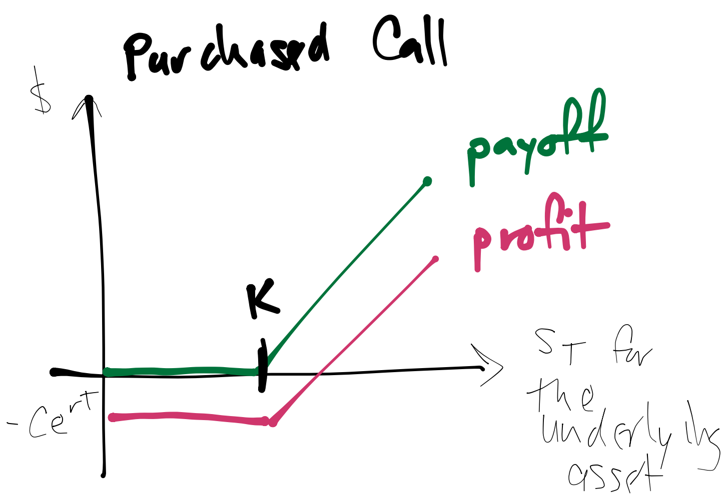
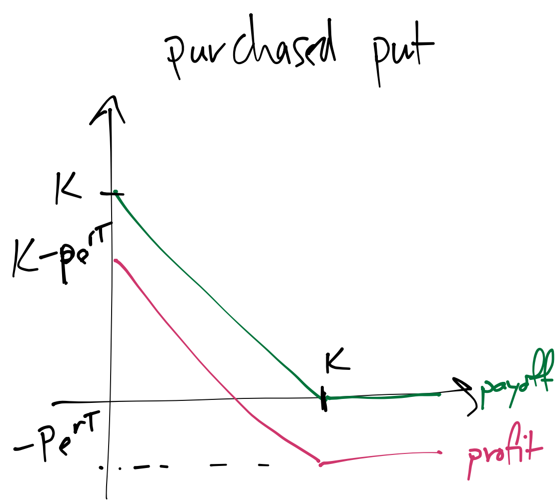
Options

Call - contract that gives the purchaser the right to buy a specified underlying asset at a specified date/time for a specified "strike" price (K).

Put - same as above, but change to "sell"





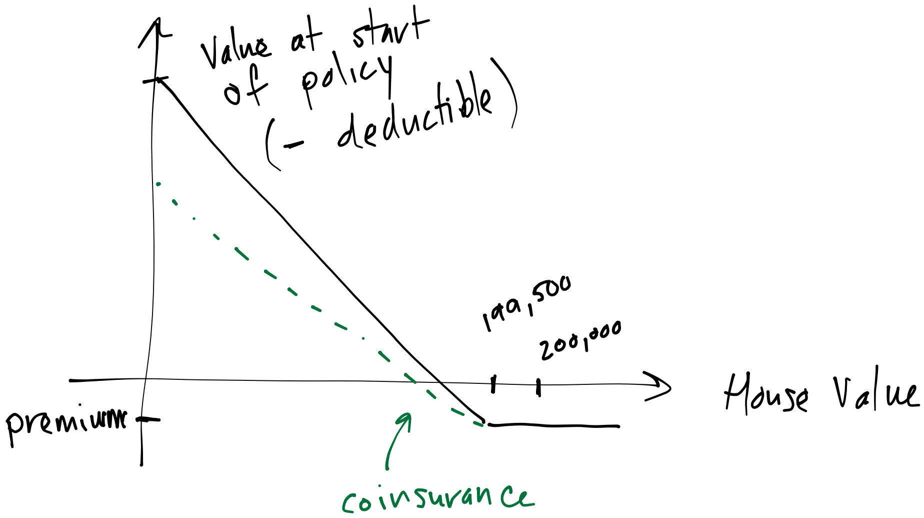
The next distinction between different options is the timing of exercise.

European - options that only allow exercise on the expiration date.

American - options that allow exercise at any point between purchase and expiration.

Bermudan - allows exercise on one or more specified dates prior to expiration.

