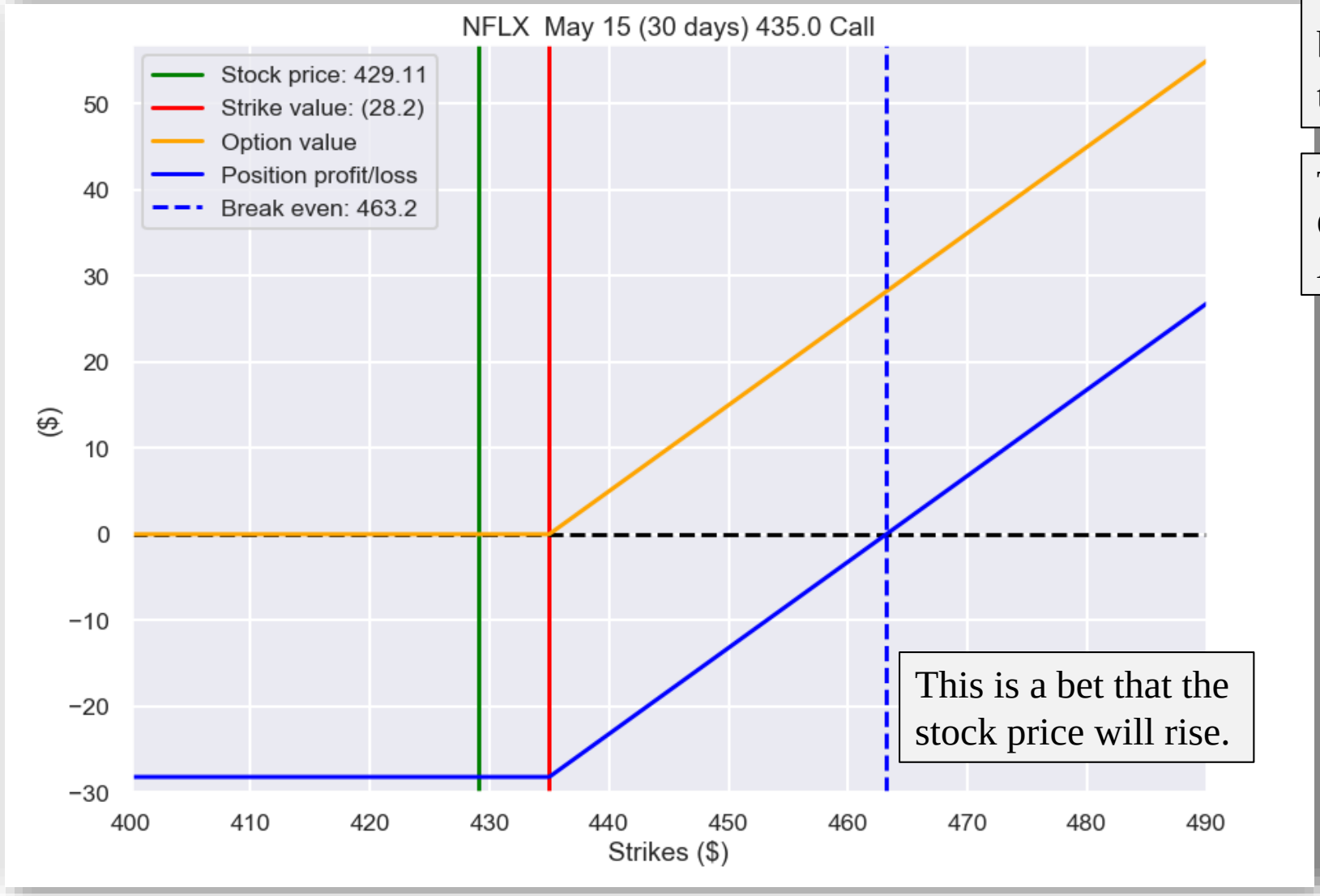
This is the view from the window of one of my offices where I go to work on the weekend. I go here to think about options and their valuation. That's because a lot of things going on in this building and those across the street seem to have a connection to math … especially Baye's Theorem.

Core Options Trading Strategies – Part 1

Potential Call Option Values
(upon expiration)

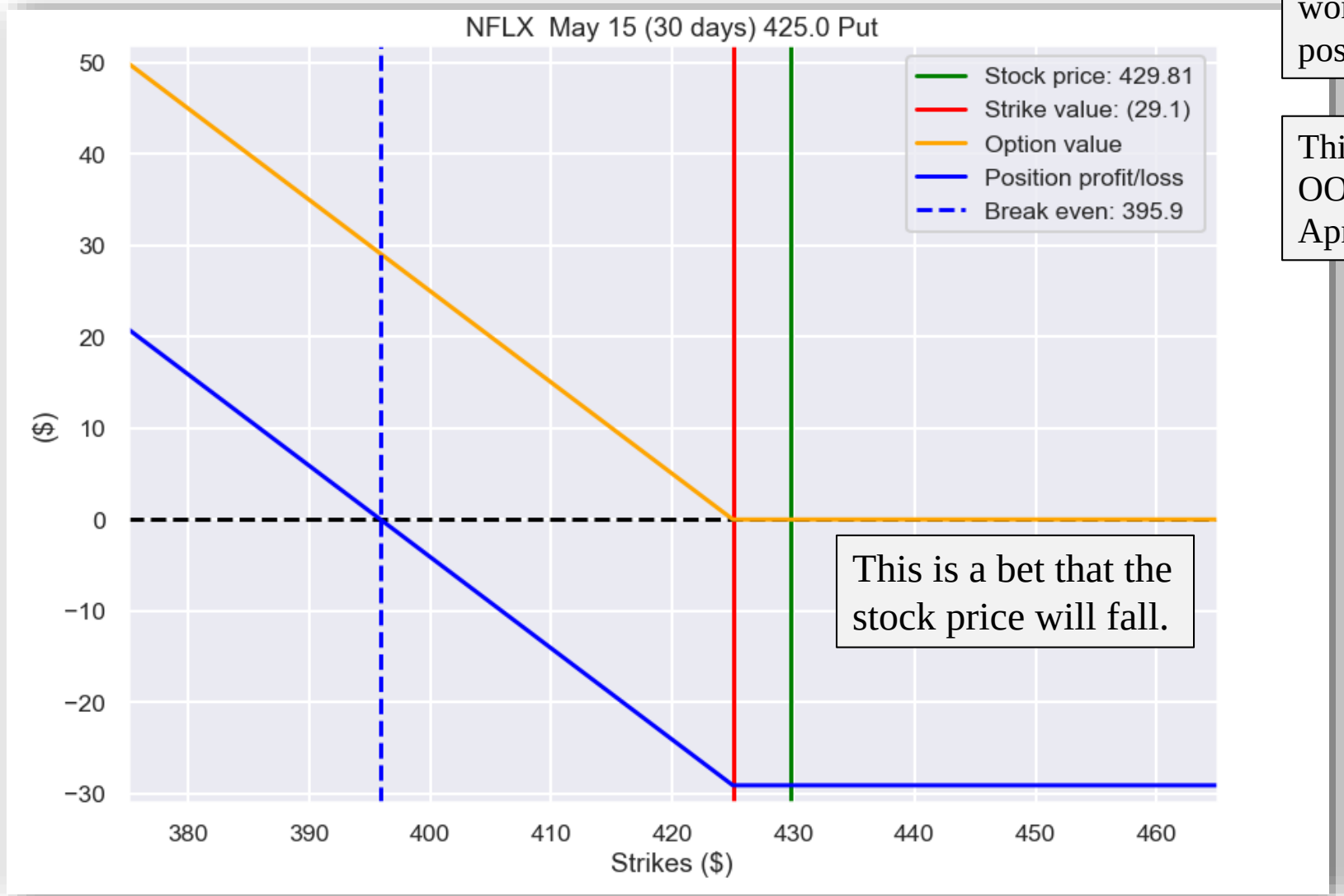


This shows only what the option will be worth if held to expiration, given the possible prices of NFLX.

This is the May 15 2020 (exp) NFLX OOM 435 Call, purchased at $28.20 on Apr 14, when NFLX was $429.11

This is a bet that the stock price will rise.

Potential Put Option Values
(upon expiration)



This is a bet that the stock price will fall.

This shows only what the option will be worth if held to expiration, given the possible prices of NFLX.

This is the May 15 2020 (exp) NFLX OOM 425 Put, purchased at $29.10 on Apr 15, 2020 when NFLX was $429.81

Short-term option values

NFLX ▾ Calls and Puts ▾ 433.50 +19.95 (+4.82%)

MAY 01 '20W 16 DAYS | MAY 08 '20W 23 DAYS | MAY 15 '20 30 DAYS | MAY 22 '20W 37 DAYS | MORE ▾

TABBED VIEW ▾ All STRIKES ▾ SMART ▾ NFLX ▾ 100 IV: 4.0%

CALLS										STRIKE	PUTS									
CHANGE %	VOLUME	OPTN OP...	HIGH	LOW	LAST	ASK SIZE	BID SIZE	ASK	BID		BID	ASK	BID SIZE	ASK SIZE	LAST	LOW	HIGH	OPTN OP...	VOLUME	CHANGE %
59.40%	194	319	41.38	24.15	41.38	1	84	42.65	40.95	415	22.95	23.60	1	53	23.59	23.42	28.03	104	122	-13.24%
62.28%	575	1.49K	38.46	22.65	38.46	15	5	39.45	38.95	420	25.05	25.70	2	4	27.00	25.65	31.00	93	126	-9.82%
65.50%	192	582	35.50	23.10	35.50	24	10	36.70	35.95	425	27.40	28.00	10	39	29.10	27.70	32.41	156	68	-10.98%
73.31%	425	499	33.50	19.60	33.50	1	4	34.00	33.40	430	29.70	30.45	54	40	32.20	30.10	33.00	12	73	-9.45%
80.23%	196	236	31.25	19.00	31.00	4	3	31.70	30.85	435	32.40	33.05	39	16	36.85	36.80	37.85	13	9	-4.14%
81.53%	113	280	29.17	16.96	28.30	4	60	29.45	28.70	440	35.05	35.80	4	42	36.40	36.40	39.80	31	38	-12.98%
86.52%	88	739	26.60	16.15	26.30	3	60	27.35	26.60	445	37.90	38.85	10	49	39.96	39.96	40.69	7	11	-11.85%
94.44%	633	1.90K	24.62	12.69	24.50	1	1	25.20	24.65	450	40.95	41.70	29	3	46.29	41.50	46.30	28	8	-5.22%
80.30%	207	172	20.50	12.95	20.50	2	6	23.50	22.70	455	44.00	44.85	5	49	46.75	44.39	46.75	3	4	-11.14%
97.24%	147	288	20.67	10.00	20.00	4	4	21.60	20.90	460	47.05	48.10	3	46	c56.38	51.69	52.38	8	2	

.. and the option reaction on the same day, all the calls down some and all the puts up some.

The previous slides may give the impression that one will make a profit only if the option finally goes above [below] the strike price for the call [put]. But logic tells you that as an OOM call approaches the strike price, the call will rise in value even though it is still out of the money. Generally, if the price of the stock goes up [down] the value of the call will rise [fall] so long as no other variables change (like volatility).

What else do we know?

```
45   target = callpr
46   precision = float(1e-3)
47   count = 0
48   low = 0.0
49   high = 1.0
50   cipd = float((high+low)/2)
51   temp_cp_tu = fu.copo_pitm(stopr,strike,cipd,days,rfir)  # passes out a tuple
52   tempcp = temp_cp_tu[0]
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```

```
64  def copo_pitm(stock: float, strike: float, dayvol: float, days: int, rfir: float) -> list:
65      d1 = math.log(stock/strike)+((rfir/365)+(dayvol**2)/2)*days
66      durvol = dayvol*math.sqrt(days)
67      delta = csnd(d1/durvol)
68      pitm = csnd((d1/durvol) - durvol)
69      discount = math.exp(-rfir*days/365)
70      callpr = (stock*delta)-(strike*discount*pitm)
71      return [callpr,delta,durvol,pitm]
72  #
```

$$d_2 = \frac{\ln(S/K)+(r/365-\sigma^2/2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Using our BSM variant call_idv_qd_v1_1.py we know:

