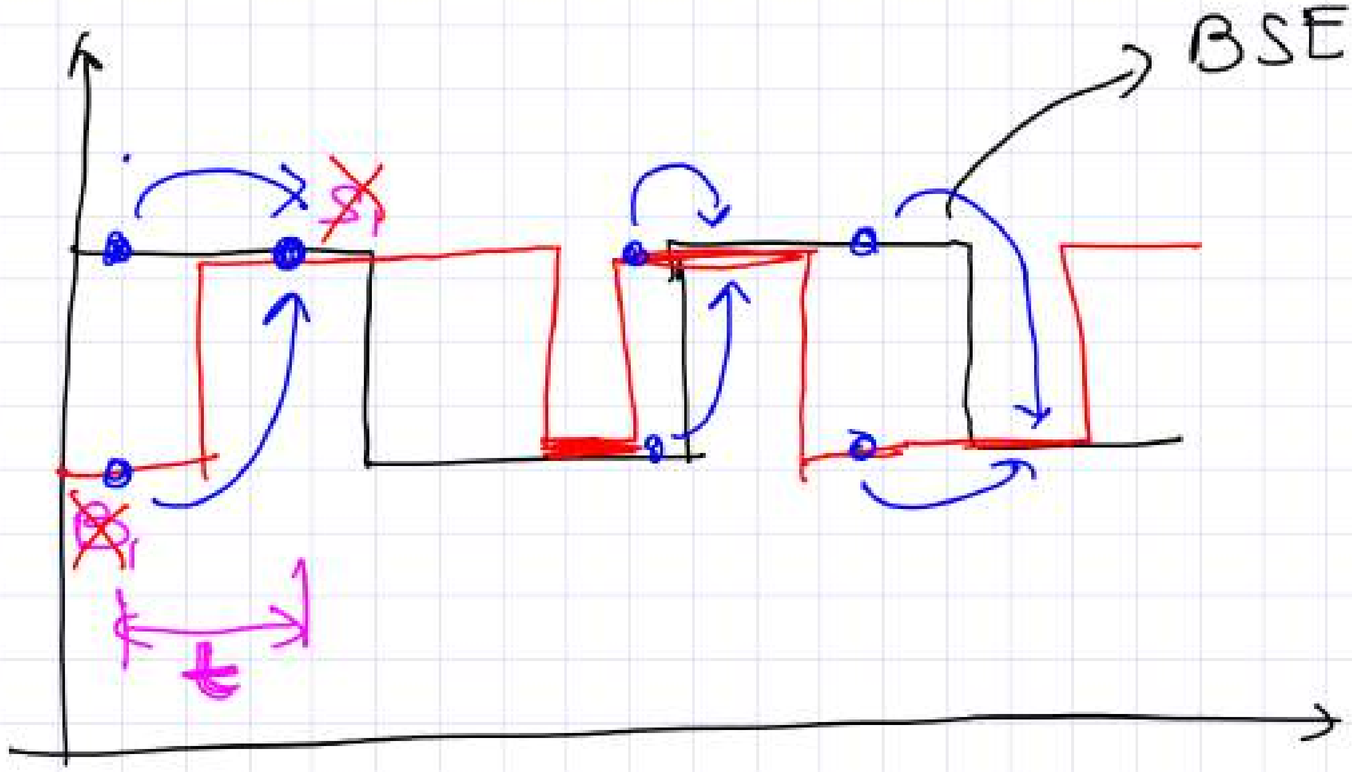


EXCH1 EXCH2



NOT

Arbitrage is possible?



Index arbitrage:

① 2 different versions of index (ETF) running on different exchanges. ~~are~~ ~~causing~~ And there is a price difference in them.

② The catch is in modern market

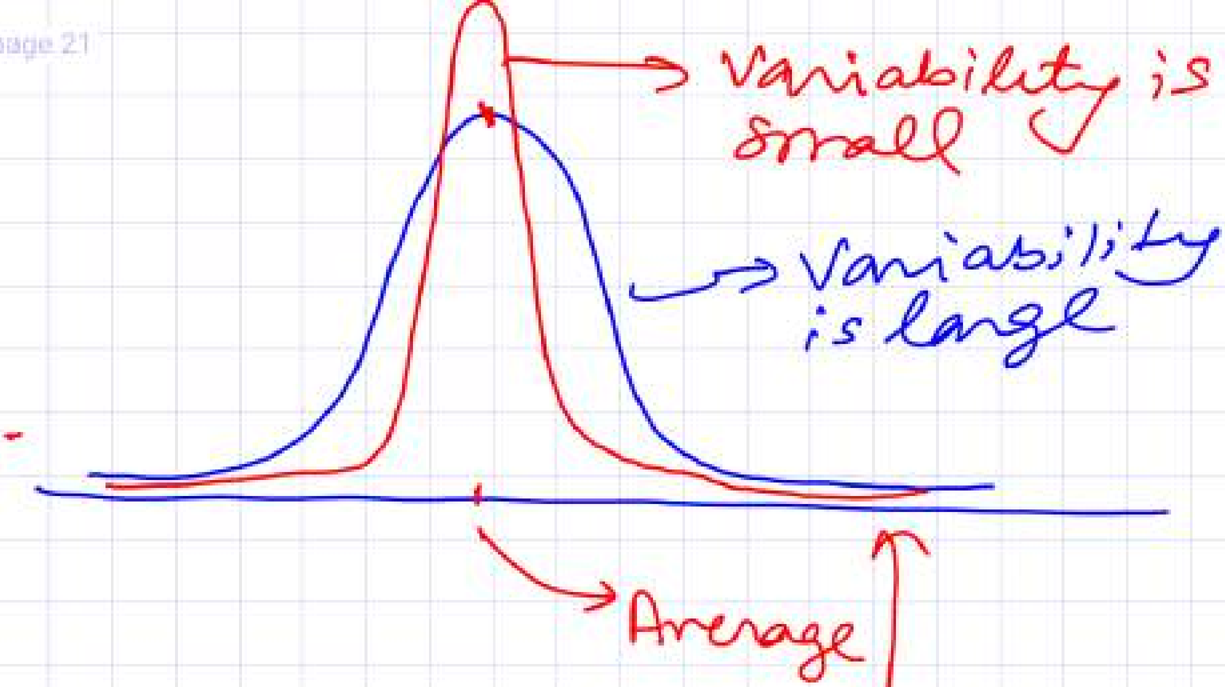
→ ~~You can~~ The price difference is only for milliseconds.

③ Difficult for retail.

Spread Arbitrage:

1. For many reasons it is possible that there is some anomaly difference in the price of spot and future contract of the same underlying.
2. Between two ~~futu~~ futures of different expiries.