Insurance is an American Put.



Think: What changes the premium?

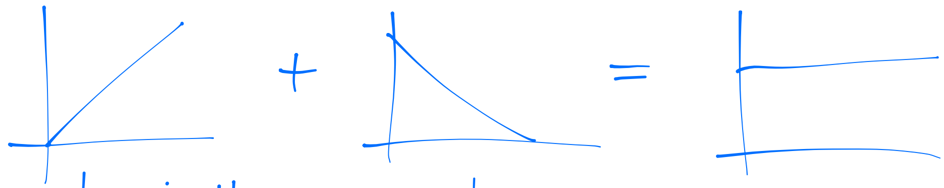
Frequency: probability of a claim

Severity: size of a random claim

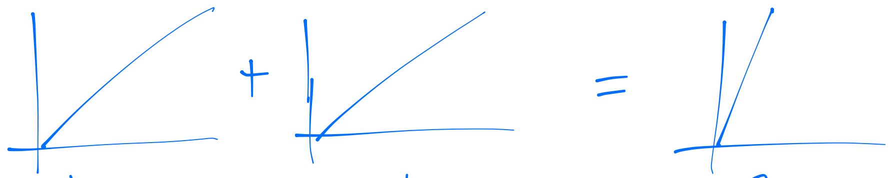
"Moneyness" of an option is a quick way to describe the relationship between an option's strike price and the asset's spot price.

EX

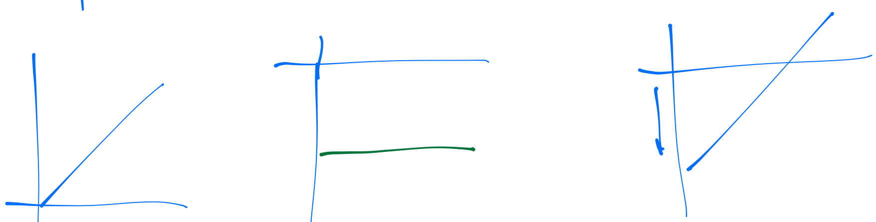
Option	Strike	Spot	"Money"
Call	50	55	"In the money"
Put	50	55	"Out of the money"
Call	50	50	"At the money"



slope: +1 — −1 — 0



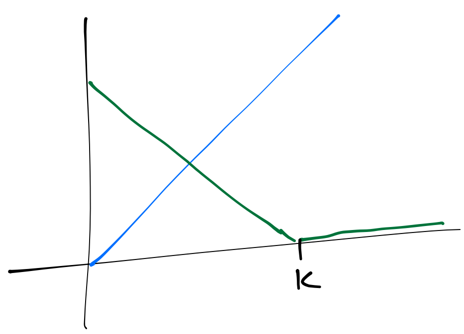
slope: +1 — +1 — 2



slope +1 — 0, but negative y-intercept

Portfolios:

1. long position on asset
2. put on that asset



Action	$t=0$	$t=T$: $S_T < K$	$t=T$: $S_T \geq K$
Buy Asset	$-S_0$	0	S_T

Buy Put	$-P$	K	0
Borrow	S_0+P	$-(S_0+P)e^{rT}$	$-(S_0+P)e^{rT}$
		$\mathrm{Max}(K, S_T) - (S_0+P)e^{rT}$	

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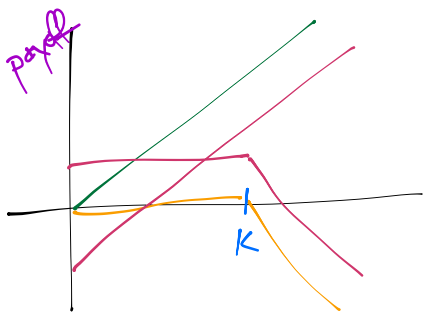
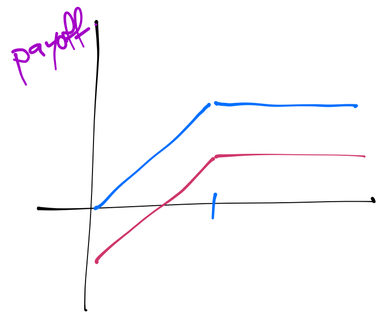
① Buy Asset