```
Model and version:  call_idv_qd_v1_1
ASSUMPTIONS:
Stock price: 429.810
Strike price: 425.00
Days to expiry: 30
Interest rate: 0.000
Call Ask: 29.200
Call Bid: 29.000
MODEL RESULTS:
Call price (PEG): 29.100
The delta: 0.560
The probability of ITM at expiry: 0.4975
The call's implied probability: 0.02854
```

The probability of being in the money at expiry!
... almost exactly 50%!

remove from master

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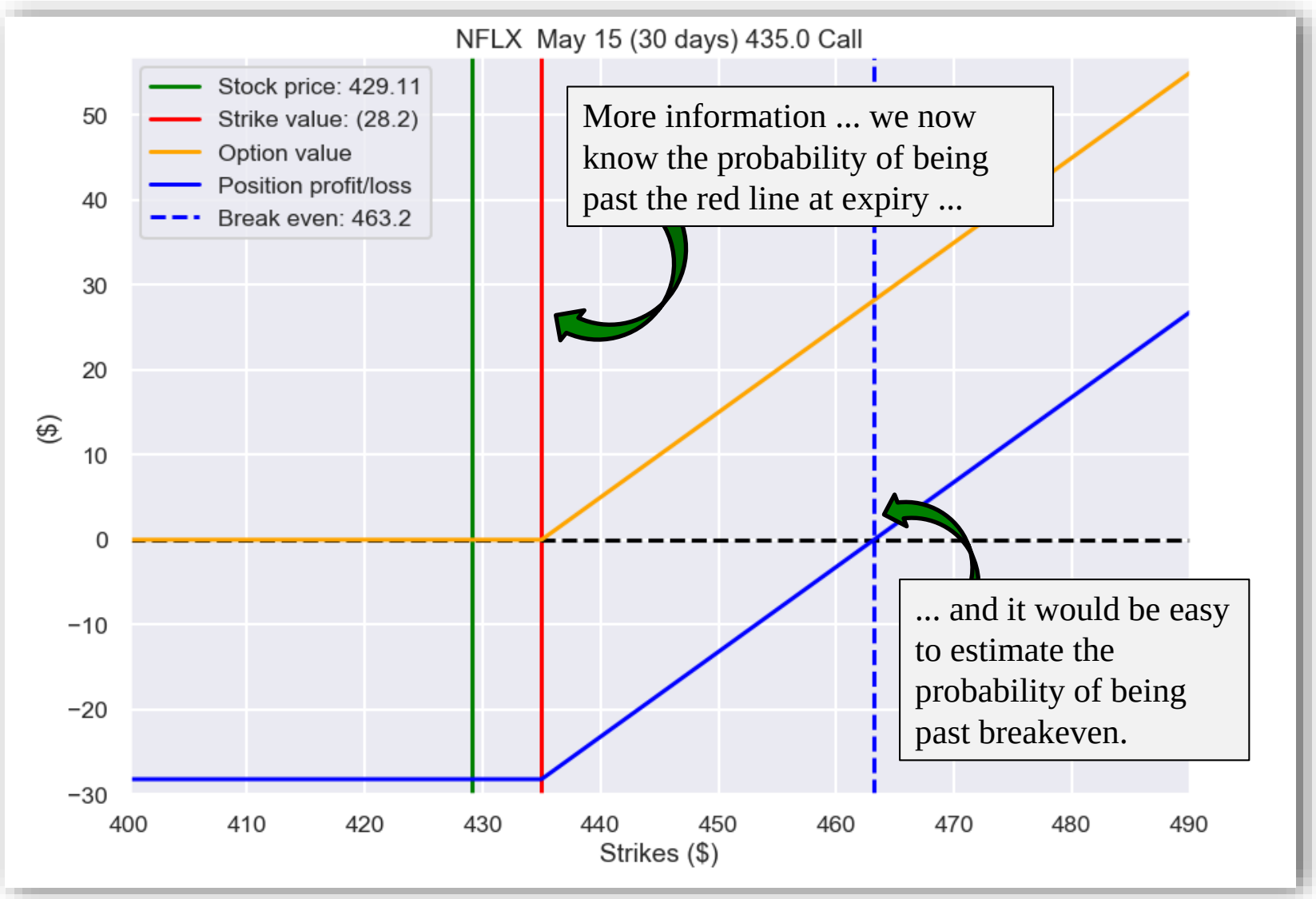
(upon expiration)



This is the May 15 2020 (exp) NFLX OOM 435 Call, purchased at $28.20 on Apr 14, when NFLX was $429.11

split into 2, remove from master

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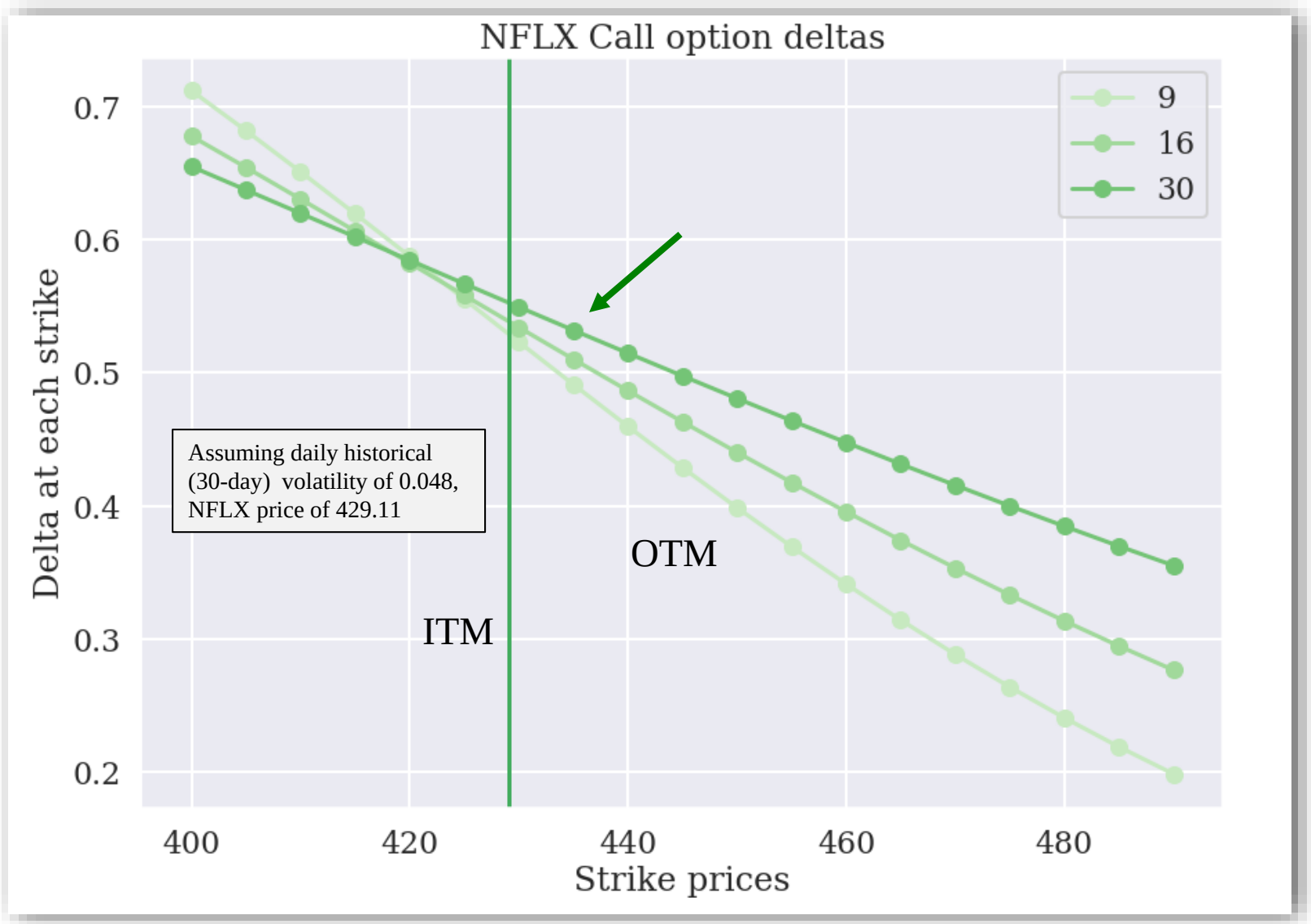
The probability of ITM at expiry: 0.4975
The call's implied volatility: 0.02854
```

The sensitivity of the option price to the underlying!

... (the **delta**) at $0.56!



We have the 30-day 435 call (shown with arrow) so our delta is about 0.56: on this day, a $1 rise (fall) in NFLX price will cause about a $0.56 rise (fall) in the call option.

[The delta changes every day of course ... note how it gets steeper as time elapses].

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63   prob_itm = temp_cp_tu[3]
64   #
```

```
4   # This is the BSM IDV model for calls only, using divide and conquer iteration
5   # for conversion.
```

Using our BSM variant call_idv_qd_v1_1.py we know:

```
Model and version:  call_idv_qd_v1_1
ASSUMPTIONS:
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MODEL RESULTS:
Call price (PEG): 29.100
The delta: 0.560
The probability of ITM at expiry: 0.4975
The call's implied volatility: 0.02854
```

The all-important implied volatility of the call!

... (the **IV**) at $0.02854!

What else do we know?

```
54    # Build the dataframe and display it
55    #
56  for i in range(0,spans):
57        start_count = length - tspan[i]
58        drift[i] = np.mean(cgr[start_count:length])
59        vol[i] = np.std(cgr[start_count:length])
60        sharpe[i] = drift[i]/vol[i]
61        xsigma[start_count:length,i] = (cgr[start_count:length]- drift[i])/vol[i]
62        maxsigma[i] = np.amax(xsigma[0:length,i])
63        minsigma[i] = np.amin(xsigma[0:length,i])
64    #
65    coltitles = ['Drift','Volatility','Sharpe','Maxsigma','Minsigma']
66    rowtitles = ['1 year', '90 day', '30 day']
```

Using our IEXCloud **hviex_short.py** or **hviex_qd.py** we know:

	Drift	Volatility	Sharpe	Maxsigma	Minsigma
1 year	0.000638	0.026284	0.024283	2.989811	-4.517363
90 day	0.003548	0.033455	0.106043	2.261964	-3.636007
30 day	0.004210	0.048828	0.086214	1.536258	-2.504817

The all important historical volatility!

... for three time intervals!

So let's compare that to our implied volatility ....

```
Model and version:  call_idv_qd_v1_1
ASSUMPTIONS:
Stock price: 429.810
Strike price: 425.00
Days to expiry: 30
Interest rate: 0.000
Call Ask: 29.200
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MODEL RESULTS:
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The probability of ITM at expiry: 0.4975
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```
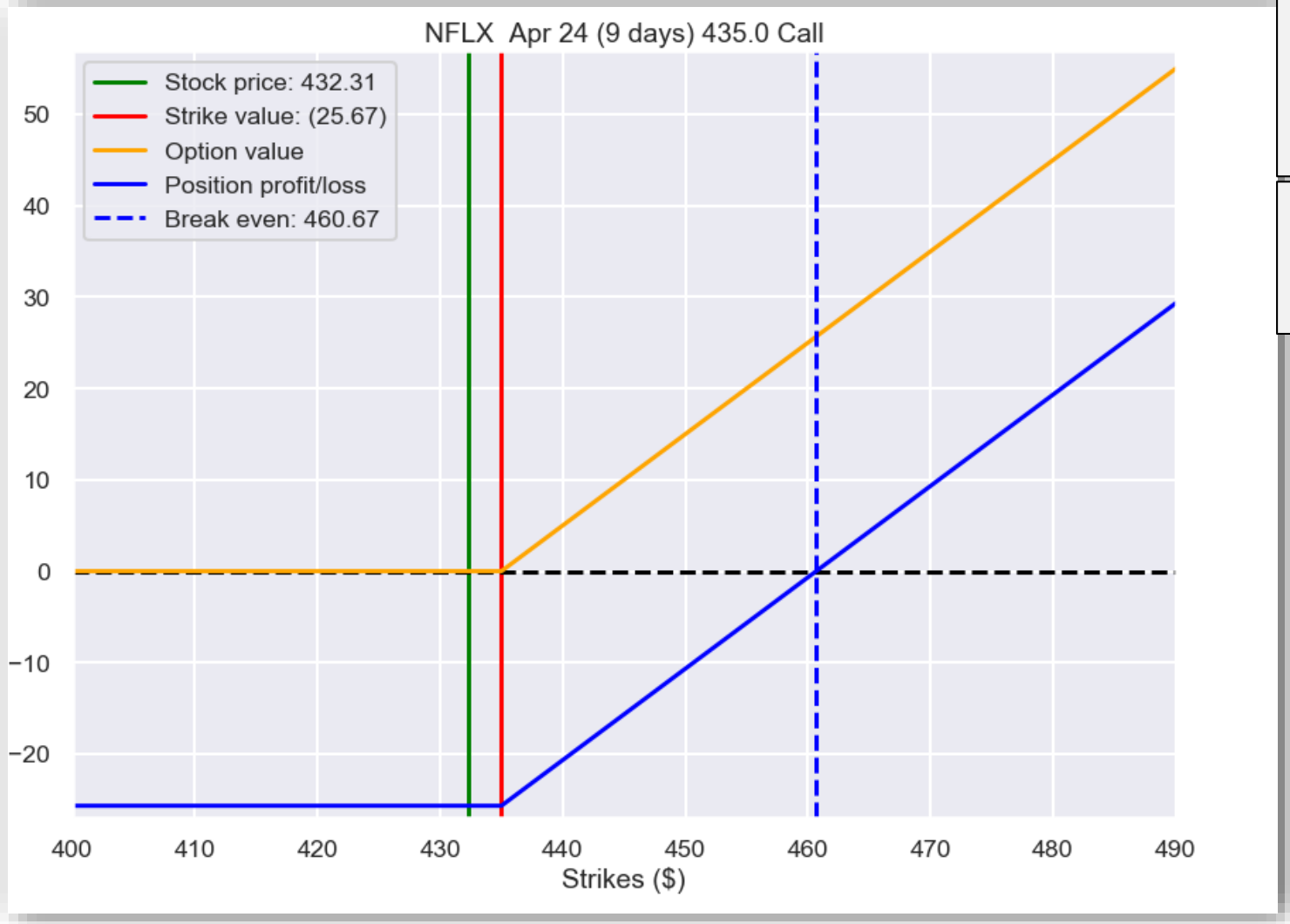
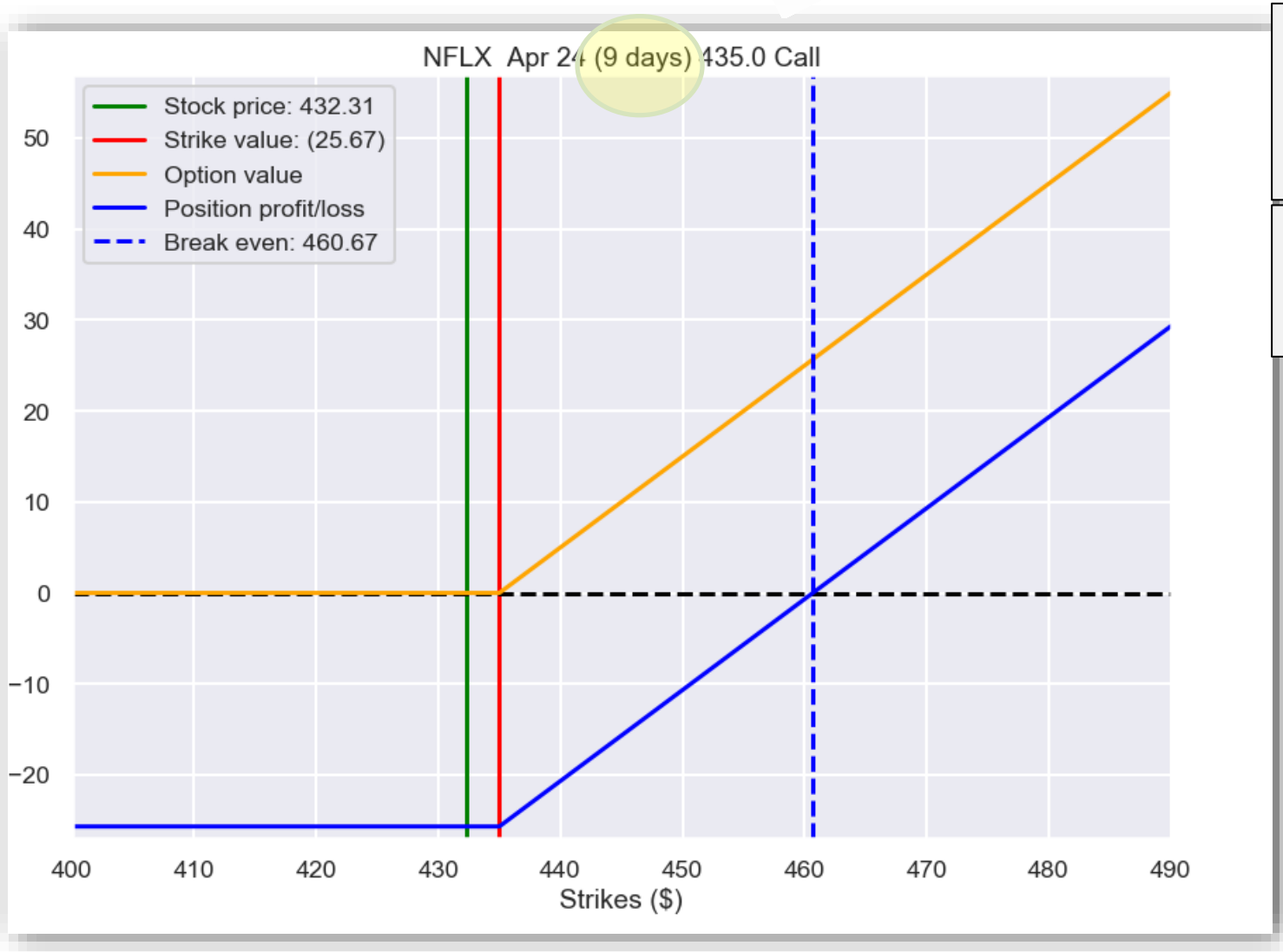