(Arbitrage Funds)

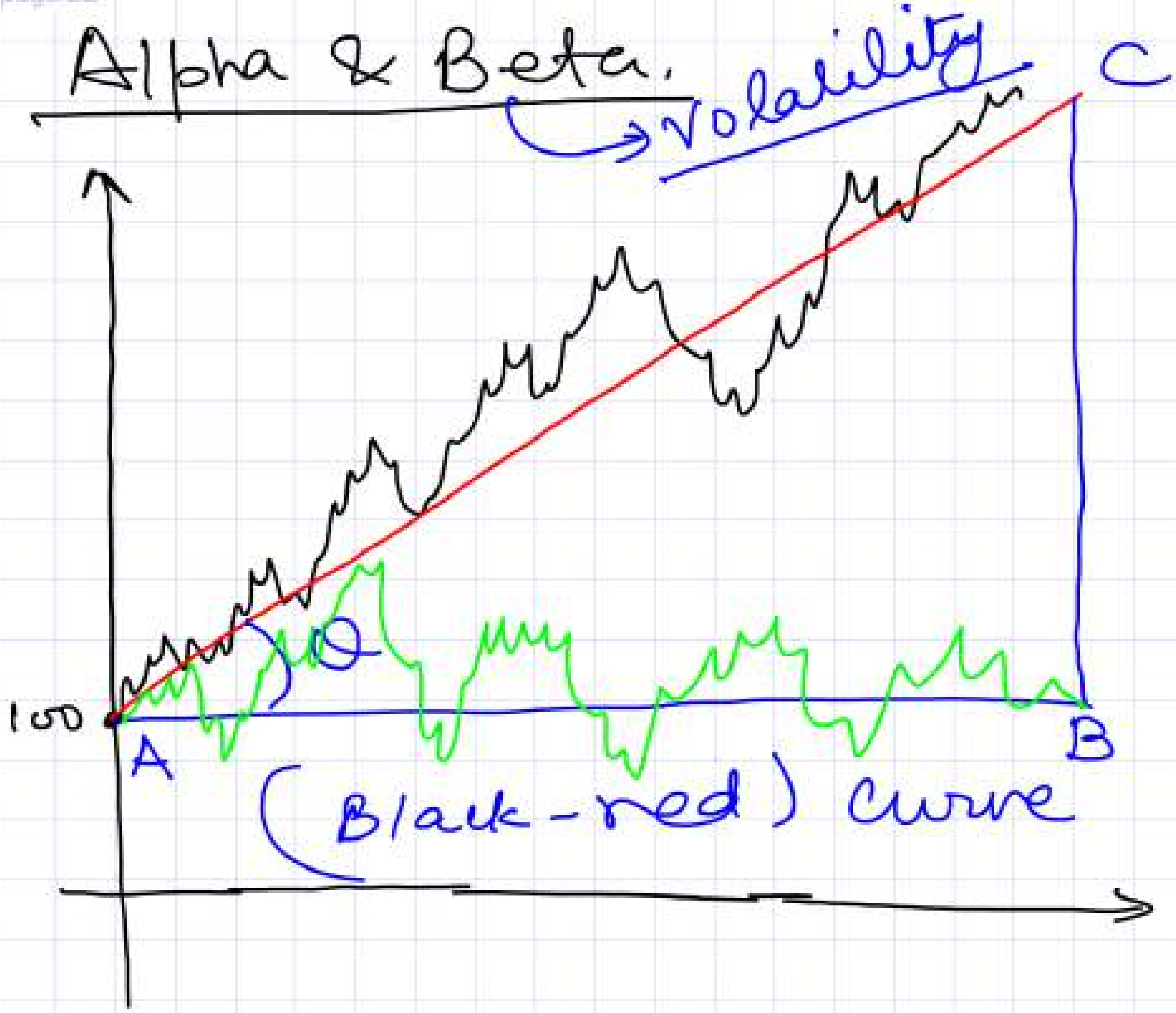


Volatility trading :

What is volatility ?

VIX

Alpha & Beta.



$$\alpha = \frac{BC}{AB} = \text{Slope of the line}$$
$$= \tan\theta$$

Day to day fluctuations

① Calculate day to day stock price movement

② Find the average value


S_1
S
S_2
B
B_2
B_1
Hysteresis

What are options :

John Hull
Options Futures & Other
derivatives

Stock

Loss :

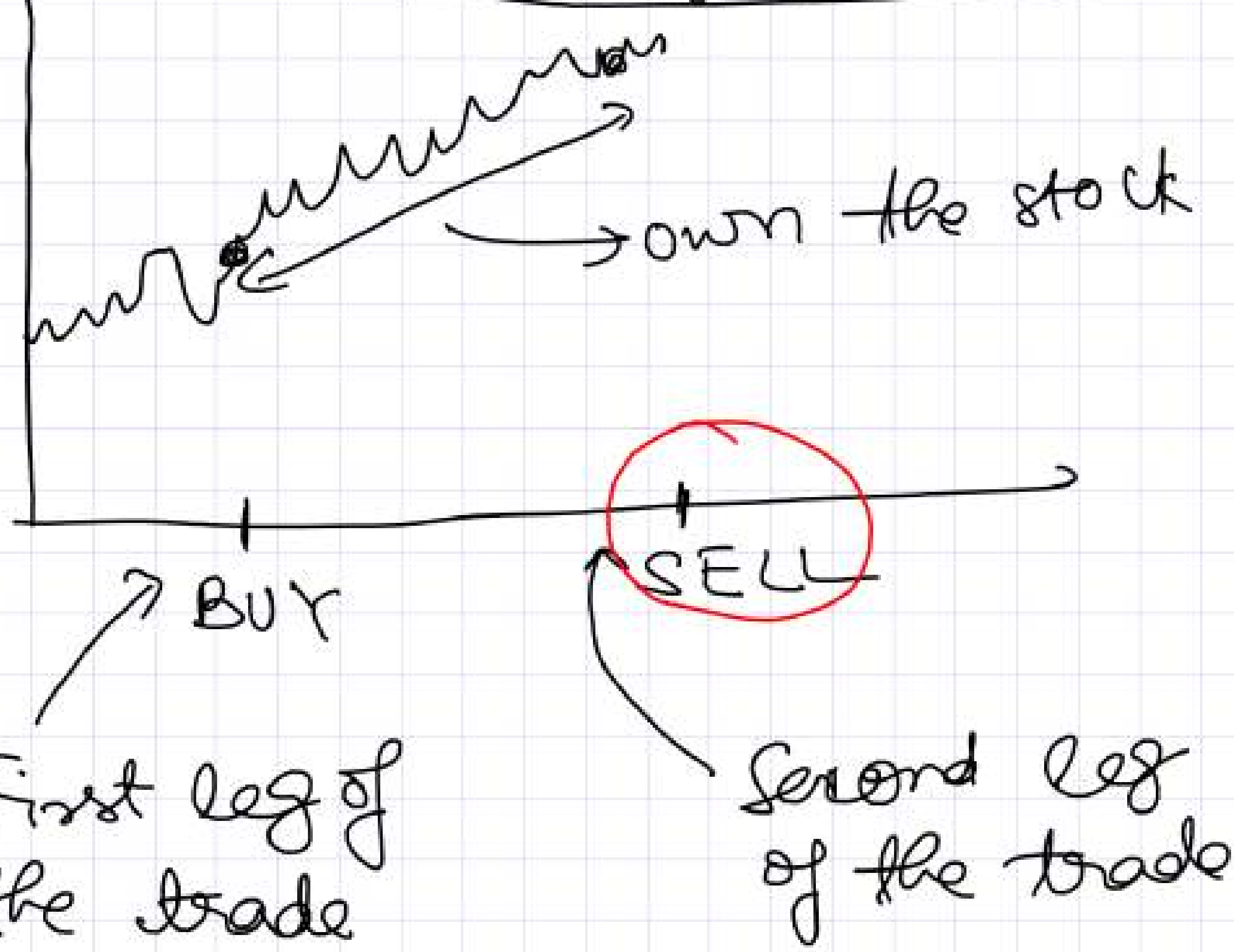
to avoid loss

One possible way is to sell the
stock when it is going down.