② Sell Call

"covered call"





Action	$t=0$	$t=T$: $S_T < K$	$S_T \geq K$
Buy Asset	$-S_0$	S_T	0
Sell Call	$+C$	0	K
Borrow	$(S_0 - C)$	$-(S_0-C)e^{rT}$	
	0	$\mathrm{Min}(S_T, K) - (S_0-C)e^{rT}$	

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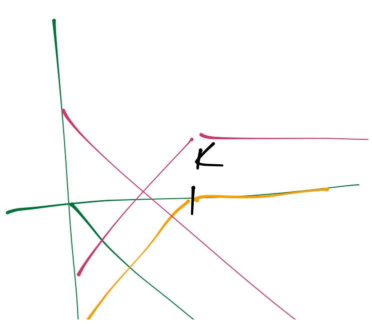
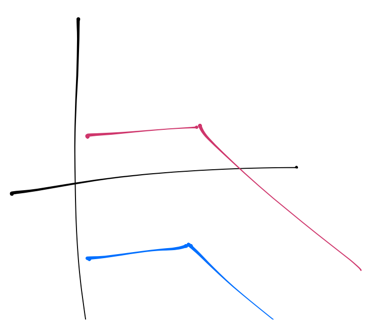
① Short Asset

② Write Put

"covered put"



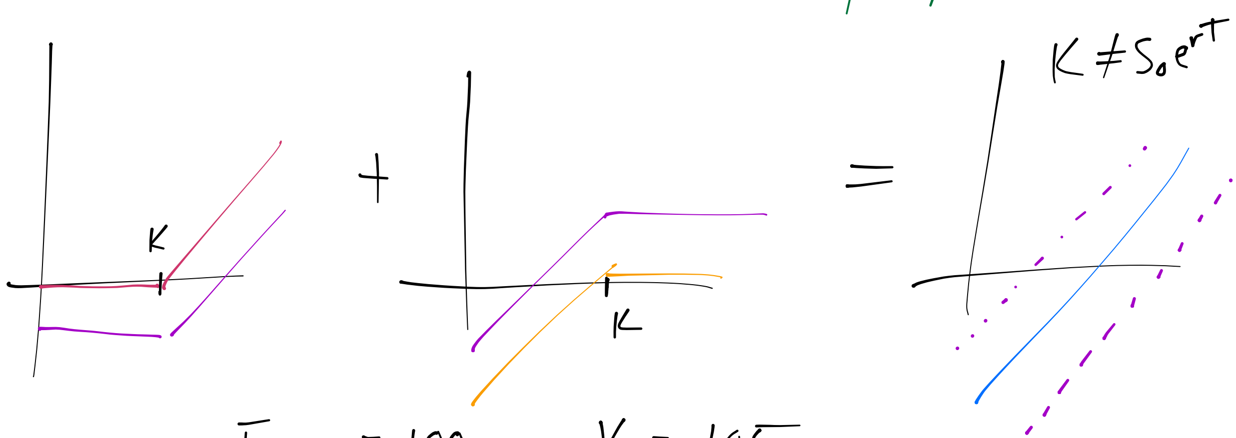


Real World limitation on the "Law of One Price" is transaction costs.

a) Visa
b) $100 bill
c) $50 bill
d) $20, $20, $10
e) 5,000 pennies

all equivalent?