Wanting to do an earnings strangle ... (the call)



This was half of a strangle that I wanted to do for NFLX earnings on eod Tuesday, April 21. Note that this expire on the following Friday.

This is the Apr 24 2020 (exp) NFLX OOM 435 Call, priced at $25.67 on Apr 15, when NFLX was $432.31

Wanting to do an earnings strangle ... (the call)



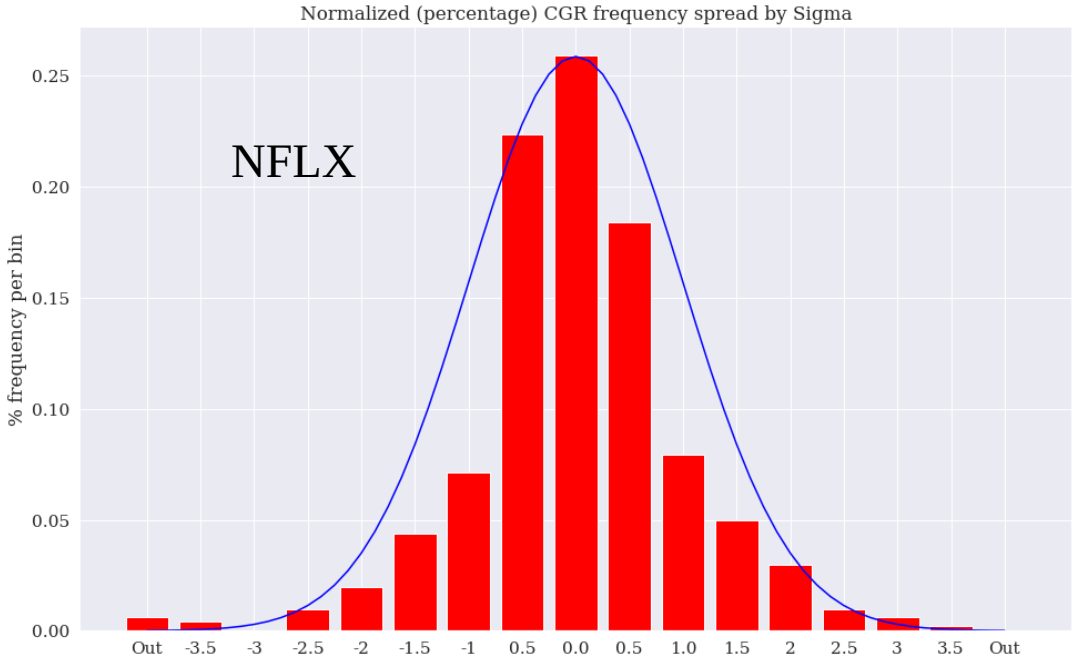
This was half of a strangle that I wanted to do for NFLX earnings on eod Tuesday, April 21. Note that this expire on the following Friday.

This is the Apr 24 2020 (exp) NFLX OOM 435 Call, priced at $25.67 on Apr 15, when NFLX was $432.31

Model used: ib_strangle_inpos_v1_5.py
Friday, April 17, 2020, 11:45:29 AM local
NFLX, Last: 415.60, Bid: 415.50, Ask: 415.66, Peg: 415.58
Expiry: 20200424, days to expiry: 7.0
Call strike: 435.00, Put strike: 430.00
Call Bid: 17.80, Ask: 18.00, Peg: 17.90
Put Bid: 33.80, Ask: 34.15, Peg: 33.97
Position value: 51.87.
Position profit/loss: 0.84.
Call (30 day) IDV: 0.059006
Put (30 day) IDV: 0.058592
Call sigma ratio: 1.2260
Put sigma ratio: 1.2174
One day time decay: 3.738.

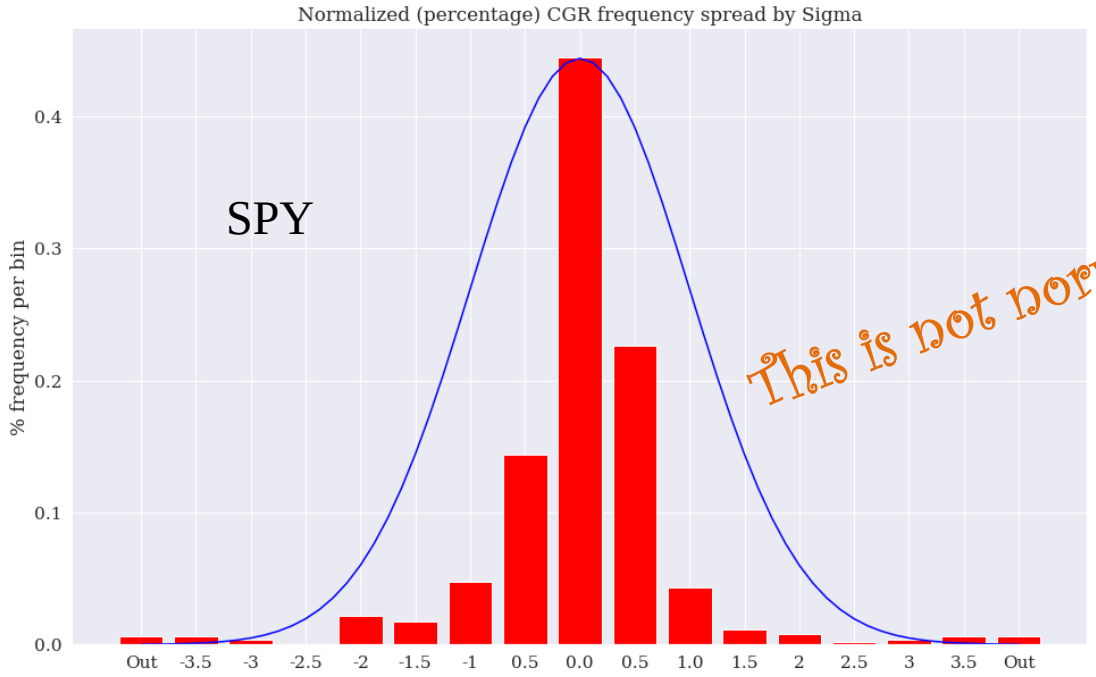
Model used: ib_strangle_inpos_v1_5.py
Friday, April 17, 2020, 11:45:31 AM local
NFLX, Last: 415.65, Bid: 415.50, Ask: 415.65, Peg: 415.57
Expiry: 20200515, days to expiry: 28.0
Call strike: 420.00, Put strike: 410.00
Call Bid: 29.25, Ask: 29.70, Peg: 29.48
Put Bid: 28.30, Ask: 28.60, Peg: 28.45
Position value: 57.93.
Position profit/loss: 0.14.
Call (30 day) IDV: 0.035896
Put (30 day) IDV: 0.035887
Call sigma ratio: 0.7458
Put sigma ratio: 0.7457
One day time decay: 1.116.

Let's take a look at some of the daemon logs from ib_strangle_inpos.py (an IB strangle-tracking model that tracks the behavior and value of a strangle once established)



	Drift	Volatility	qVolatil	Sharpe	Maxsigma	Minsigma
2 year	0.000586	0.026877	0.023285	0.021806	3.430656	-4.415671
1 year	0.000556	0.026021	0.021911	0.021377	3.023215	-4.559921
90 day	0.003461	0.032961	0.025915	0.105009	2.298496	-3.687890
30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

NFLX



	Drift	Volatility	qVolatil	Sharpe	Maxsigma	Minsigma
2 year	0.000118	0.015302	0.009444	0.007702	5.660200	-7.580927
1 year	-0.000090	0.019527	0.009980	-0.004588	4.446182	-5.930094
90 day	-0.001107	0.030731	0.013002	-0.036034	2.858334	-3.735012
30 day	0.001142	0.047032	0.018058	0.024287	1.819806	-2.488291

SPY

This is not normal!!!

All of the measures shown were done on April 15, 2020, about 10:00 AM PDT, using hviexmaster_3_5.ipynb

The decision ...

```
Wednesday, April 15, 2020, 11:11:07 AM local
Model used: ibapistrangle v1.9 dev
Stock:  NFLX
Historical daily volatility (30 day): 0.04813
Option expiry and days to:  9.0 days to 4 / 24
Stock peg: 432.200
Call strike and peg: 435.0 at 25.550
Put strike and peg: 430.000 at 25.480
Call implied daily volatility: 0.05190
Put implied daily volatility: 0.05149
Call sigma ratio:  1.0783
Put sigma ratio:  1.0699
One day time decay: 3.03
Position cost (at peg):  51.03
Call break-even: 76.58 from 25.55 or from 432.20 to 486.03
Put break-even: 76.51 from 25.48 or from 432.20 to 378.97
```

This was done with the large (non-daemon) strangle matching model I use called ib_apistrangle_v1_9, specifically designed to evaluate strangle candidates by my standards ...

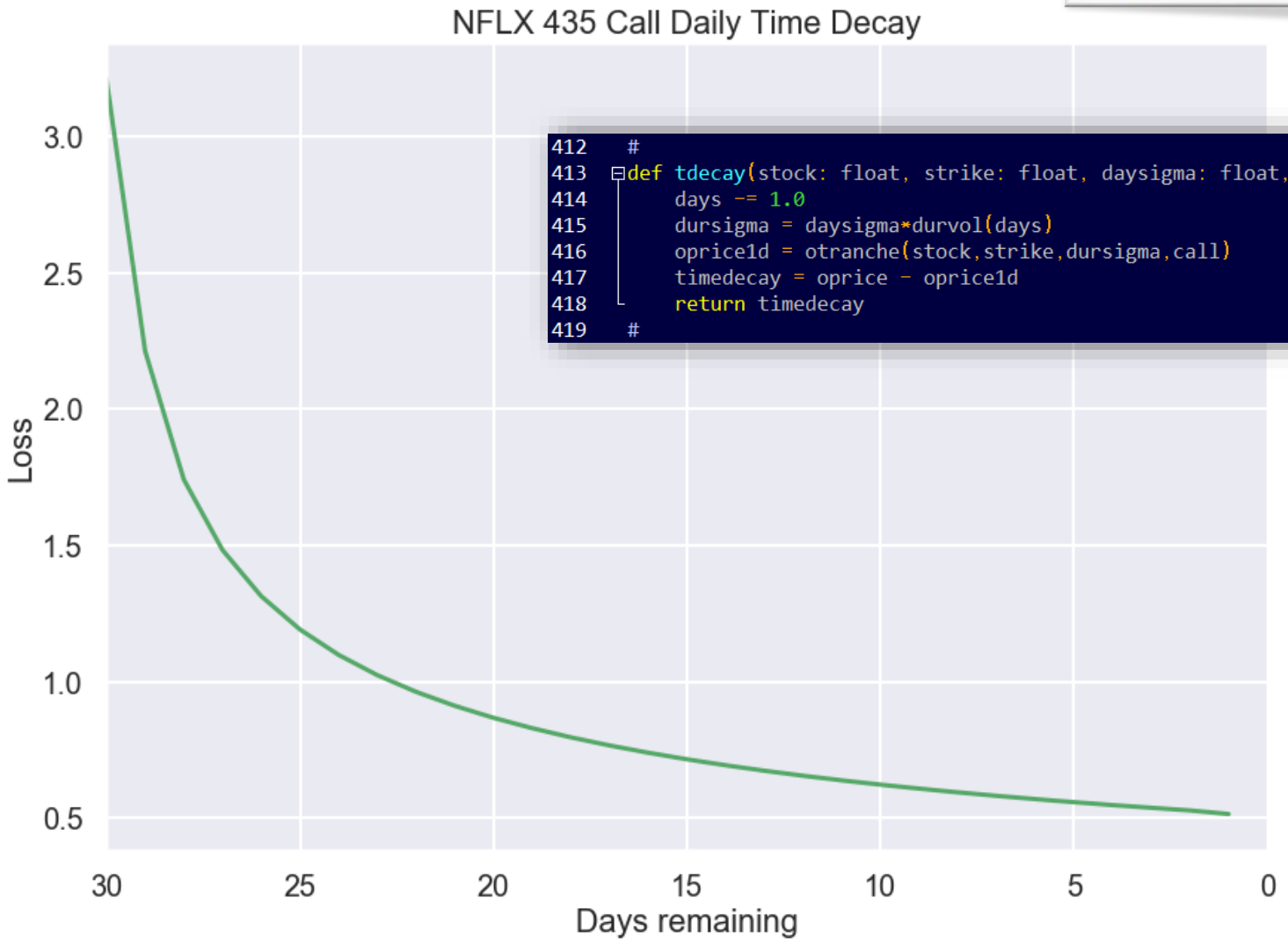
	Drift	Volatility	qVolatil	Sharpe	Maxsigma	Minsigma
2 year	0.000586	0.026877	0.023285	0.021806	3.430656	-4.415671
1 year	0.000556	0.026021	0.021911	0.021377	3.023215	-4.559921
90 day	0.003461	0.032901	0.025915	0.105009	2.298496	-3.687890
30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

No Way!!!