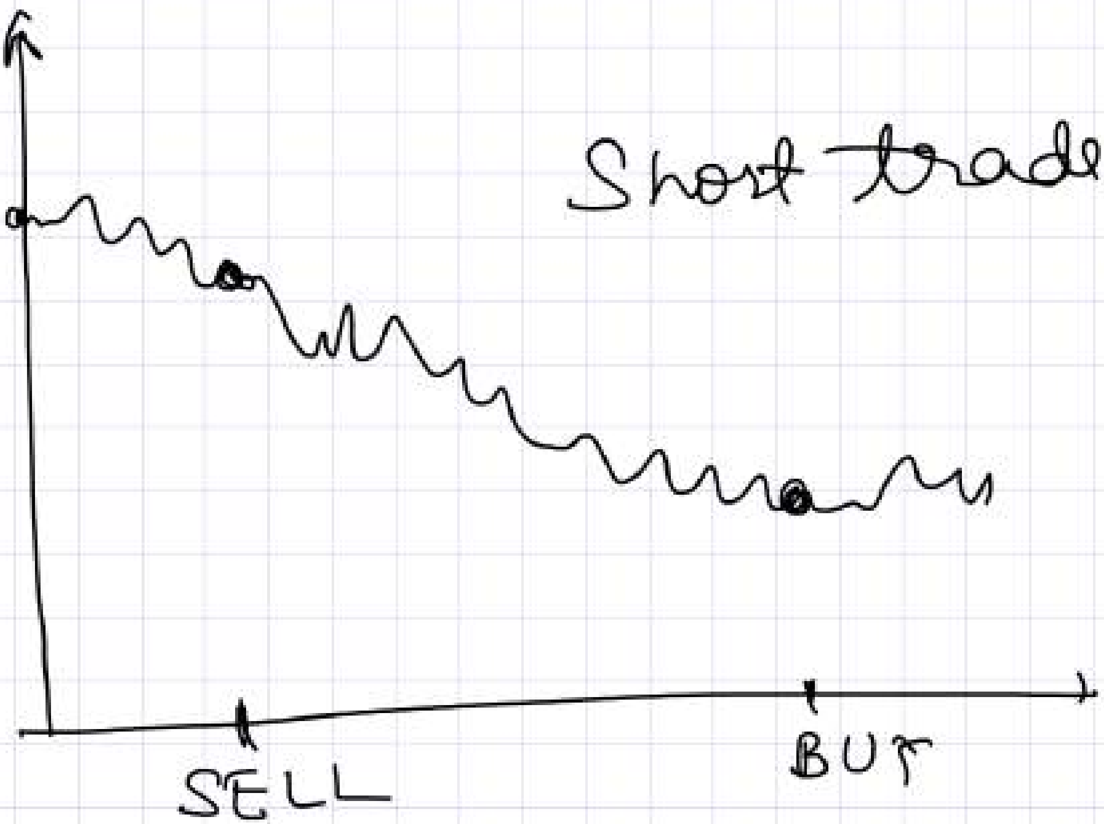
If you have a short position
in stock, in order to avoid
loss when it is going up.

the way is to buy it bak

In long position

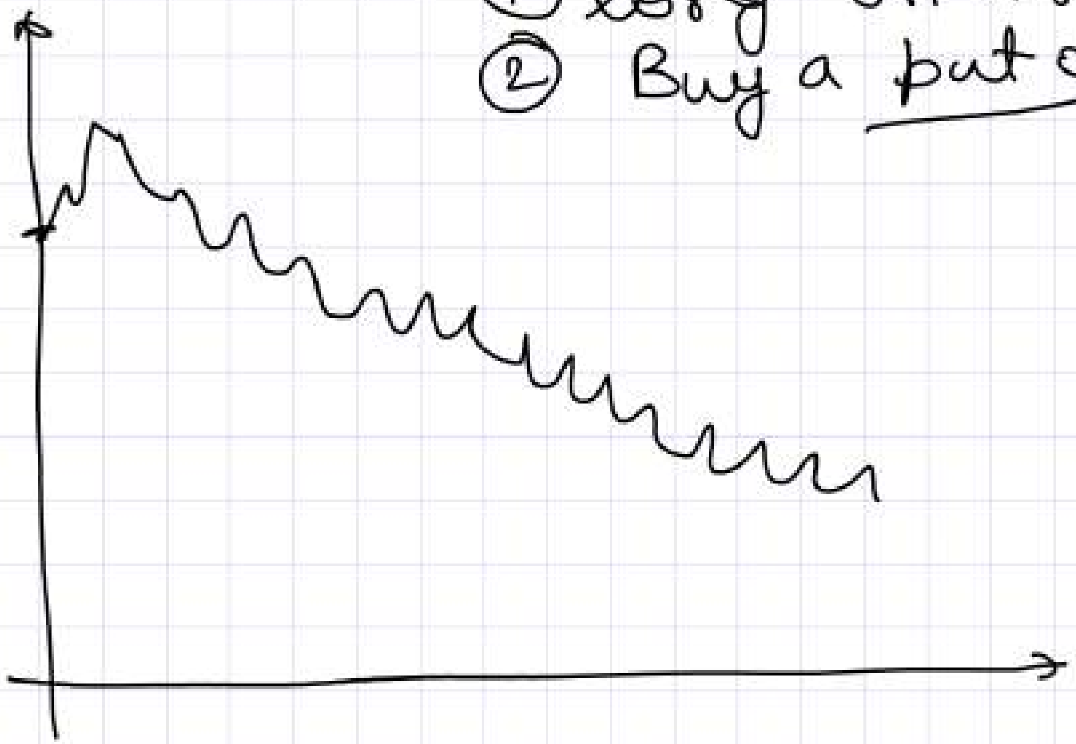


Short trade



Options are basically hedging mechanism.

① long on a stock
② Buy a put option



→ Short on stock
→ Buy a call option.

$S = 120$
$K = 100$

Call option :

① Striske price (K)
② Expiry time (T)

Call option gives you (a right but not obligation) to

→ $\boxed{\text{Buy the one unit of underlying stock at price } \hat{K} \text{ at time } T.}$

Put option :

① Striske price (K)
② Expiry time (T)