Synthetic Forward: Buy a Call and a Sell a Put for same asset, T, K



eg. $F_{0,T} = 100$ $K = 105$

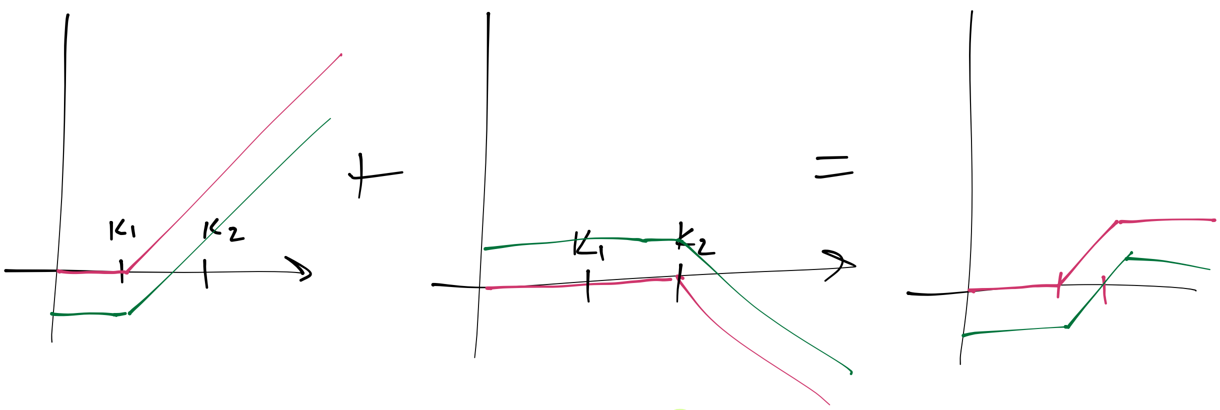
no matter what S_T is, the payoff is $(S_T - K)$ (compare to forward $F_{0,T} - K$)

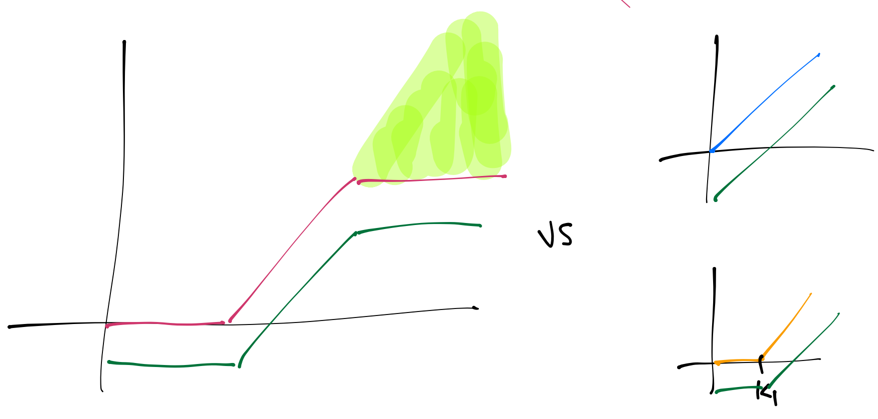
To convince the counterparty to enter the agreement, there is a premium of $PV(F_{0,T} - K)$

$$\text{Call}(K,T) - \text{Put}(K,T) = PV(F_{0,T} - K)$$

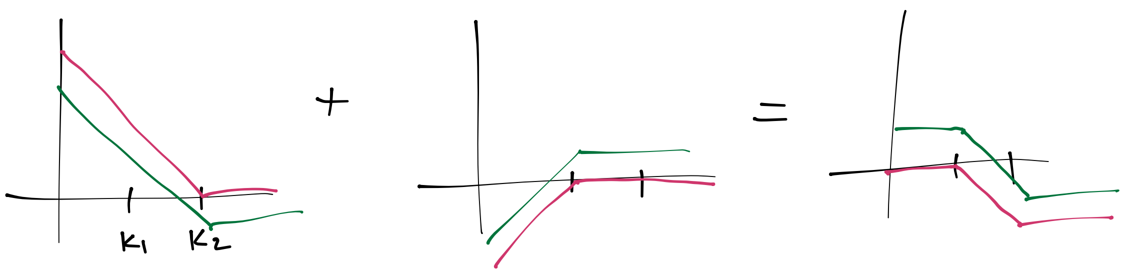
Put - Call Parity (true for European options)