Trading advice: Don't even think about trading options unless you have a good knowledge of and respect for **historical volatility** and **implied volatility**, how they relate and interact, how they behave and how they trend sometimes. Volatility will force you to make critical calls all of the time, just like it did here.

What else do we know?

```
Call sigma ratio:  1.0783
Put sigma ratio:  1.0699
One day time decay: 3.03
```



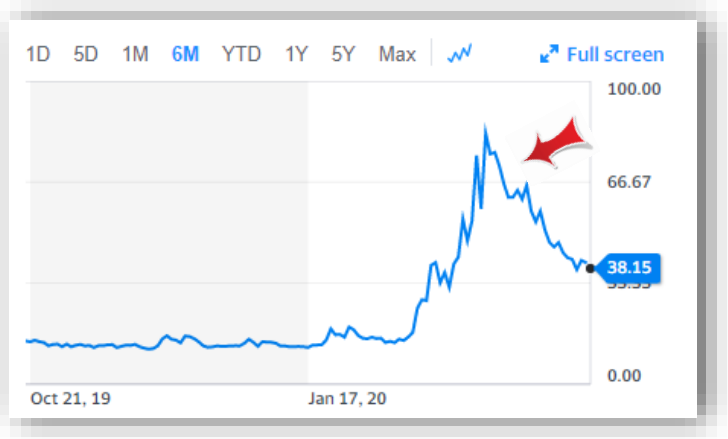

```
412   #
413  def tdecay(stock: float, strike: float, daysigma: float, oprice: float, days, call: bool) ->float:
414       days -= 1.0
415       dursigma = daysigma*durvol(days)
416       oprice1d = otranche(stock,strike,dursigma,call)
417       timedecay = oprice - oprice1d
418       return timedecay
419   #
```

Sensitivity to Stock Volatility [vega]

[old slide]

Option premiums (and values) rise sharply when underlying stock volatility rises as here ...

... and fall when volatility falls.



... a bad environment for strangles

The VIX index, shown above, measures the relative volatility of the S&P 500 (and hence SPY). When the volatility of any underlying stock rises, premiums and option prices rise with it, sometimes even enough to overcome a movement in a stock's price in the wrong direction!
Note: there are many ways to measure stock volatility. The VIX is a good proxy. There are VIX ETFs – VXX is heavily traded.

Key take-aways that you *must* understand ...

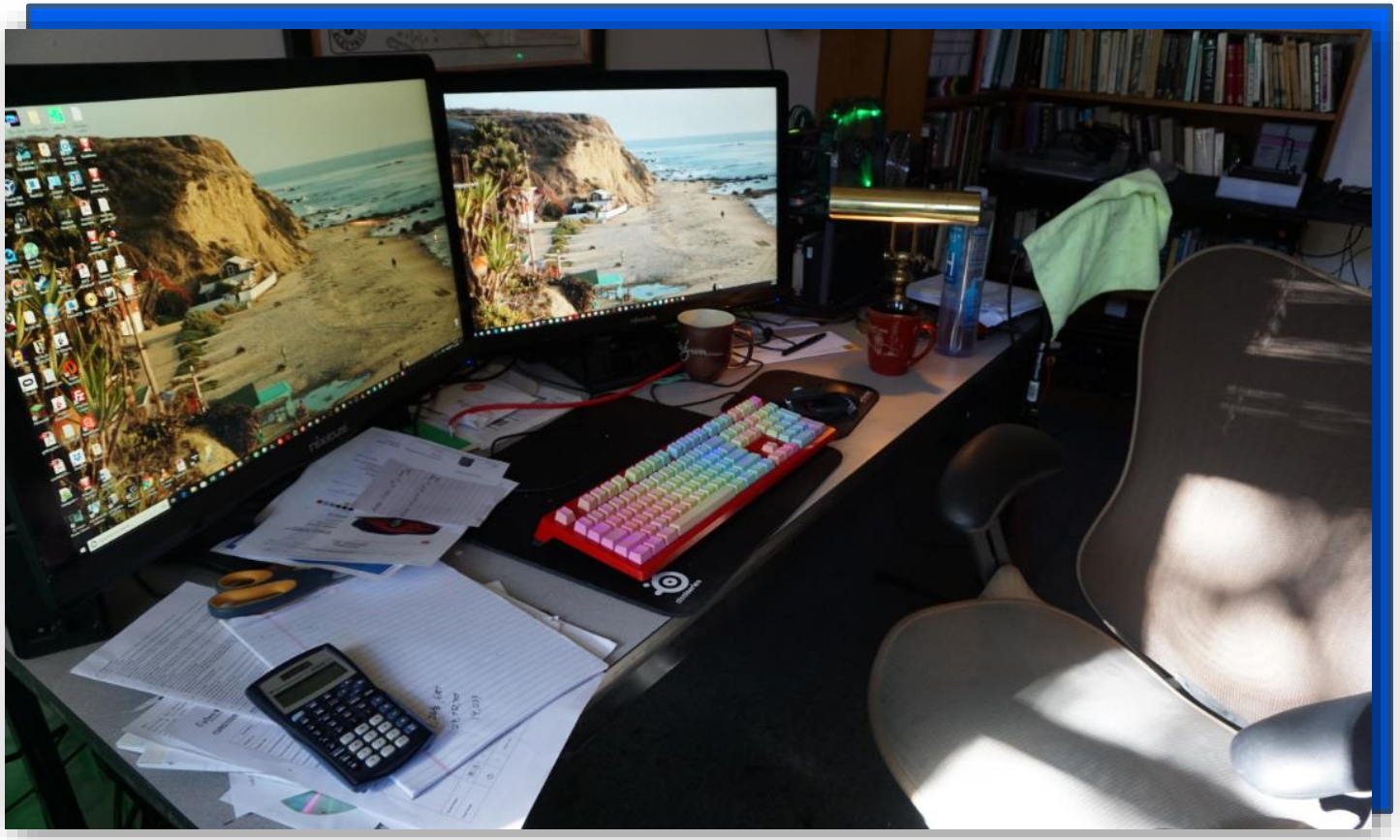
1. An appreciation for the subtleties of this kind of complex strategy

2. You had already learned about the Greeks, but here we are emphasizing the (a) relative importance and (b) certain things that you should know about their application.

3. The relentess pressure of time decay to long positions with premiums.

4. Really important and crux of the lecture: the subtleties and complex interaction between historical volatility and implied volatility including ...
   a) ... generally, how we have been calculating IV (partly from previous)
   b) ... generally, how we have been calculating HV (partly from previous)
   c) ... why the time period chosen makes so much of a difference in HV
   d) ... how changing market positions and especially a “black swan”
   e) ... sensitivity to Vega (IV) matters right now.

That's it ...



Core Options Trading Strategies – Part 2

A pro comments on options market-making:

AMA responses for Reddit user nsfwmisc 4/23/20 and 1 year before:

https://www.reddit.com/r/algotrading/comments/az8azn/ive_worked_at_a_top_hftmm_prop_trading_firm_for/

https://www.reddit.com/r/algotrading/comments/g6dre6/i_work_at_a_top_hft_firm_ama/

[–] **jajohn99** 3 points 17 hours ago

Some of the firms I know have been saying that their trading is being run with more human involvement than usual, are you finding this to be true at all?

permalink embed save report give award reply

[–] **nsfwmisc** [S] 19 points 17 hours ago

It depends on the space you're in. I'm a derivatives market maker, and in my space that is very true. The options space is moving toward a semi-manual hybrid where all the automated tools are built to ultimately function with a human at the helm. I think there was a period of time a decade or so ago where people thought more powerful computers and better data would lead to the automation that dominates D1 trading to take over derivatives as well. That has turned out to be decidedly not true, as the derivatives space is proving to be too complex, with human decision making necessary to maximize profits. Humans are still far better at flexibly adapting to new situations than the best of the best computers -- think about how easily and fluidly a teenager can drive a car after a few hours of experience, and compare that to the years and billions upon billions of dollars the world's biggest tech giants have dumped into building self-driving cars, with limited success. Some of the firms that were gunning for full automation have made a u-turn and have been trying for the last few years to poach good human traders from the firms that were more manual. And conversely, the more manual firms are trying to hire developers like mad to catch up on the tech side. There's a convergence on what the ideal business structure appears to be.

If you were asking about just recent market conditions, the answer is also yes. All the models have gone to shit. This is new territory. Everyone is guessing.

Reviewing the NFLX strangle decision ...
(a lesson in HDV and IDV)

The decision ...

```
Wednesday, April 15, 2020, 11:11:07 AM local
Model used: ibapistrangle v1.9 dev
Stock:  NFLX
Historical daily volatility (30 day): 0.04813
Option expiry and days to:  9.0 days to 4 / 24
Stock peg: 432.200
Call strike and peg: 435.0 at 25.550
Put strike and peg: 430.000 at 25.480
Call implied daily volatility: 0.05190
Put implied daily volatility: 0.05149
Call sigma ratio:  1.0783
Put sigma ratio:  1.0699
One day time decay: 3.03
Position cost (at peg):  51.03
Call break-even: 76.58 from 25.55 or from 432.20 to 486.03
Put break-even: 76.51 from 25.48 or from 432.20 to 378.97
```

	Drift	Volatility	qVolatil	Sharpe	Maxsigma	Minsigma
2 year	0.000586	0.026877	0.023285	0.021806	3.430656	-4.415671
1 year	0.000556	0.026021	0.021911	0.021377	3.023215	-4.559921
90 day	0.003461	0.032961	0.025915	0.105009	2.298496	-3.687890
30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

No Way!!!

But we did decide to track both the Apr 24 and May 15 expiries ()

The tracking results ...

Cost	24-Apr	W	T	F	M	T eod	W mo	T
25.55	**435 Call**	15-Apr	16-Apr	17-Apr	20-Apr	21-Apr	22-Apr	23-Apr
	Peg	26.10	31.20	17.90	27.00	31.45	11.05	3.38
	30d IDV	0.05221	0.05746	0.05900	0.07806	0.09332	0.04926	0.04787
	Sigma	1.0850	1.1980	1.2260	1.6219	1.9332	1.0230	0.9947
23.00	**430 Put**							
	Peg	25.17	23.00	33.97	24.25	22.62	10.90	12.60
	30d IDV	0.05150	0.05691	0.05859	0.07710	0.09264	0.05026	0.04800
	Sigma	1.0710	1.1779	1.2174	1.6019	1.9247	1.0443	0.9974
48.55	**Strangle**							
	Stock Pr	432.96	440.48	415.58	434.78	441.26	432.68	422.12
	days	9	8	5	4	3	2	1
	pr/loss	0.24	3.17	0.84	0.22	3.04	-29.08	-35.05
	T-decay	3.048	3.581	3.738	7.135	10.128	7.096	n/a