$S = 70$
$K = 80$

~~Call~~ Put option gives you (a right but not obligation) to

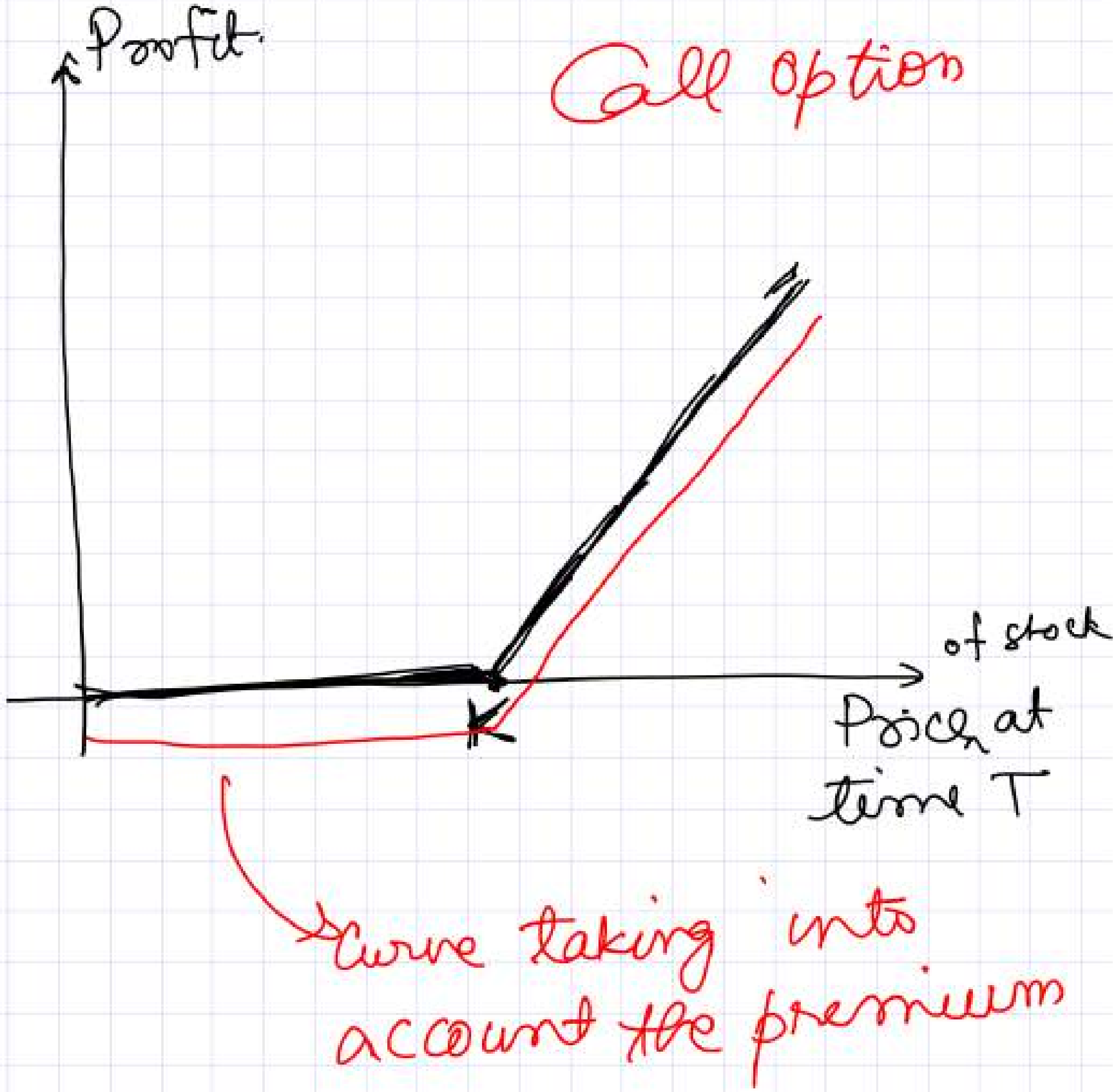
→ ~~Buy~~ Sell the one unit of underlying stock at price $\hat{K}$ at time T.

For the call option:

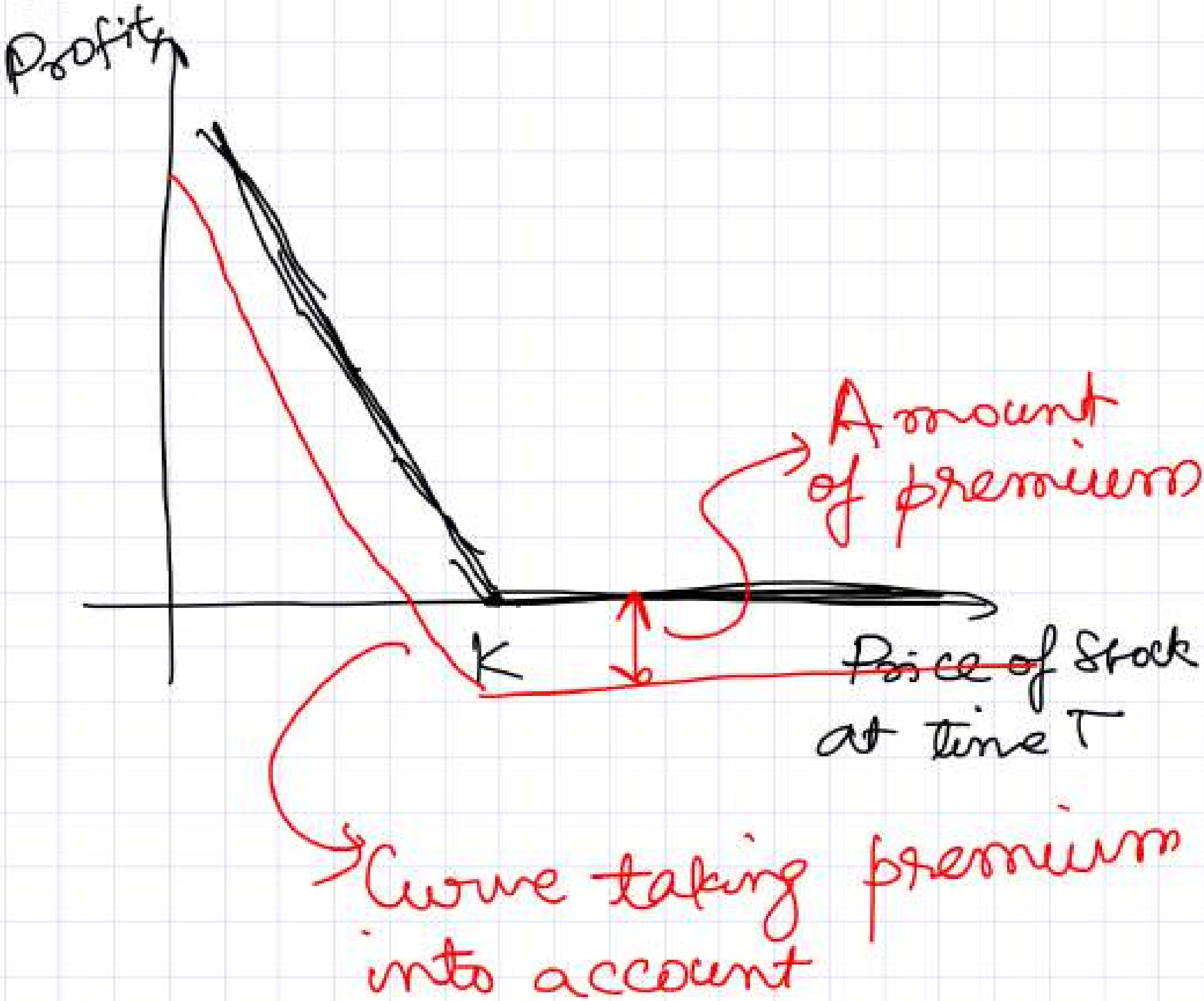
Strike price (K) = 100

Price of stock at time T (S)

S = 120



Put option :



Both long & short options can be of two types.

→ American option

→ European option

Q: What are the factors that affect option prices? → Option premium > 0)

A: There are 6 factors.

① The current stock price (S_0)
② The strike price (K) ($K\uparrow$,
③ The time to expiration (T)
④ The volatility of the stock price (σ)
⑤ The risk free interest rate (r)
⑥ The dividends that are expected to be paid.

Call option premium $= C$

strike price

$C_1 \longrightarrow S_0, K_1$

$C_2 \longrightarrow S_0, K_2$

current stock price

$K_1 < K_2 \longrightarrow$ Given

Then,

① $C_1 < C_2 \longrightarrow$?

② $C_1 > C_2$

→ Which of ① or ② is true.