① Bull Spread





Bear Spread



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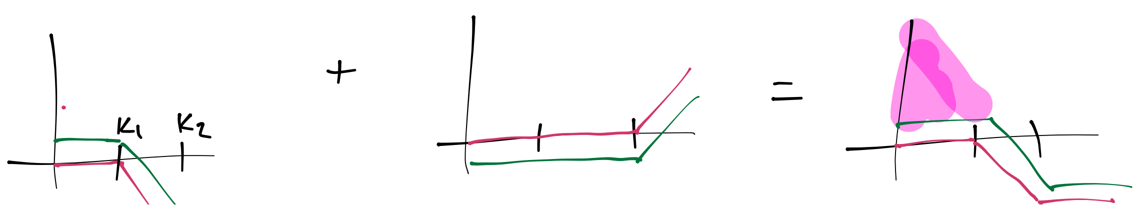
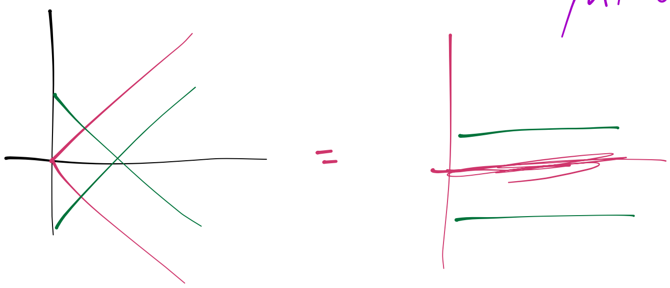
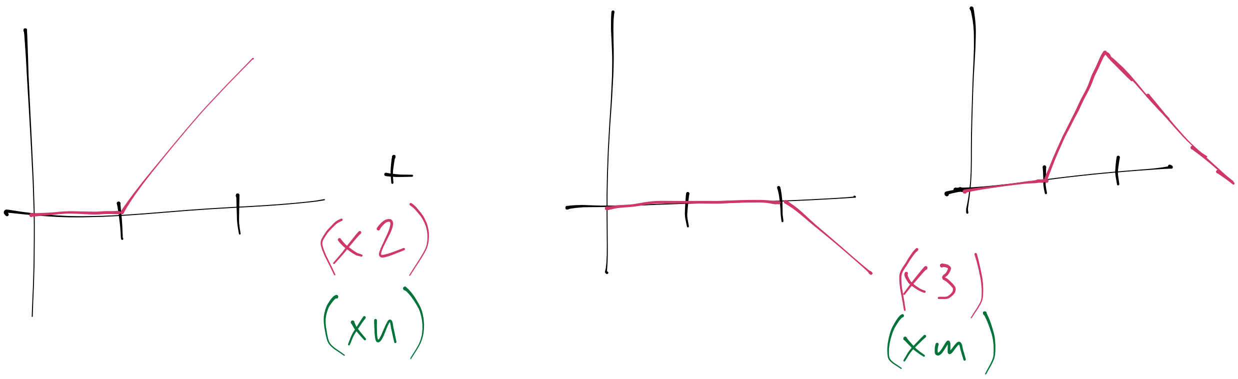