	15-May	F	M	T	W	T	F
29.48	**435 Call**	17-Apr	20-Apr	21-Apr	22-Apr	23-Apr	24-Apr
	Peg	29.48	42.52	40.98	32.33	25.95	19.88
	30d IDV	0.03590	0.03865	0.04181	0.03138	0.02756	0.02441
	Sigma	0.7458	0.8031	0.8686	0.6520	0.5727	0.5072
28.45	**430 Put**						
	Peg	28.45	20.50	24.00	16.23	13.82	13.18
	30d IDV	0.03589	0.03849	0.04126	0.03221	0.02744	0.02441
	Sigma	0.7457	0.7998	0.8573	0.6692	0.5702	0.5073
57.93	**Strangle**						
	Stock Pr	415.57	437.54	432.00	432.68	427.71	422.02
	days	28	25	24	23	22	21
	pr/loss	0.14	5.23	7.19	-9.23	-18.02	-24.73
	T-decay	1.116	1.225	1.394	1.081	0.962	0.883

earnings impact

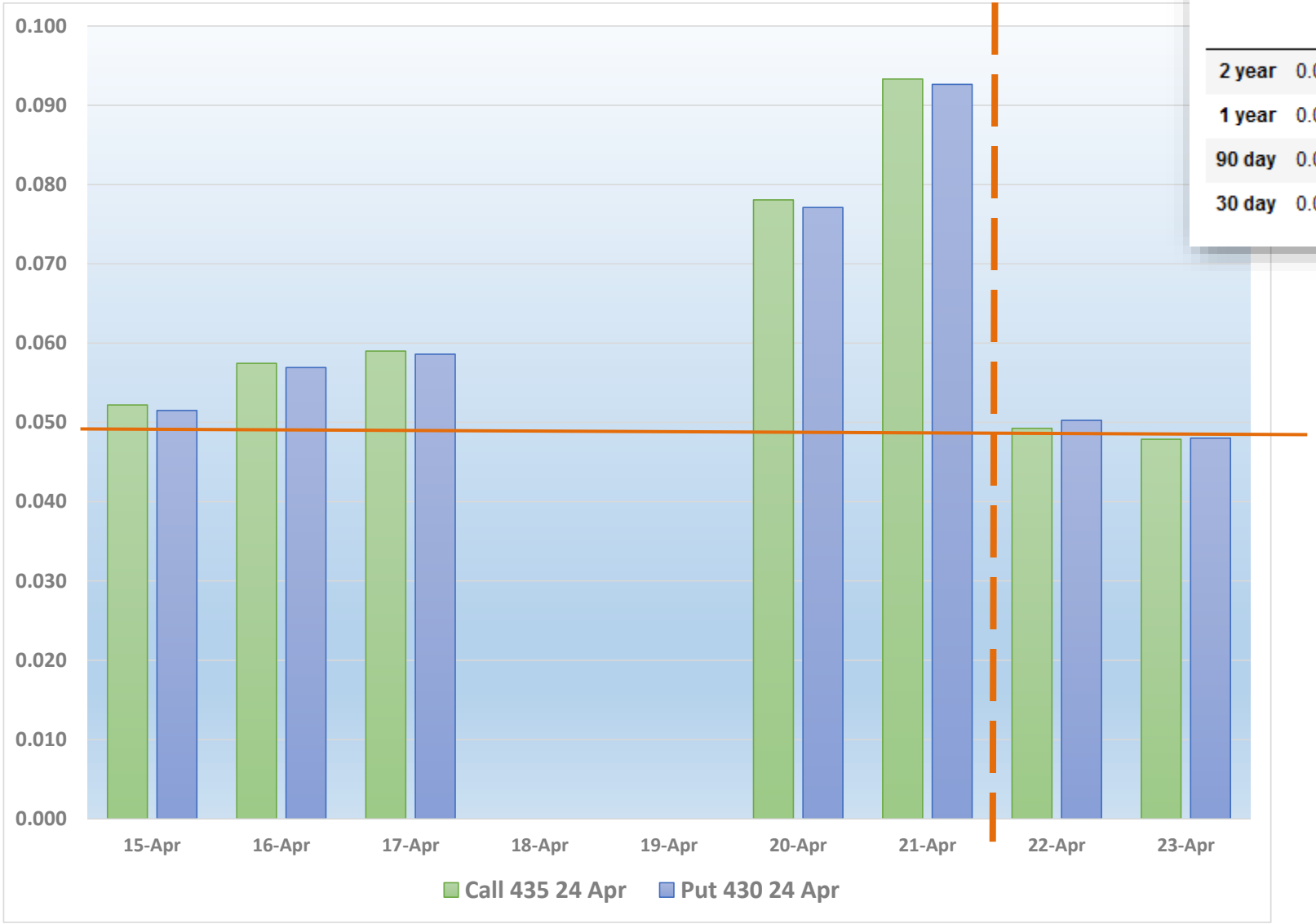
	Drift	Volatility	qVolatil	Sharpe	Maxsigma	Minsigma
2 year	0.000586	0.026877	0.023285	0.021806	3.430656	-4.415671
1 year	0.000556	0.026021	0.021911	0.021377	3.023215	-4.559921
90 day	0.003461	0.032961	0.025915	0.105009	2.298496	-3.687890
30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

Our little Linux-mint daemons are hard at work!!

Model used: ib_strangle_inpos_v1_5.py
Friday, April 17, 2020, 11:45:29 AM local
NFLX, Last: 415.60, Bid: 415.50, Ask: 415.66, Peg: 415.58
Expiry: 20200424, days to expiry: 7.0
Call strike: 435.00, Put strike: 430.00
Call Bid: 17.80, Ask: 18.00, Peg: 17.90
Put Bid: 33.80, Ask: 34.15, Peg: 33.97
Position value: 51.87.
Position profit/loss: 0.84.
Call (30 day) IDV: 0.059006
Put (30 day) IDV: 0.058592
Call sigma ratio: 1.2260
Put sigma ratio: 1.2174
One day time decay: 3.738.

Model used: ib_strangle_inpos_v1_5.py
Friday, April 17, 2020, 11:45:31 AM local
NFLX, Last: 415.65, Bid: 415.50, Ask: 415.65, Peg: 415.57
Expiry: 20200515, days to expiry: 28.0
Call strike: 420.00, Put strike: 410.00
Call Bid: 29.25, Ask: 29.70, Peg: 29.48
Put Bid: 28.30, Ask: 28.60, Peg: 28.45
Position value: 57.93.
Position profit/loss: 0.14.
Call (30 day) IDV: 0.035896
Put (30 day) IDV: 0.035887
Call sigma ratio: 0.7458
Put sigma ratio: 0.7457
One day time decay: 1.116.

IV Crush for the 24 Apr [Friday exp] strangle ...



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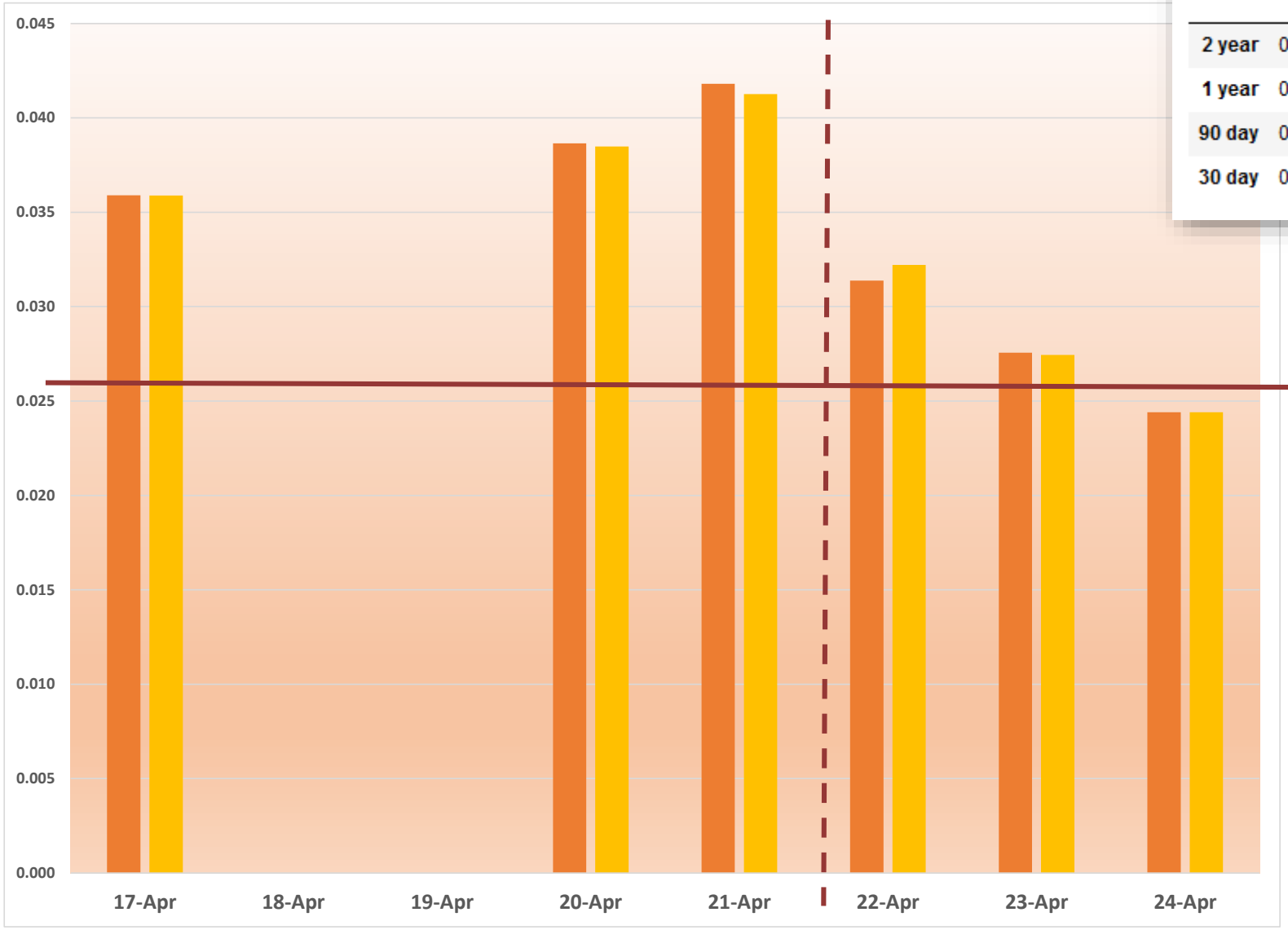
30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

IV Decline (to long-term HV) for the 15 Mar strangle ...



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30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

The tracking results ...

Cost	24-Apr	W	T	F	M	T	W	T
						eod	mo	
25.55	**435 Call**	15-Apr	16-Apr	17-Apr	20-Apr	21-Apr	22-Apr	23-Apr
	Peg	26.10	31.20	17.90	27.00	31.45	11.05	3.38
	30d IDV	0.05221	0.05746	0.05900	0.07806	0.09332	0.04926	0.04787
	Sigma	1.0850	1.1980	1.2260	1.6219	1.9332	1.0230	0.9947
23.00	**430 Put**							
	Peg	25.17	23.00	33.97	24.25	22.62	10.90	12.60
	30d IDV	0.05150	0.05691	0.05859	0.07710	0.09264	0.05026	0.04800
	Sigma	1.0710	1.1779	1.2174	1.6019	1.9247	1.0443	0.9974
48.55	**Strangle**							
	Stock Pr	432.96	440.48	415.58	434.78	441.26	432.68	422.12
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	pr/loss	0.24	3.17	0.84	0.22	3.04	-29.08	-35.05
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	15-May	F	M	T	W	T	F
29.48	**435 Call**	17-Apr	20-Apr	21-Apr	22-Apr	23-Apr	24-Apr
	Peg	29.48	42.52	40.98	32.33	25.95	19.88
	30d IDV	0.03590	0.03865	0.04181	0.03138	0.02756	0.02441
	Sigma	0.7458	0.8031	0.8686	0.6520	0.5727	0.5072
28.45	**430 Put**						
	Peg	28.45	20.50	24.00	16.23	13.82	13.18
	30d IDV	0.03589	0.03849	0.04126	0.03221	0.02744	0.02441
	Sigma	0.7457	0.7998	0.8573	0.6692	0.5702	0.5073
57.93	**Strangle**						
	Stock Pr	415.57	437.54	432.00	432.68	427.71	422.02
	days	28	25	24	23	22	21
	pr/loss	0.14	5.23	7.19	-9.23	-18.02	-24.73
	T-decay	1.116	1.225	1.394	1.081	0.962	0.883

earnings impact

Before the earnings report, rising IV is working against time decay (winning out in these two examples), but that doesn't always happen.

Comments about this on Reddit ...

Introduction to Volatility (self.thetagang)
submitted 12 hours ago by petriefly42

https://www.reddit.com/r/thetagang/comments/g7k52g/introduction_to_volatility/

NFLX earnings. Anyone trade this recently? Great example of what you may have heard called "IV Crush" occurring. This is why the WSB crowd lose a ton of money on earnings plays. Netflix (NFLX) announced earnings on 4/21, earlier this week.

The day before the announcement, a $420 call expiring on 5/15 was worth a whopping $44.00 at the close. Yes, it would cost you $4,400 to buy 100 shares of NFLX at a price $3 higher than it closed that day. IV Rank for NFLX was 71 and change at the market close on 4/21. Here's how that looked the next day:

https://preview.redd.it/osbpoo2izuu41.png?width=1489&format=png&auto=webp&s=259024ff371c245111a66cb4b7c69bcd3076ded2

Note - that's a graph of IV Rank, not price. The next day, IVR dropped to a low of 45. That same call option? It's now worth $22. If you sold one of these the day before, you profited 50% of max overnight. What happened to NFLX price? It went down a couple percent, not really a huge deal. This was a perfect example of how once earnings are announced, there's no more uncertainty fueling the buying and selling of options, and IV crashes back to earth.

This can also go the other way. If you sell options and IV goes UP for some reason, those options will be worth more, even if the underlying has stayed still or maybe even moved in your favor.

Let me just close by saying I don't think I have any sort of edge as far as picking stock direction. I can try my hand at it based on fundamentals, technical analysis, sentiment, or whatever else, but I'm not a professional. I do think that by combining a positive theta decay and a knowledge that there is some bias towards IV overstating HV, I can come out ahead.

nflx 1

10/17/2019

Did not play this because this was the week when we had to repair the large machine. Assuming the purchase the day before of the 287.5 put and the 290 call at about $15 per pair, this would have been about a 20% loser at open and a huge loser with any delay. Look at the 290 call at 12:49.