For a call option (C)

① $S_0 \Longrightarrow S_0 \downarrow, \; C \downarrow$

② $K \longrightarrow K \uparrow, \; C \uparrow$

③ $T \longrightarrow T \uparrow, \; C \uparrow$

④ $\sigma \longrightarrow \sigma \uparrow, \; C \uparrow$

⑤ $r \longrightarrow r \uparrow, \; C \uparrow$

⑥ $d \longrightarrow d \uparrow, \; C \downarrow$

For the put option the premium

Black Scholes formula:

$$c = S_0 N(d_1) - \underbrace{K e^{-rT} N(d_2)}_{}$$

$\downarrow$

$$p = K e^{-rT} N(-d_2) - S_0 N(-d_1)$$

$d_1 \downarrow, d_2 \downarrow$

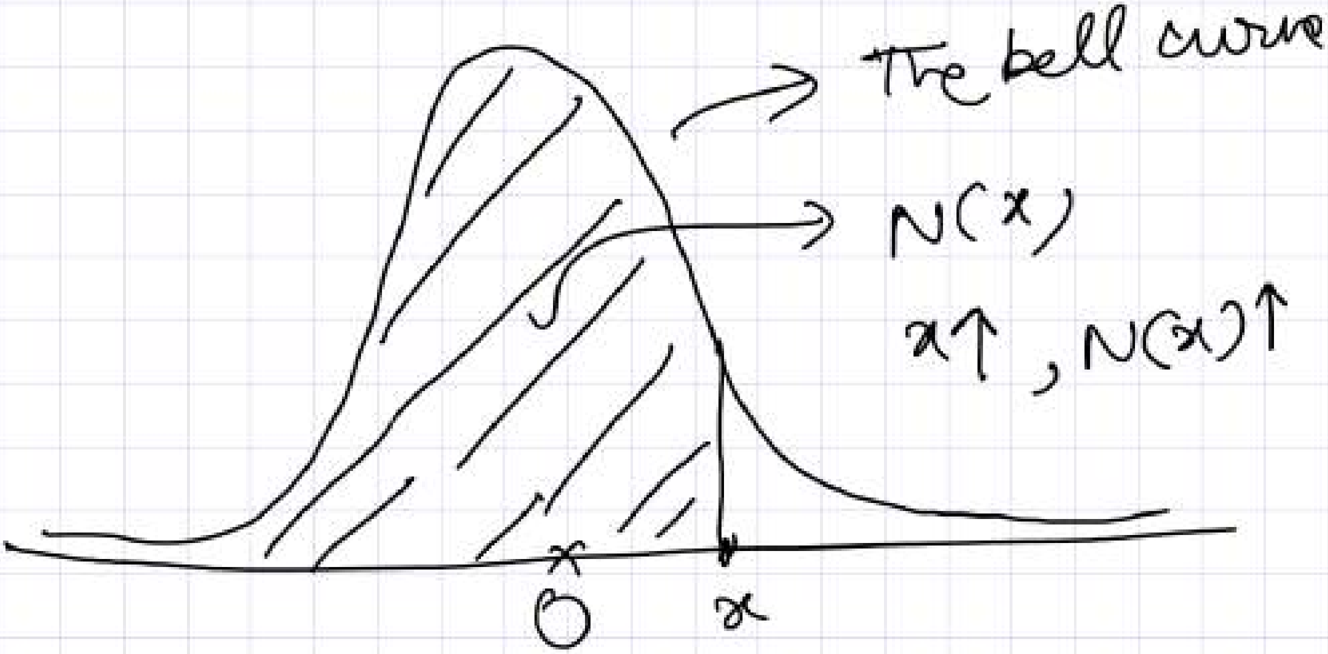
$N(d_2) \downarrow$

where,

$$d_1 = \frac{\ln(S_0/K) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(S_0/K) + (r - \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$= d_1 - \sigma\sqrt{T}$$



Option Greeks:

1. Delta
2. Gamma
3. Vega
4. Theta
5. Rho

Option greek Delta:

One of the factors that affect option price is current stock price.

For call option $S_0\uparrow, C\uparrow$

$S_0\downarrow, C\downarrow$

For Put option $S_0\uparrow, P\downarrow$

$S_0\downarrow, P\uparrow$

The delta tells you by what fraction the option premium is affected if we change the stock price.

$\mathcal{O} \longrightarrow$ Option Premium

$\longrightarrow \mathcal{O} = C$ for call

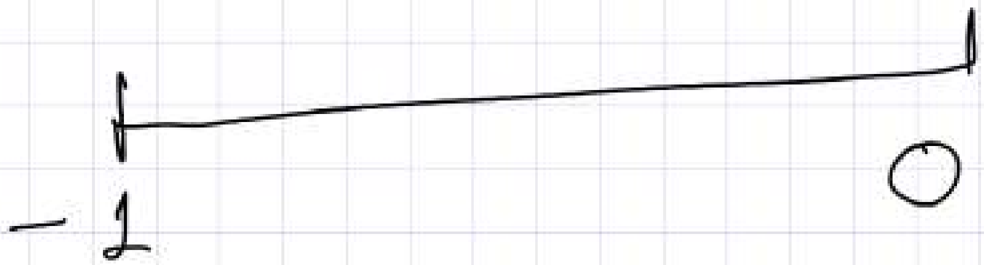
$\mathcal{O} = P$ for put

$$\frac{\Delta \mathcal{O}}{\Delta S_0} = \frac{\partial \mathcal{O}}{\partial S_0}$$

Delta is between -1 & $+1$

For call option $\rightarrow$ between 0 & 1

For put option $\rightarrow$ $[-1, 0]$



Delta = ~~0.9~~ -1

Deta = -0.1

In the money

Out of the money

$$\left.\begin{array}{l} S_0 = 100 \\ K = 50 \end{array}\right\}$$ Out of the money Put option