Box Spread: Buy synthetic long forward
Short synthetic forward

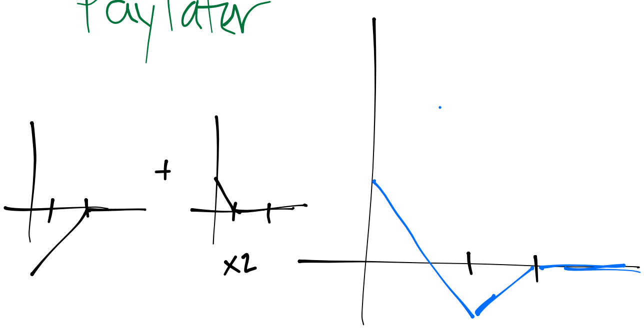


regulatory arbitrage

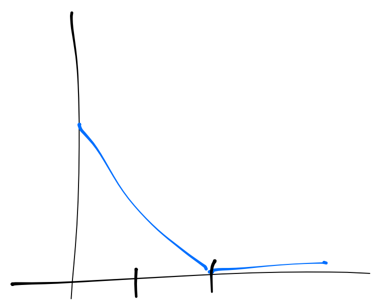
Ratio Spread



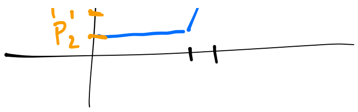
Paylater

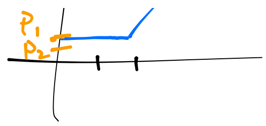


Put

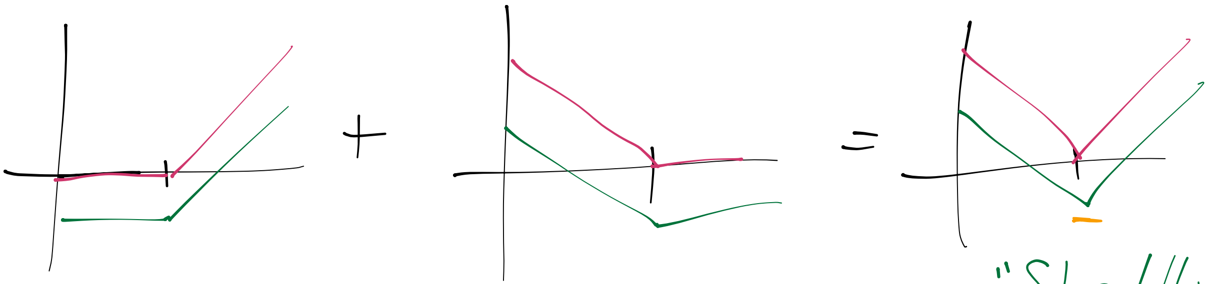


Plus the asset:



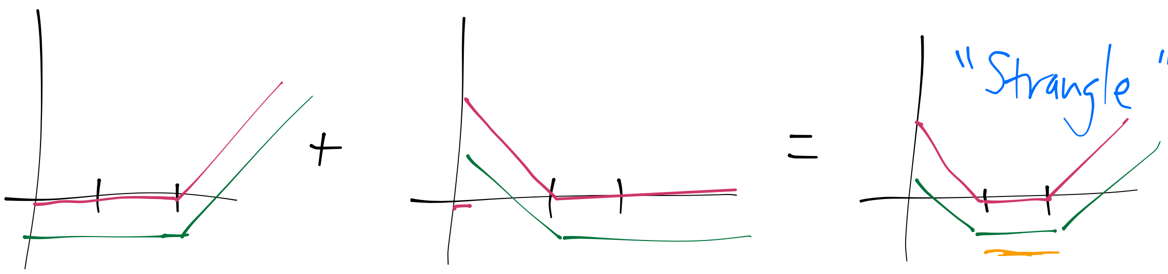


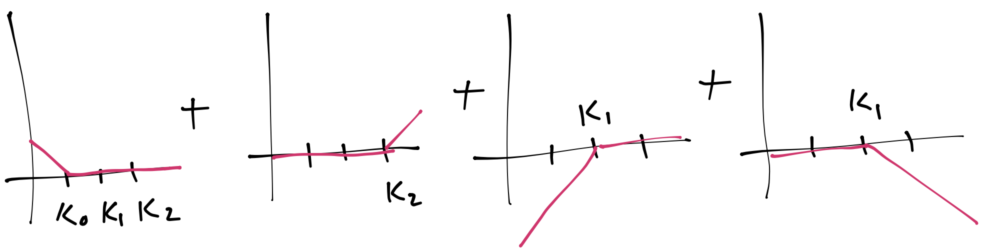
Betting on Volatility



"Straddle"

"Strangle"





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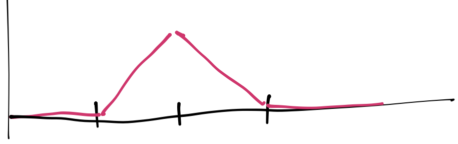
Butterfly Spread



(written straddle

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Summary

If you believe ___ then you should buy ___

Price \ volatility →	Fall	No Opinion	Rise
Fall	Sell Call	Sell Asset	Buy Put
No Opinion	Sell Straddle	Do Nothing	Buy Straddle
Rise	Sell Put	Buy Asset	Buy Call