NFLX Calls and Puts — 294.54 +8.26 (+2.89%)

OCT 18 '19 (1 DAY) | OCT 25 '19 (8 DAYS) | NOV 01 '19 (15 DAYS) | NOV 08 '19 (22 DAYS) | MORE

TABBED VIEW | All STRIKES | SMART | NFLX | 100 | IV: 2.9%

CALLS											STRIKE	PUTS									
CHANGE %	VOLUME	OPTN OP...	HIGH	LOW	LAST	ASK SIZE	BID SIZE	ASK	BID		BID	ASK	BID SIZE	ASK SIZE	LAST	LOW	HIGH	OPTN OP...	VOLUME	CHANGE %
-47.98%	1.73K	2.39K	21.95	5.80	8.10	46	23	8.20	8.00	287.5	1.00	1.06	2	2	1.02	0.63	4.92	1.03K	6.40K	-93.88%
-57.40%	7.32K	7.04K	19.85	4.50	6.13	42	73	6.20	6.00	290	1.51	1.59	2	2	1.54	0.54	6.18	4.38K	26.6K	-91.44%
-66.31%	6.74K	2.00K	17.10	3.50	4.45	6	41	4.45	4.30	292.5	2.26	2.36	9	4	2.37	1.16	7.55	250	8.61K	-87.73%
-76.14%	18.2K	7.60K	15.11	2.58	2.88	14	8	3.00	2.89	295	3.35	3.40	1	2	3.35	1.48	9.17	3.26K	20.8K	-83.79%
-83.44%	9.87K	2.64K	12.60	1.74	1.81	4	8	1.91	1.79	297.5	4.75	4.90	1	87	4.80	1.95	10.60	263	6.81K	-78.21%
-88.96%	38.3K	45.6K	11.46	1.03	1.10	114	6	1.14	1.05	300	6.45	6.60	27	12	6.44	2.27	12.67	13.0K	15.5K	-72.68%
-93.13%	8.97K	6.81K	9.30	0.62	0.63	4	15	0.63	0.60	302.5	8.45	8.65	11	57	8.54	3.15	14.55	129	1.97K	-66.20%
-95.94%	15.9K	5.27K	8.05	0.33	0.34	12	87	0.36	0.33	305	10.70	10.90	35	31	11.25	4.10	16.68	1.76K	4.98K	-58.30%
-97.12%	4.95K	846	6.45	0.22	0.22	103	23	0.23	0.20	307.5	13.05	13.25	14	26	13.00	5.40	18.31	64	919	-54.77%

We also had to miss MSFT on Oct 23 and SNAP on Oct 22 because we were gone to Pechanga on fall break.

NFLX 3

7/15/2019

Monday 7/15

```
Stock symbol:  NFLX
Stock price:  365.25
Call strike price:  382.500
Call Bid:  6.750
Call Ask:  6.850
Call price:  6.810
Days to maturity:  4.0
Drift rate:  0.00014
Drift price:  365.45
Implied duration volatility:  0.0915
Implied daily volatility:  0.0458
```

On July 17, 2019, bought 100 NFLX in aftermarket 1:03 for 332.05 for $1.00. Good move BUT NFLX was 320 15 minutes later! Made about $2,500 at my price. Must exercise in the morning. Have the right to sell for 377.50.

Morning of Thur, July 19, 2019 (Jennifer's birthday). Am trading from home so could not capture all the typical screen shots. This was a hugely profitable trade as NFLX disappoints with an actual drop in subscribers. As above, we bought the stock to exercise at 332.05, although we could have bought it as low as 320, so we left as much as $1,200 on the table. I thought it was going to bounce off of the initial reaction but it didn't. It looks like the open this morn will be at about 325 or 326.

I exercised at 6:33 for a profit of

Stock open bid: 323.00
but quickly rose to 328.
Put early bid: 51.50
Put early ask: 54.80

Cost: $2,394
Gain: $2,154

DONE										
		Stock:	nflx		381.57					
		When:	17-Jul						Transaction cost	
	Exp	Strike	Shares	Buy Price	Cost	Sell Price	Recovery		Buy	Sell
Call	19-Jul	382.5	100	12.14	1,214.00	0.03	3.00		0.79	0.80
Put	19-Jul	377.5	100	11.80	1,180.00	45.45	4,545.00		0.79	1.00
			BE:	23.94	2,394.00	332.05	4,548.00		Total:	3.38
						Profit:	2,154.00		Net:	2,150.62
					Note: This was an exercise, effectively selling the put at 45.45.					

NFLX 3

4/16/2019

TOTAL NFLX		2,567	2,380	359.21	359.28	359.29		-51	-187
NFLX Apr18'19 352.5 C…	1	1,306	1,632	16.30	16.50	16.25	+4.52	458	326
NFLX Apr18'19 347.5 PUT	1	1,261	748	7.40	7.55	7.40	-5.18	-509	-513

```
Tuesday, April 16, 2019, 09:37:17 AM local
Stock:  NFLX
Historical daily volatility: 0.02759
Option expiry and days to:  2 days to 4 / 18
Stock peg: 358.870
Call strike and peg: 352.5 at 16.200
Put strike and peg: 347.500 at 7.580
Call implied daily volatility: 0.06331
Put implied daily volatility: 0.06241
Call sigma ratio:  2.2945
Put sigma ratio:  2.2619
Position cost (at peg):  23.780
One day time decay: 6.940
```

```
Tuesday, April 16, 2019, 12:56:43 AM local
Stock:  NFLX
Historical daily volatility: 0.02759
Option expiry and days to:  2 days to 4 / 18
Stock peg: 360.130
Call strike and peg: 352.5 at 17.230
Put strike and peg: 347.500 at 7.470
Call implied daily volatility: 0.06483
Put implied daily volatility: 0.06401
Call sigma ratio:  2.3497
Put sigma ratio:  2.3199
Position cost (at peg):  24.700
One day time decay: 7.037
```

TOTAL NFLX		2,567	2,460	360.19	360.24	360.19		29	-107
NFLX Apr18'19 352.5 C…	1	1,306	1,722	17.10	17.55	17.40	+5.67	548	416
NFLX Apr18'19 347.5 PUT	1	1,261	738	7.30	7.50	7.36	-5.22	-519	-523

... at 12:59

06:37:17	NFLX Apr18'19 347.5 PUT	SLD	1	0.97	BATS	0.80
06:35:48	NFLX Apr18'19 352.5 C…	SLD	1	14.29	NASDAQOM	0.83

		When:	18-Apr						Transaction cost	
	Exp	Strike	Shares	Buy Price	Cost	Sell Price	Recovery		Buy	Sell
Call	18-Apr	352.5	100	13.05	1,305.00	14.29	1,429.00		1.09	0.83
Put	18-Apr	347.5	100	12.60	1,260.00	0.97	97.00		1.09	0.80
			BE:	25.65	2,565.00		1,526.00		Total:	3.81
						Profit:	-1,039.00		Net:	-1,042.81

Cost: $2,565

Loss: $-1,042

nflx 3

16 Jul 2018

			Stock:	nflx		417.05				
			When:	11-Jul					Transaction cost	
	Exp	Strike	Shares	Buy Price	Cost	Sell Price	Recovery		Buy	Sell
Call	20-Jul	420	100	18.75	1,875.00	0.14	14.00		0.79	1.57
Put	20-Jul	415	100	19.00	1,900.00	68.20	6,820.00		0.79	1.18
					3,775.00		6,834.00		Total:	4.33
						Profit:	3,059.00		Net:	3,054.67

The key to this was to sell at open on earnings day. Had a limit order in place at 71.20 for the put. Quickly dropped it to 68.20. The high price for the day was 69.35 BUT the put plunged through the day. Hesitation would have reduced this gain by one or two thousand dollars!

Cost: $3,775

Gain: $3,054

Note: I sold the CALL at around 9 for 0.14. Had I waited, it was selling for 0.55! I should have remembered that it had 3 days to recover. This was a Monday earnings report.

10:14 AM (sold earlier for 68.30)

NFLX 2

10/10/2018

10:31:17	NFLX Oct19'18 335 PUT	BOT	1	18.50	BATS	0.78
10:30:12	NFLX Oct19'18 340 CALL	BOT	1	17.90	GEMINI	0.78

```
Tuesday, October 16, 2018, 09:57:45 AM local
Stock:  NFLX
Historical daily volatility: 0.02341
Option expiry and days to:  3 days to 10 / 19
Stock peg: 339.015
Call strike and peg: 340.0 at 16.275
Put strike and peg: 335.000 at 15.100
Call implied daily volatility: 0.07124
Put implied daily volatility: 0.07317
Call sigma ratio:  3.0427
Put sigma ratio:  3.1252
One day time decay: 6.160
```

This ended up being one of the least-disciplined, stupidist trades I have ever made because I did not follow the rule to **SELL AT THE OPEN** after expiration. I would have actually made a small profit or small loss. Look at this result, hoping that NFLX would bounce up, which it didn't.

Cost: $3,640

Loss: $-2,565

OPEN										
		Stock:	NFLX		339.14					
		When:	10-Oct						Transaction cost	
	Exp	Strike	Shares	Buy Price	Cost	Sell Price	Recovery		Buy	Sell
Call	19-Oct	340	100	17.90	1,790.00	10.20	1,020.00		0.78	0.80
Put	19-Oct	335	100	18.50	1,850.00	0.55	55.00		0.78	0.80
					3,640.00		1,075.00		Total:	3.16
						Profit:	-2,565.00		Net:	-2,568.16

Also, had I been able to sell short in the aftermarket, I would have made a $1,035 profit at this price above!!

NFLX 3

1/16/2018

OPEN										
		Stock:	NFLX		222.84					
		When:	16-Jan						Transaction cost	
	Exp	Strike	Shares	Buy Price	Cost	Sell Price	Recovery		Buy	Sell
Call	26-Jan	225	200	7.40	1,480.00	26.65	5,330.00		0.98	0.00
Put	26-Jan	220	200	8.45	1,690.00	0.00	0.00		1.78	0.00
					3,170.00		5,330.00		Total:	2.76
						Profit:	2,160.00		Net:	2,157.24

10:58:16	NFLX Jan26'18 220 PUT	BOT	2	8.45	PSE 0.98
10:57:10	NFLX Jan26'18 225 CALL	BOT	2	7.40	PSE 0.98
06:45:57	NFLX Jan26'18 225 CALL	SLD	1	26.80	PSE 0.86
06:42:38	NFLX Jan26'18 225 CALL	SLD	1	26.55	PSE 0.85

Cost: $3,170

Gain: $2,157

Sold for a $2,160 gain, a profit of 52%. Bungled the exit because I woke up with a cold, logged in late. I saw prices at 28.50 before I got the order in, so I could have earned another $400 dollars. So rushed that I sold one at a time. But still …

NFLX

7 of 7

Jul 13, 2017

07:05:55	NFLX Aug18'17 155 PUT	BOT	1	6.65	PSE	0.79
07:03:52	NFLX Aug18'17 160 CALL	BOT	1	7.50	GEMINI	0.79

Activity | Orders | Trades

+/-	Time	Fin Instrument	Action	Quantity	Price	Exch.	Commission
	06:48:10	NFLX Aug18'17 155 PUT	SLD	1	0.46	NASDAQOM	0.80
	06:47:00	NFLX Aug18'17 160 CALL	SLD	1	18.20	BATS	0.84

This pretty much speaks for itself. Cost of trade = $1,415. Exit was $1,866. Gain was $451. Could have sold it for 23 for another $500 had I wanted to gamble. But this was fine.

Cost: $1,415

Gain: $451

NFLX

Thur 4/13 11:28


```
Date:  Thu Apr 13 2017
CALL NFLX Apr 21
Stock price:  143.330
Strike price:  145.00
Days to expiry:  8
Call ASK:  5.200
Call BID:  5.050
Call price (PEG):  5.140
The Delta: 0.4716
One day time decay: 0.380
The call's implied probability:  0.03650
```

```
Date:  Thu Apr 13 2017
PUT NFLX Apr 21
Stock price:  143.440
Strike price:  143.00
Days to expiry:  8
Put ASK:  5.750
Put BID:  5.650
Put price (PEG):  5.710
The Delta: 0.46784
One day time decay: 0.382
The put's implied probability:  0.03672
```

```
Date:  Thu Apr 13 2017
CALL NFLX May 19
Stock price:  143.360
Strike price:  150.00
Days to expiry:  36
Call ASK:  4.500
Call BID:  4.300
Call price (PEG):  4.420
The Delta: 0.3794
One day time decay: 0.093
The call's implied probability:  0.02067
```

10:33:20

```
Date:  Thu Apr 13 2017
PUT NFLX May 19
Stock price:  143.320
Strike price:  135.00
Days to expiry:  36
Put ASK:  3.750
Put BID:  3.550
Put price (PEG):  3.670
The Delta: 0.29457
One day time decay: 0.087
The put's implied probability:  0.02127
```

2.09K	93	511	6.00	6.15	220	143	2.60K	163	1,261	5.65	5.75	4
2.92K	358	301	5.55	5.65	17	144	1.34K	322	2,476	6.15	6.30	86
12.7K	675	252	5.10	5.20	67	145	8.84K	734	9	6.75	6.85	168

Records lost: loss was $0.17 per 11.05 cost

NFLX

Did not play because we were on vacation in San Diego. This would have been a massive gain for any strangle

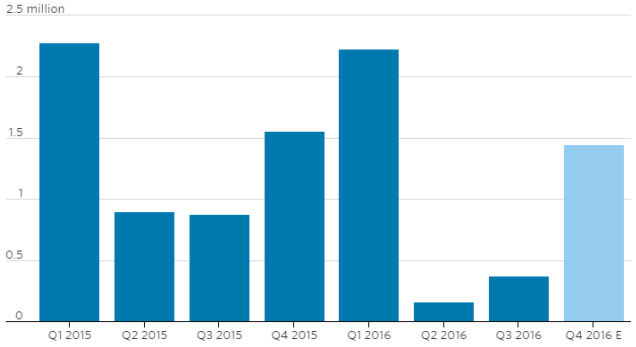
STICK TO STRATEGY

How did we get this one so wrong?