$S_0 = 100$
$K = 200$

In the money Put option

$S_0 \to 101$

Then

100

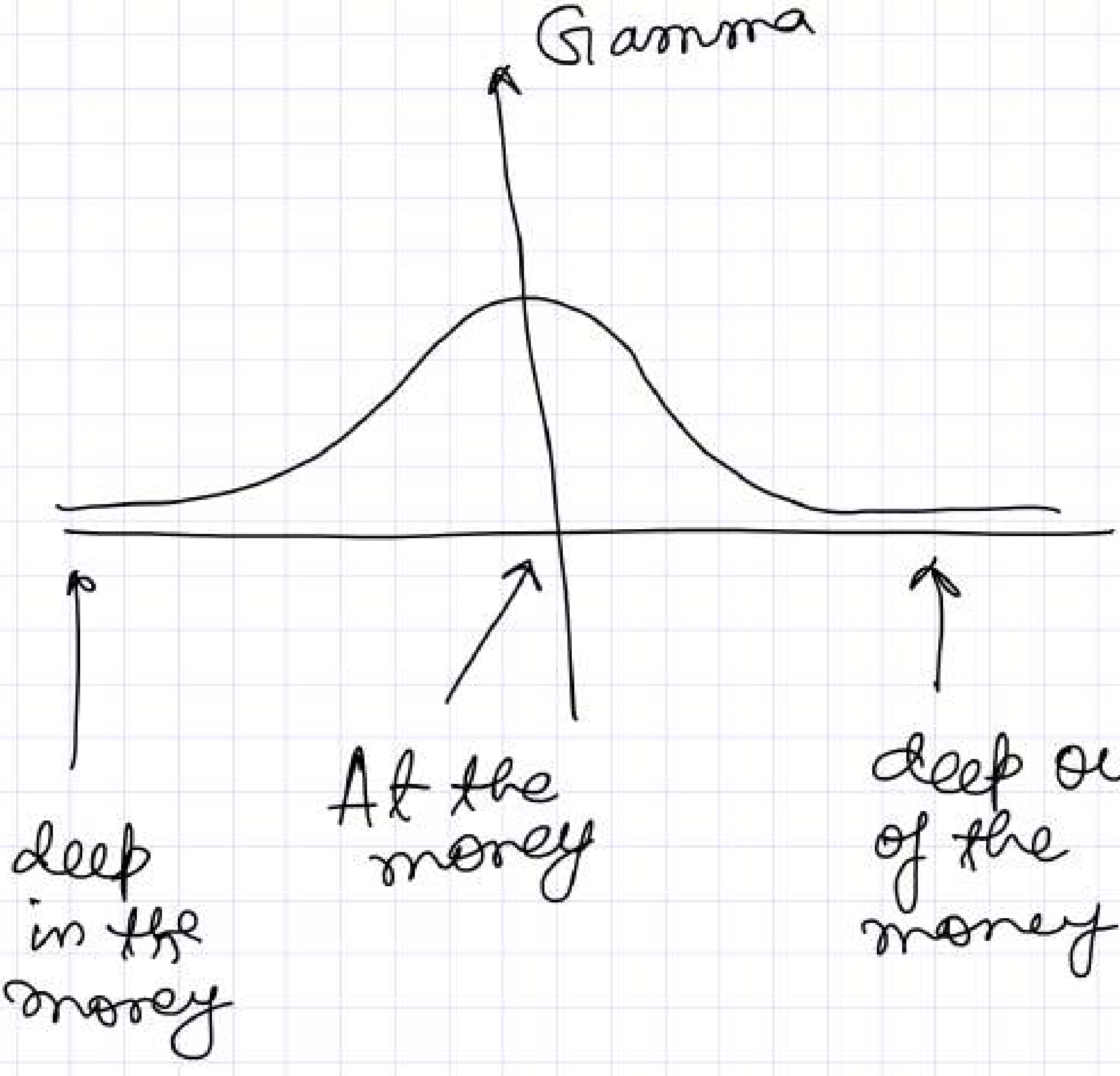
~~101~~ 99

$$\frac{\{\text{Change in Payoff}\}}{\Delta S_0}$$

$$= \frac{-1}{+1} = -1$$

Gamma :

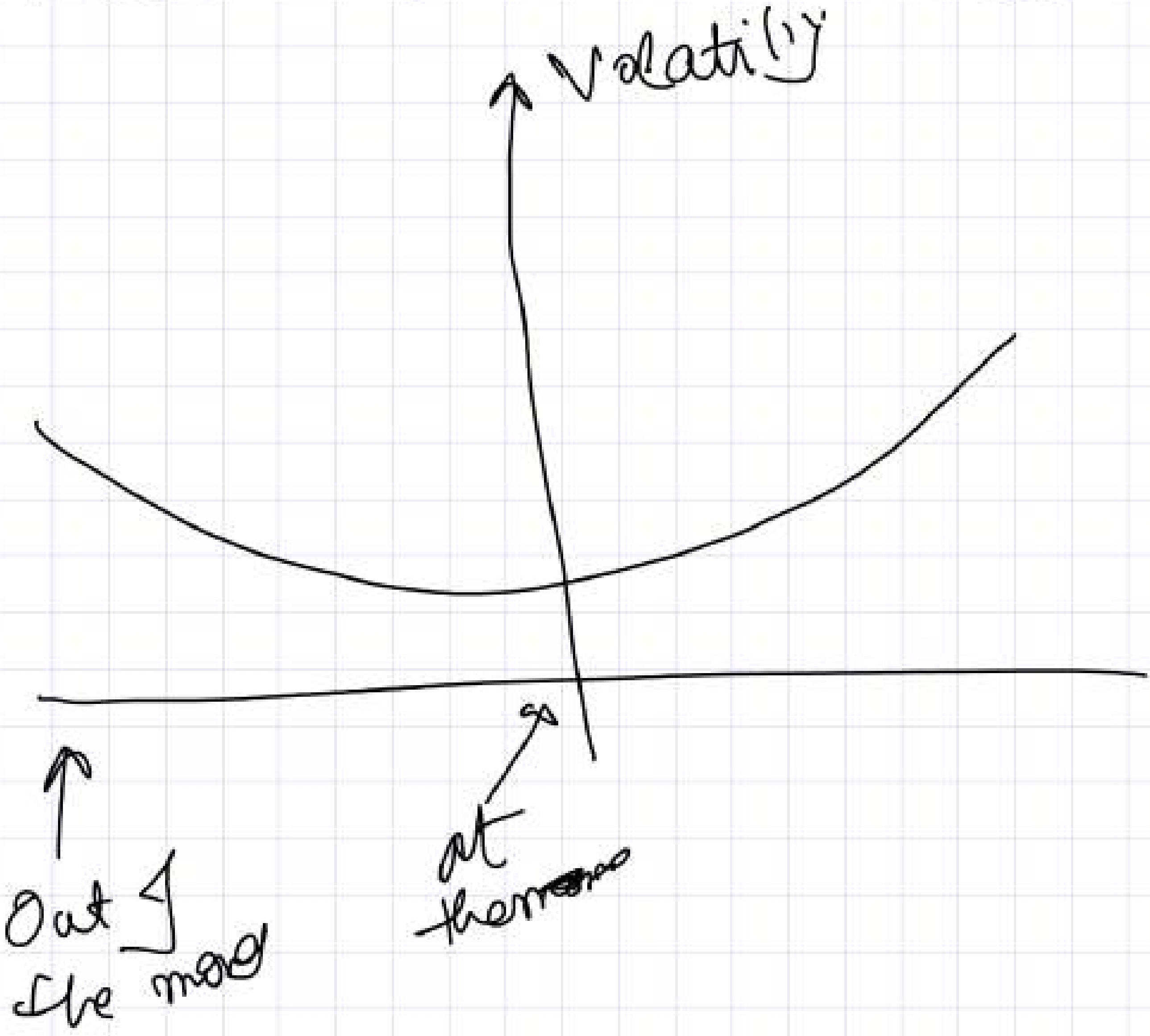
→ Change in deta relative to price of the underlying.