We assumed Netflix's subscriber growth would continue to slow. And it did. Just not as badly as anticipated. Netflix added 370,000 new U.S. subscribers in the third quarter, better than its own estimate of 300,000 and higher than the prior quarter's 160,000 net new additions. Yet even so, Netflix just isn't adding as many domestic subscribers as it used to. Its third-quarter growth was significantly less than the 880,000 net domestic additions a year ago, or its growth rate in prior years.

Buffering

Netflix's quarterly domestic subscriber net additions

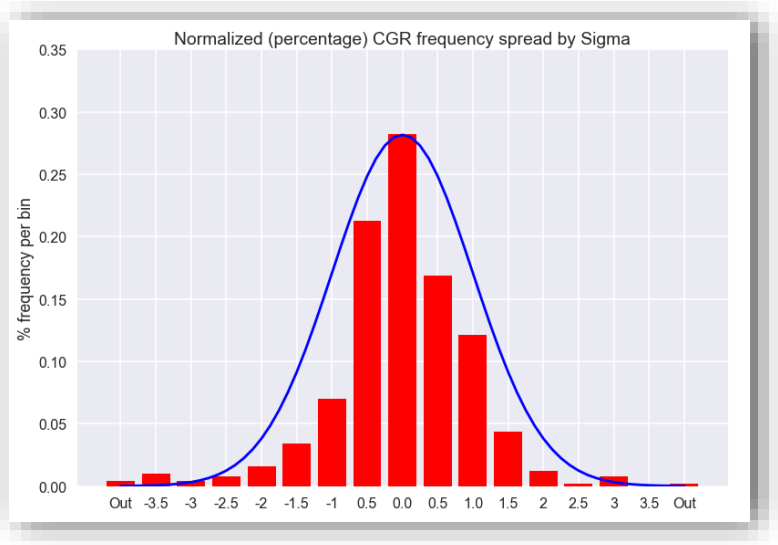


Note: Q4 2016 is the company's estimate
Source: the company

THE WALL STREET JOURNAL

Odds ‘n ends ...

- Have never made a profit trading TSLA
- Biggest losers in percentage of times lost AMD, NVDA
- Biggest winner in percentage of time gained is MSFT
- Biggest gain ever is FB, plunged from 217 to 177, gained $6,195 on cost of $2,205.
- Biggest loss was the poorly traded NFLX loss on Oct 10, 2018, $2,565 on $3,640.
- Favorite trade is AAPL



So you want to write strangles and think it is easy money ...?

217

177

... and for those who say you should be writing strangles, this always happens in after-hours and there is nothing you can do to get out of this trade!

... but when this happens, we will often buy the stock at $177 in the aftermarket (didn't do it here though, not as profitable).

Why?

		Stock:	FB		209.38		
		When:	27-Jul				
	Exp	Strike	Shares	Buy Price	Cost	Sell Price	Recovery
Call	27-Jul	215	300	3.25	975.00	0.00	0.00
Put	27-Jul	205	300	4.10	1,230.00	28.00	8,400.00
					2,205.00		8,400.00
						Profit:	6,195.00

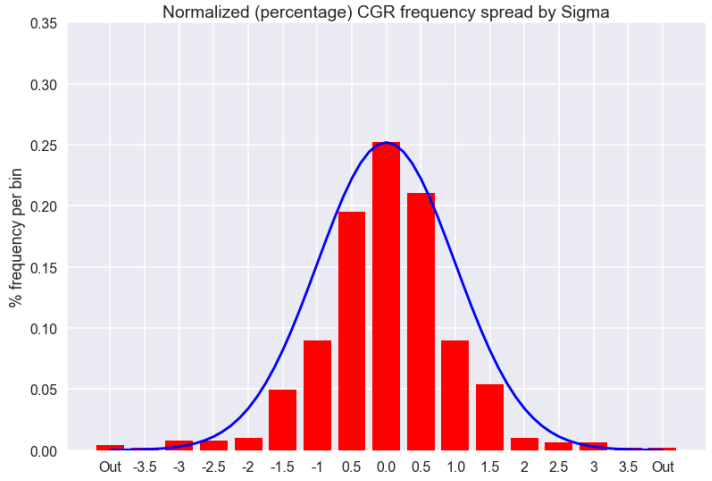
This put went from $4.10 to $28.00!

PIT strangle strategy ...

1. Stock must have a clear pattern of Kurtosis
   - You don't have to (you can't) backtest
   - Check at least three years of quarterly earnings with hiviex.
2. Stock must be "normal" otherwise
3. Use the models to check and contrast HDV and IDV and sigma ratio – they have to be within parameters.
   - Run inpos daemons regardless for candidates
4. We trade only the expiry that is on the Friday after earnings (from experience).
5. We get into position usually on the Thursday or Friday of the week before XSigma starts ramping up (it may already be at 1.5 to 2X!
6. We never exit with a profit on the day of earnings (before the earnings report)
7. The purchase of two legs and the exit of one must be done by machine algo.
8. We exit the profitable leg within 30 seconds of the market open with machine algo!
9. **IV crush is irrelevant**! One of your options is very close to one-delta or it is not!

FB 1 30-Oct-W-2pm

	date	open	high	low	close	volume	cgr	Xsigma
0	07 24 18	215.11	216.20	212.60	214.67	28,468,681	0.01767	0.823089
1	07 25 18	215.72	218.62	214.27	217.50	64,592,585	0.01310	0.605101
2	07 26 18	174.89	180.13	173.75	176.26	169,803,668	-0.21024	-10.039649
3	10 29 18	148.50	148.83	139.03	142.09	31,336,784	-0.02282	-1.106865
4	10 30 18	139.94	146.64	139.74	146.22	50,528,278	0.02865	1.346482
5	10 31 18	155.00	156.40	148.96	151.79	60,101,251	0.03739	1.762766
6	01 29 19	148.09	148.10	143.43	144.19	17,631,953	-0.02249	-1.091200
7	01 30 19	146.22	150.95	145.70	150.42	44,613,240	0.04230	1.996973
8	01 31 19	165.60	171.68	165.00	166.69	77,233,602	0.10270	4.876027
9	04 23 19	182.74	184.22	181.48	183.78	19,954,814	0.01281	0.591635
10	04 24 19	184.49	185.14	181.65	182.58	37,289,871	-0.00655	-0.331366
11	04 25 19	196.98	198.48	192.12	193.26	54,148,789	0.05685	2.690392
	07 24 19	197.63	204.81	197.22	204.66	32,532,540	0.01130	0.518535
	07 25 19	206.70	208.66	198.26	200.71	39,889,869	-0.01949	-0.914432
	07 26 19	200.19	202.88	196.25	199.75	24,433,985	-0.00479	-0.230567



GOOG, SNAP, UBER (NO TRADE)

Mudd (Palm Island Traders) finance

goog M 3 Feb

	Drift	Volatility	Sharpe	Maxsigma	Minsigma
1 year	0.001018	0.014502	0.070218	6.782655	-5.592905
90 day	0.001670	0.010165	0.164342	2.232012	-2.516431
30 day	0.001891	0.010503	0.180073	2.139126	-2.334147

```
Monday, February 3, 2020, 07:37:17 AM local
Model used: ibapistrangle v1.9 dev
Stock:  GOOG
Historical daily volatility (90 day): 0.01017
Option expiry and days to:  4.0 days to 2 / 7
Stock peg: 1475.760
Call strike and peg: 1477.5 at 39.200
Put strike and peg: 1475.000 at 39.350
Call implied daily volatility: 0.03385
Put implied daily volatility: 0.03368
Call sigma ratio:  3.3305
Put sigma ratio:  3.3138
One day time decay: 10.68
Position cost (at peg):  78.55
Call break-even: 117.75 from 39.20 or from 1475.76 to 1556.05
Put break-even: 117.90 from 39.35 or from 1475.76 to 1396.45
```

```
(algos) C:\Users\Prof Gary Evans\Dropbox\PyGo\IB>python ib_inpos_strangle_goog.py
Monday, February 3, 2020, 07:44:53 AM local
<bound method IB.connect of <IB connected to 127.0.0.1:7496 clientId=82>>
GOOG, Last: 1472.26, Bid: 1472.06, Bid Size: 2, Ask: 1472.44, Ask Size: 1, Peg: 1472.25
Expiry: 20200207, days to expiry: 4.0
Call strike: 1477.50, Put strike: 1475.00
Call Bid: 37.30, Ask: 37.90,  Peg: 37.60
Put Bid: 40.80, Ask: 41.20,  Peg: 41.00
Position cost/value: 78.60.
Call IDV: 0.034021, Duration Volatility: 0.068043
Put IDV: 0.033589, Duration Volatility: 0.067179
Call sigma ratio: 3.3453
Put sigma ratio: 3.3028
One day time decay: 10.665.
```

snap Tu 4 Feb

	Drift	Volatility	Sharpe	Maxsigma	Minsigma
1 year	0.003898	0.031593	0.123370	6.175270	-2.722096
90 day	0.000789	0.024022	0.032847	3.109286	-2.545400
30 day	0.006552	0.017558	0.373169	2.249304	-1.901776

```
Monday, February 3, 2020, 07:53:17 AM local
Model used: ibapistrangle v1.9 dev
Stock:  SNAP
Historical daily volatility (90 day): 0.02402
Option expiry and days to:  4.0 days to 2 / 7
Stock peg: 18.610
Call strike and peg: 19.0 at 0.940
Put strike and peg: 18.000 at 0.810
Call implied daily volatility: 0.07523
Put implied daily volatility: 0.07425
Call sigma ratio:  3.1315
Put sigma ratio:  3.0909
One day time decay: 0.29
Position cost (at peg):  1.75
Call break-even: 2.69 from 0.94 or from 18.61 to 20.75
Put break-even: 2.56 from 0.81 or from 18.61 to 16.25
```

```
(algos) C:\Users\Prof Gary Evans\Dropbox\PyGo\IB>python ib_inpos_strangle_snap.py
Monday, February 3, 2020, 07:56:46 AM local
<bound method IB.connect of <IB connected to 127.0.0.1:7496 clientId=82>>
SNAP, Last: 18.61, Bid: 18.60, Bid Size: 175, Ask: 18.61, Ask Size: 35, Peg: 18.61
Expiry: 20200207, days to expiry: 4.0
Call strike: 19.00, Put strike: 18.00
Call Bid: 0.93, Ask: 0.94,  Peg: 0.94
Put Bid: 0.80, Ask: 0.81,  Peg: 0.81
Position cost/value: 1.75.
Call IDV: 0.074905, Duration Volatility: 0.149811
Put IDV: 0.074524, Duration Volatility: 0.149048
Call sigma ratio: 3.1182
Put sigma ratio: 3.1023
One day time decay: 0.289.
```

uber Th 6 Feb

	Drift	Volatility	Sharpe	Maxsigma	Minsigma
1 year	-0.000742	0.028359	-0.026174	2.817209	-3.985310
90 day	0.001056	0.025678	0.041123	2.605090	-4.077548
30 day	0.006624	0.018964	0.349288	3.233813	-1.216049

```
Monday, February 3, 2020, 08:00:15 AM local
Model used: ibapistrangle v1.9 dev
Stock:  UBER
Historical daily volatility (90 day): 0.02568
Option expiry and days to:  4.0 days to 2 / 7
Stock peg: 37.250
Call strike and peg: 37.5 at 1.500
Put strike and peg: 37.000 at 1.480
Call implied daily volatility: 0.05444
Put implied daily volatility: 0.05383
Call sigma ratio:  2.1202
Put sigma ratio:  2.0965
One day time decay: 0.43
Position cost (at peg):  2.98
Call break-even: 4.48 from 1.50 or from 37.25 to 40.48
Put break-even: 4.46 from 1.48 or from 37.25 to 34.02
```

```
(algos) C:\Users\Prof Gary Evans\Dropbox\PyGo\IB>python ib_inpos_strangle_UBER.py
Monday, February 3, 2020, 08:03:57 AM local
<bound method IB.connect of <IB connected to 127.0.0.1:7496 clientId=82>>
UBER, Last: 37.25, Bid: 37.24, Bid Size: 26, Ask: 37.25, Ask Size: 30, Peg: 37.25
Expiry: 20200207, days to expiry: 4.0
Call strike: 37.50, Put strike: 37.00
Call Bid: 1.46, Ask: 1.50,  Peg: 1.48
Put Bid: 1.47, Ask: 1.49,  Peg: 1.48
Position cost/value: 2.96.
Call IDV: 0.053600, Duration Volatility: 0.107201
Put IDV: 0.053993, Duration Volatility: 0.107986
Call sigma ratio: 2.0874
Put sigma ratio: 2.1027
One day time decay: 0.427.
```

WAIT and lose! In this actual trade I would have lost $1,000 more had I waited 15 minutes!

WAIT and lose! In this actual trade I broke even and would have lost $1,500!!

Didn't matter.

WAIT and die! No trade but a loser would have been an even bigger loser, Feb 2020

Key take-aways that you *must* understand ...

1. An options trader needs at least three good measures of HDV

2. An options trader needs a good model to estimate recurring IDV
   - ... do not rely upon broker-provided estimates of IAV!