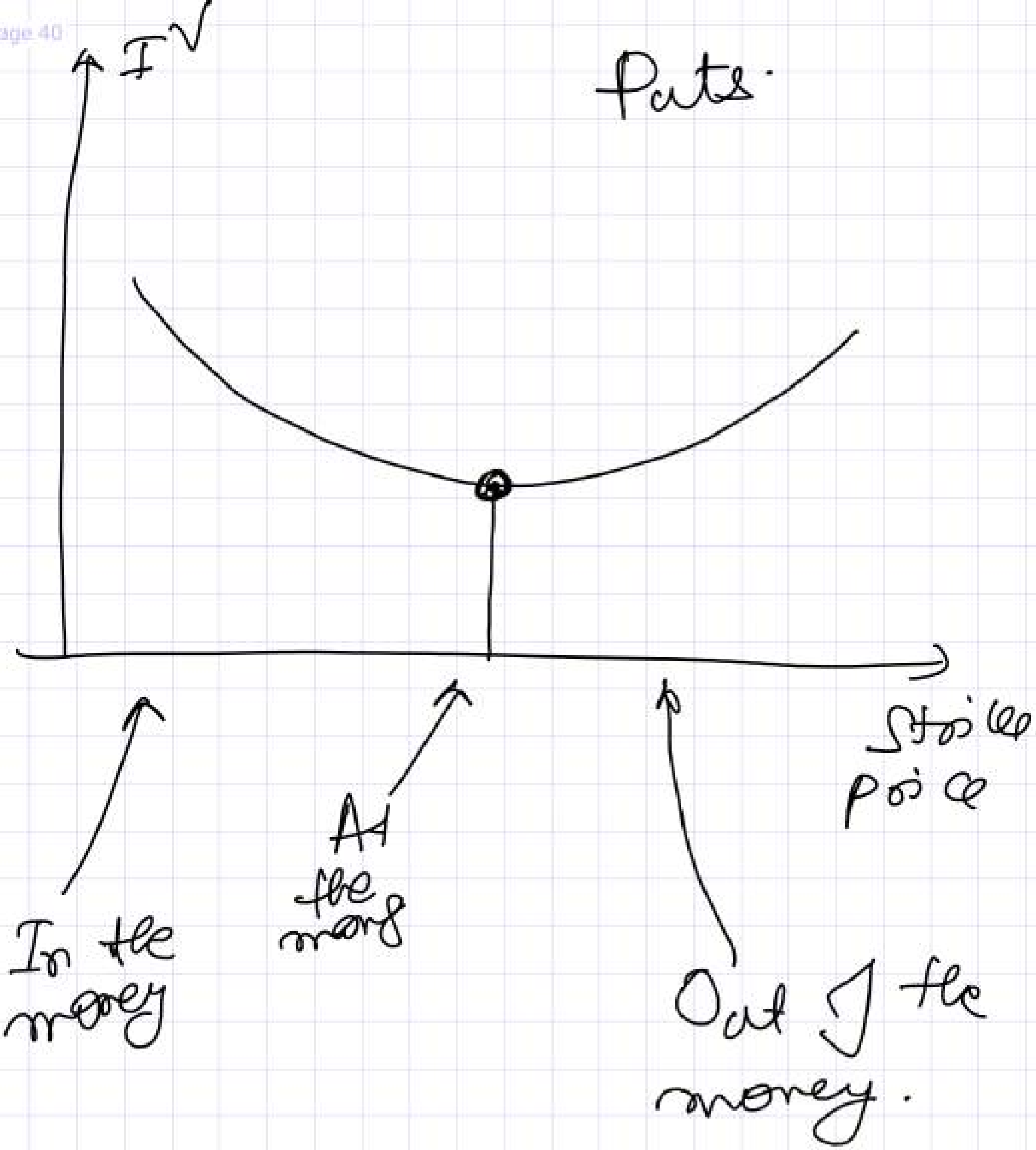


Implied Volatility (IV):

The volatility at which the option price was calculated.

Volatility Smile:





<u>Scalping</u>: It is a trading strategy where we close the position immediately when we are in profit.

Now we'll study:

Gamma Scalping:

There are many option trading strategies.

→ Butterfly
→ Stradle. } → You can get the resources.

Strddle option trading strategy:

It involves the following

① Buying or selling of call/put option (at the money)
② The options should have the same underlying asset.
③ They should have the same strike price (K)

④ They must have the same expiry date. (T)

Gamma Scalping:

① Trader purchases straddle at some initial price.

② Initially deltas cancel each other

$$\Delta_c - \Delta_p = 0$$

② Then market moves in some direction, and deltas change.

$$\Delta_c' - \Delta_p' \neq 0$$

Then we implement this strategy.

③ $S \downarrow$ $\quad \Delta_c - \Delta_p < 0$

Then the investor buys one stock.

Delta of the stock $= 1$

$$\Delta_c - \Delta_p + \alpha S = 0$$

We have rebalance the delta of the portfolio to zero again.

We'll keep buying or selling the stock to rebalance the delta of the portfolio.

→ With ~~the~~ time your portfolio value ~~with~~ will increase

IF there are moves in the market.

HOWEVER IF :

Market mostly does not move. Investor looses money.

Spread Arbitrage:

Here we take advantage of the spot & future contract of the same asset with different strike price.

Spot Price
Future Price

$F = S + \alpha$

(+)ve or (−)ve

wha

long in the future.

→ You have obligation to buy one unit of stock at time "T."

There is no strike price.

(1) Arbitrage money is made when there is a stock & future prices are not related to each other, the way they should have been after taking into account all the necessary factors like

→ Interest rate
→ Delivery / Storage cost
→ Contagio / Backwardness
→ ~~E~~ Expected dividend etc. etc.

All these factors are Public Knowldge.

$$\boxed{F = S + \alpha}$$

~~$\alpha = (+)$ve~~

α is known

What it SHOULD BE

WHAT IT SHOULD BE

$$\boxed{F = S + \beta}$$

REALITY

$\alpha = 1$, $\beta = 2$

$F = S + 1$ → should be

$F = S + 2$ → IS

Short on Future

$\longrightarrow$ Sold a future contract

$= S_0$

[Adjustments for time value] money

[
1. Sell a future contract
2. Buy the stock
]

$F = S_0$

$F > S_0$ }
$F < S_0$ } This will lead to arbitrage opportunity.

($F < S_0$)
1. Buy the future
2. Sell the stock

Future we have expiry

$F_1 \longrightarrow$ expiry T_1

$F_2 \longrightarrow$ expiry T_2

There is a relation in F_1 & F_2 price. In case $t_2 = 0$, etc.

$$F_1 = F_2$$

o.w.

$$F_1 = F_2 + \alpha$$

$$F_1 > F_2$$

Calendar spread.

Electronic market making:

Market makers place limit orders for both buy & sell. They make money based on the ~~difference between~~ Bid ask spread.

——— Ask (P_1)

——— Bid (P_2)

$$P_1 > P_2$$

They sell at P_1

They buy at P_2

They make money

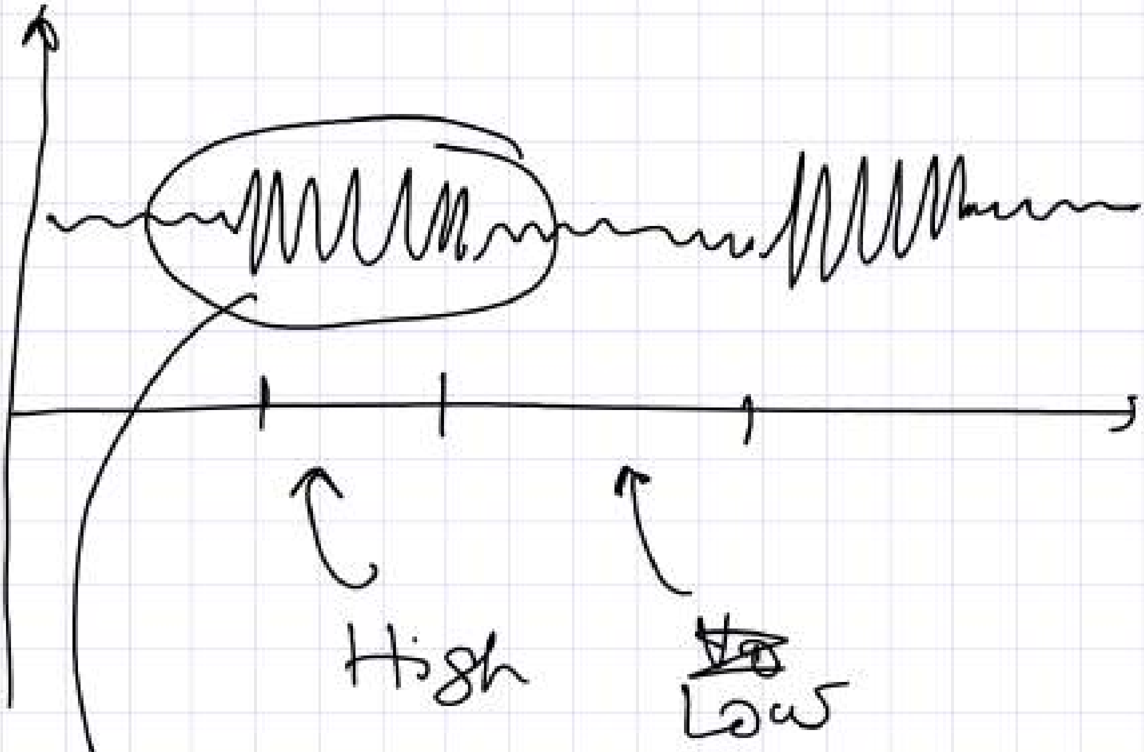
$(P_1 - P_2)$

Bid - Ask spread.

② Valatility (V)

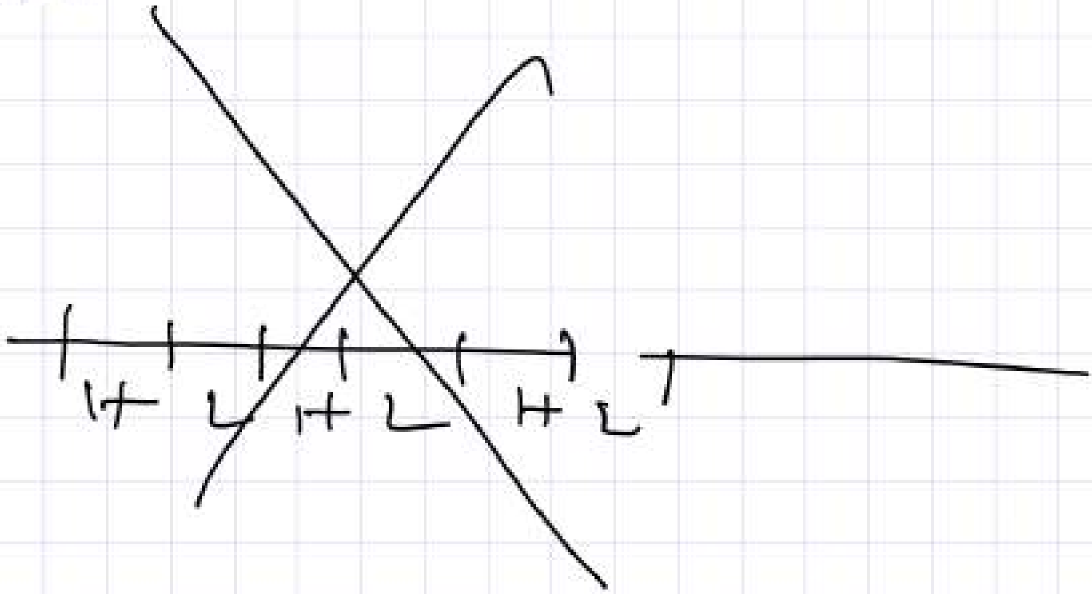
V ↑ , Bid-ask aspread ↑

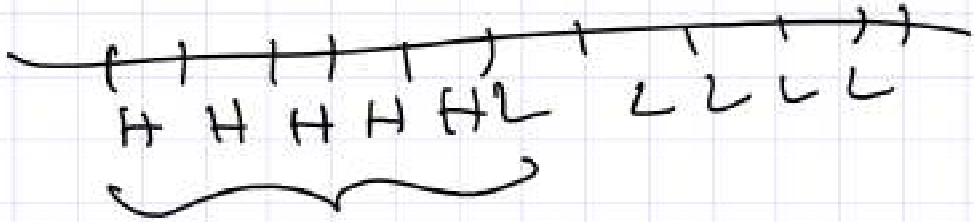
Volatility clustering :



High volatility movemens are clustered near each

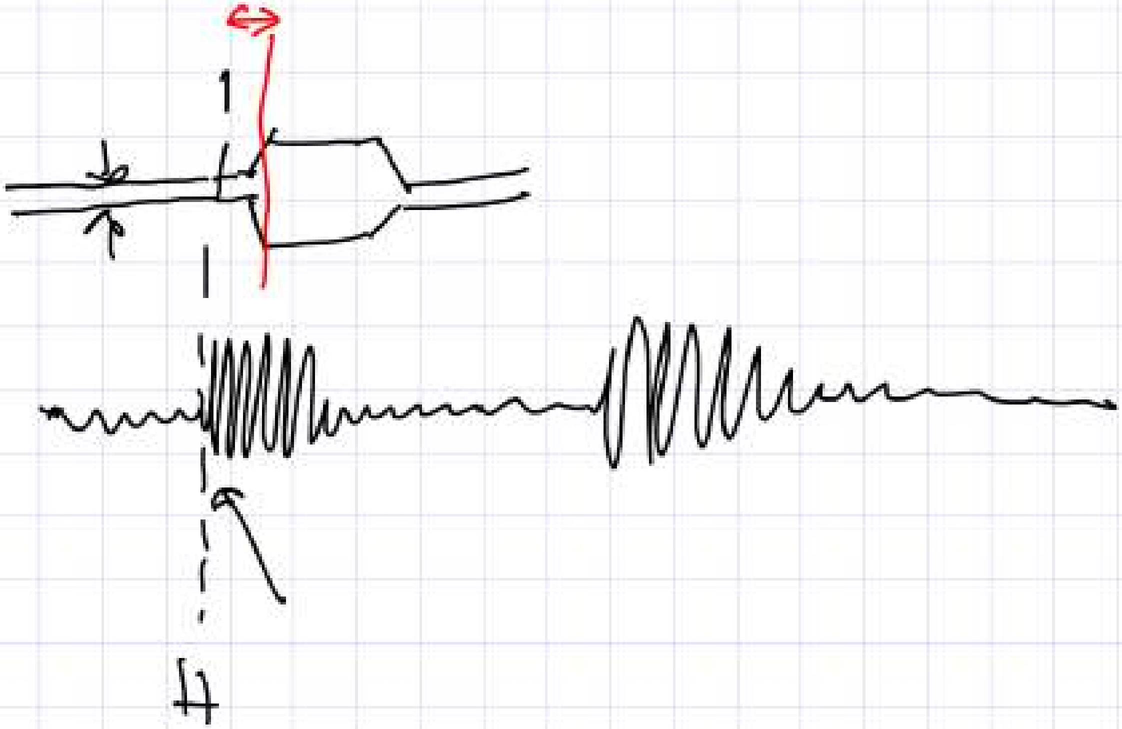
Volatily clustery





However we do not know when volatility ~~is~~ will be high.
If we know in advance we will be able to increa[se] bid ask spread.

[Predict when the next high volatility zone will come]



These things can be modeled.

→ HMM → Machine learning technique

Hidden markov models.