3. An options trader knows how these match and are paired.

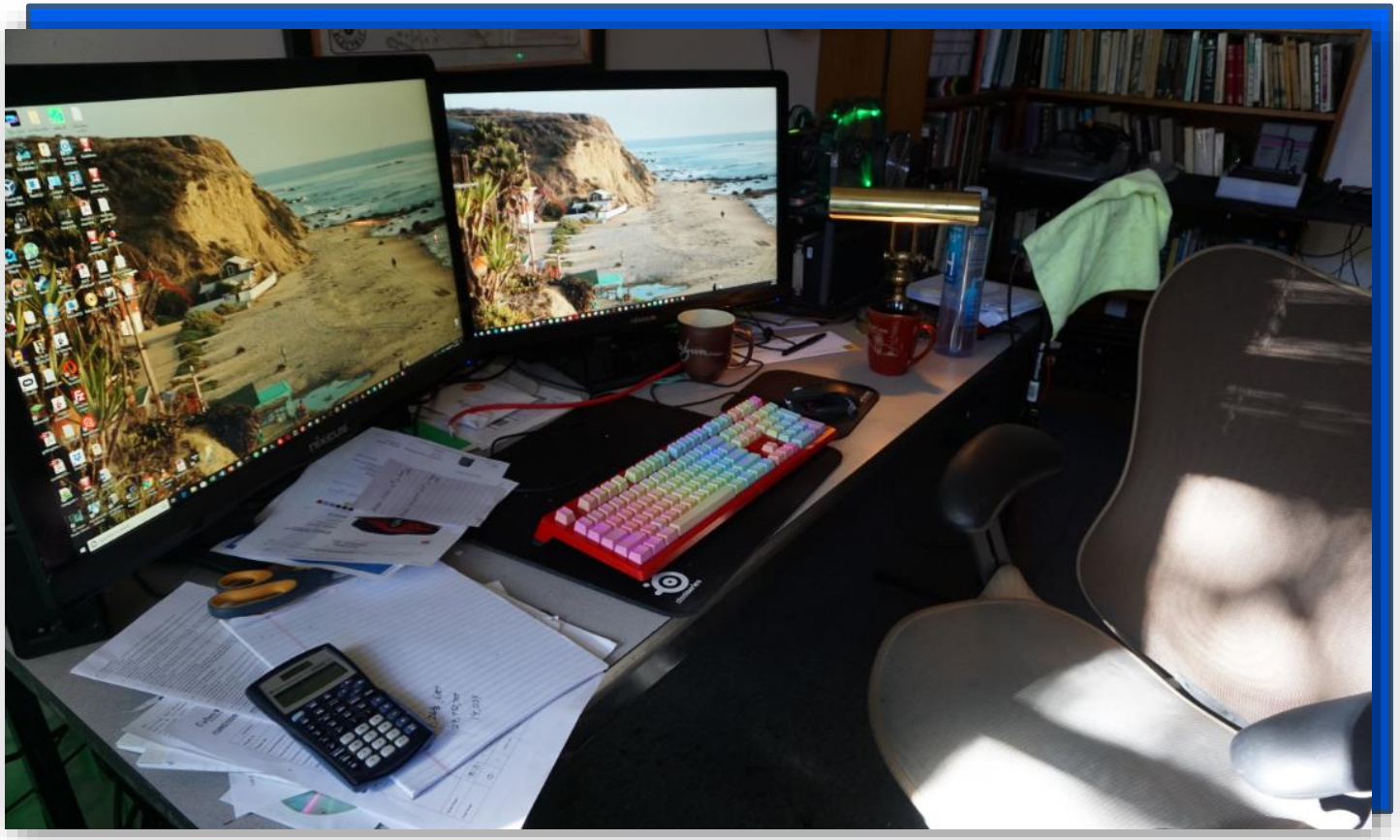
4. An options trader needs machines and algos ...
   - ... for relentless feedback
   - ... for tracking (like inpos)
   - ... for trading (limit orders in a chaotic market)

5. There are methods for isolating strangle candidates
   - ... kurtosis is your friend, not your enemy.

6. Strategy matters a lot, as does making good trades
   - ... that is why you want to use machines

7. For strangles, “IV crush” is largely irrelevant
   - ... as a fat-tailed event, one of the options has to get close to one-delta.

That's it ...



Core Options Trading Strategies – Part 3

... back to the basics (revised on May 1 – additions made for clarity)

Here are some key questions ...

1. How do you know when to make an options trade, long or short?
   - Is there a time to buy options, despite time decay?
   - Is there a time to write options?

2. How do you judge the degree of risk associated with an options trade?

3. Are certain types of options trades always adviseable in all market and almost all markets?
   - No!

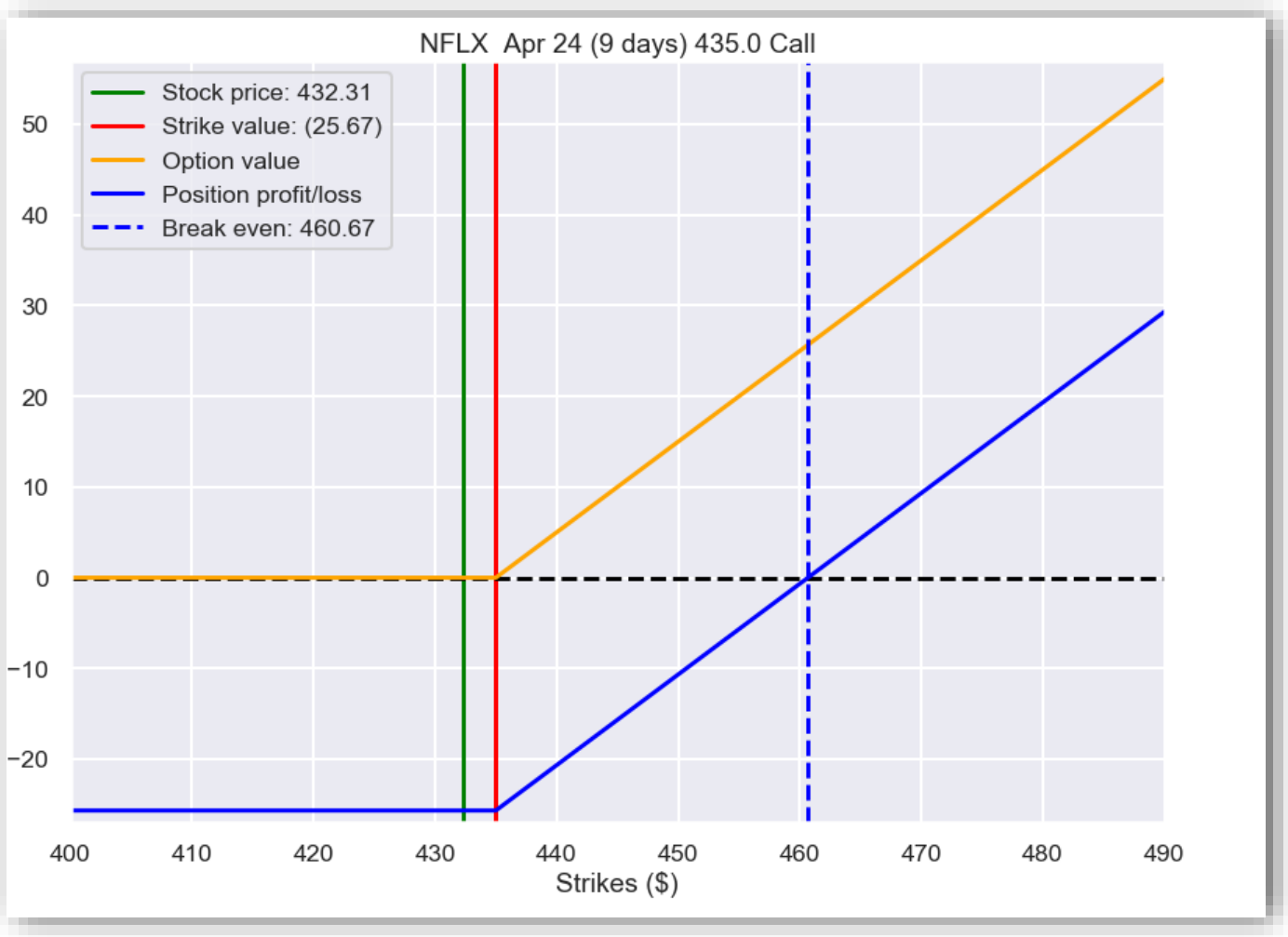
4. What would Mr. Spock say about all of this?


FASCINATING


LOGIC

Going back to our roots with one of our NFLX options ...

[This was our original proposal]



This was half of a strangle that I wanted to do for NFLX earnings on eod Tuesday, April 21. Note that this expire on the following Friday.

This is the Apr 24 2020 (exp) NFLX OOM 435 Call, priced at $25.67 on Apr 15, when NFLX was $432.31

Going back to our roots with one of our NFLX options ...

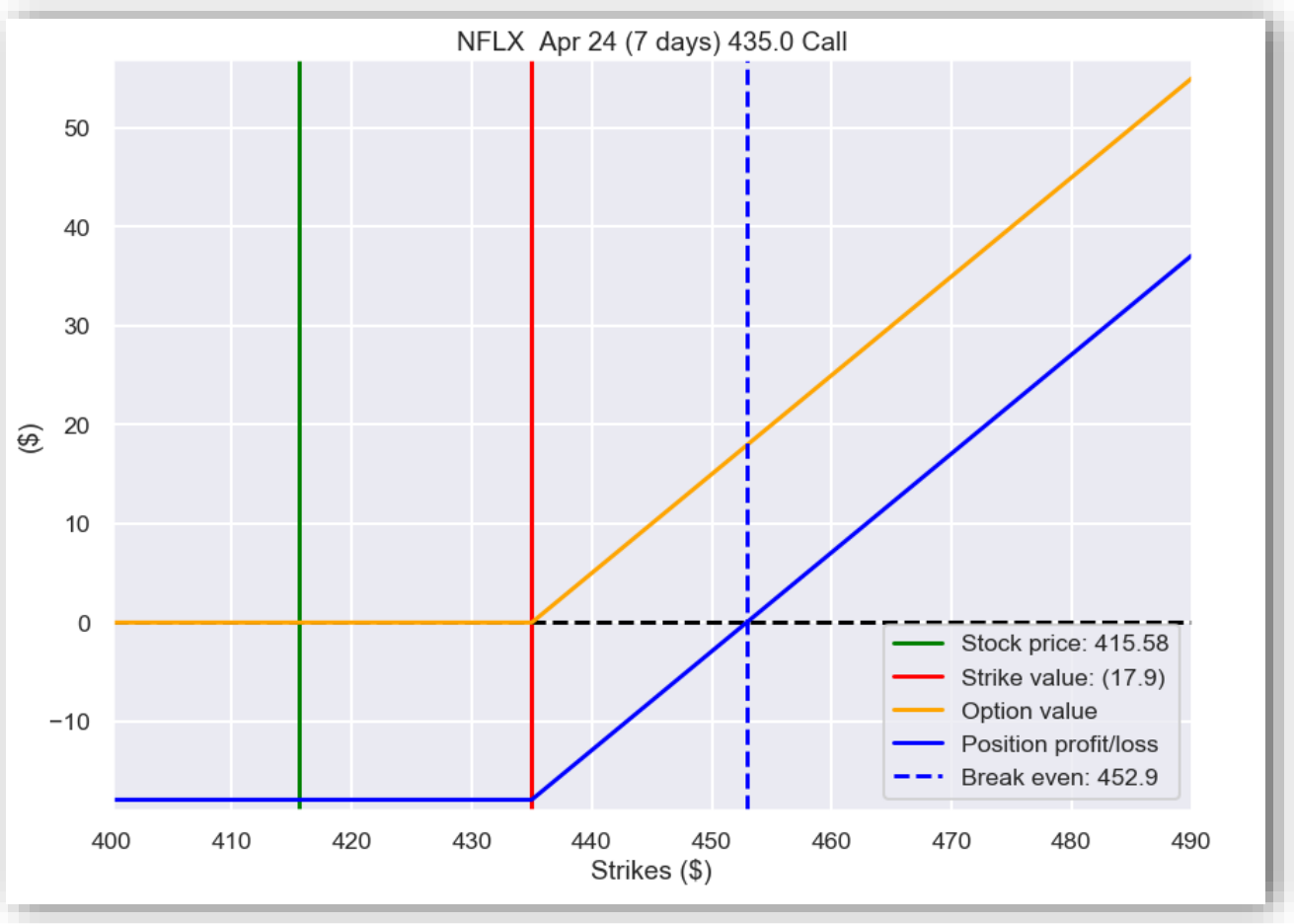
Model used: ib_strangle_inpos_v1_5.py
Friday, April 17, 2020, 11:45:29 AM local
NFLX, Last: 415.60, Bid: 415.50, Ask: 415.66, Peg: 415.58
Expiry: 20200424, days to expiry: 7.0
Call strike: 435.00, Put strike: 430.00
Call Bid: 17.80, Ask: 18.00, Peg: 17.90
Put Bid: 33.80, Ask: 34.15, Peg: 33.97
Position value: 51.87.
Position profit/loss: 0.84.
Call (30 day) IDV: 0.059006
Put (30 day) IDV: 0.058592
Call sigma ratio: 1.2260
Put sigma ratio: 1.2174
One day time decay: 3.738.

Model used: ib_strangle_inpos_v1_5.py
Friday, April 17, 2020, 11:45:31 AM local
NFLX, Last: 415.65, Bid: 415.50, Ask: 415.65, Peg: 415.57
Expiry: 20200515, days to expiry: 28.0
Call strike: 420.00, Put strike: 410.00
Call Bid: 29.25, Ask: 29.70, Peg: 29.48
Put Bid: 28.30, Ask: 28.60, Peg: 28.45
Position value: 57.93.
Position profit/loss: 0.14.
Call (30 day) IDV: 0.035896
Put (30 day) IDV: 0.035887
Call sigma ratio: 0.7458
Put sigma ratio: 0.7457
One day time decay: 1.116.

	Drift	Volatility	qVolatil	Sharpe	Maxsigma	Minsigma
2 year	0.000586	0.026877	0.023285	0.021806	3.430656	-4.415671
1 year	0.000556	0.026021	0.021911	0.021377	3.023215	-4.559921
90 day	0.003461	0.032961	0.025915	0.105009	2.298496	-3.687890
30 day	0.002489	0.048129	0.035685	0.051724	1.594295	-2.505428

Going back to our roots with one of our NFLX options ...

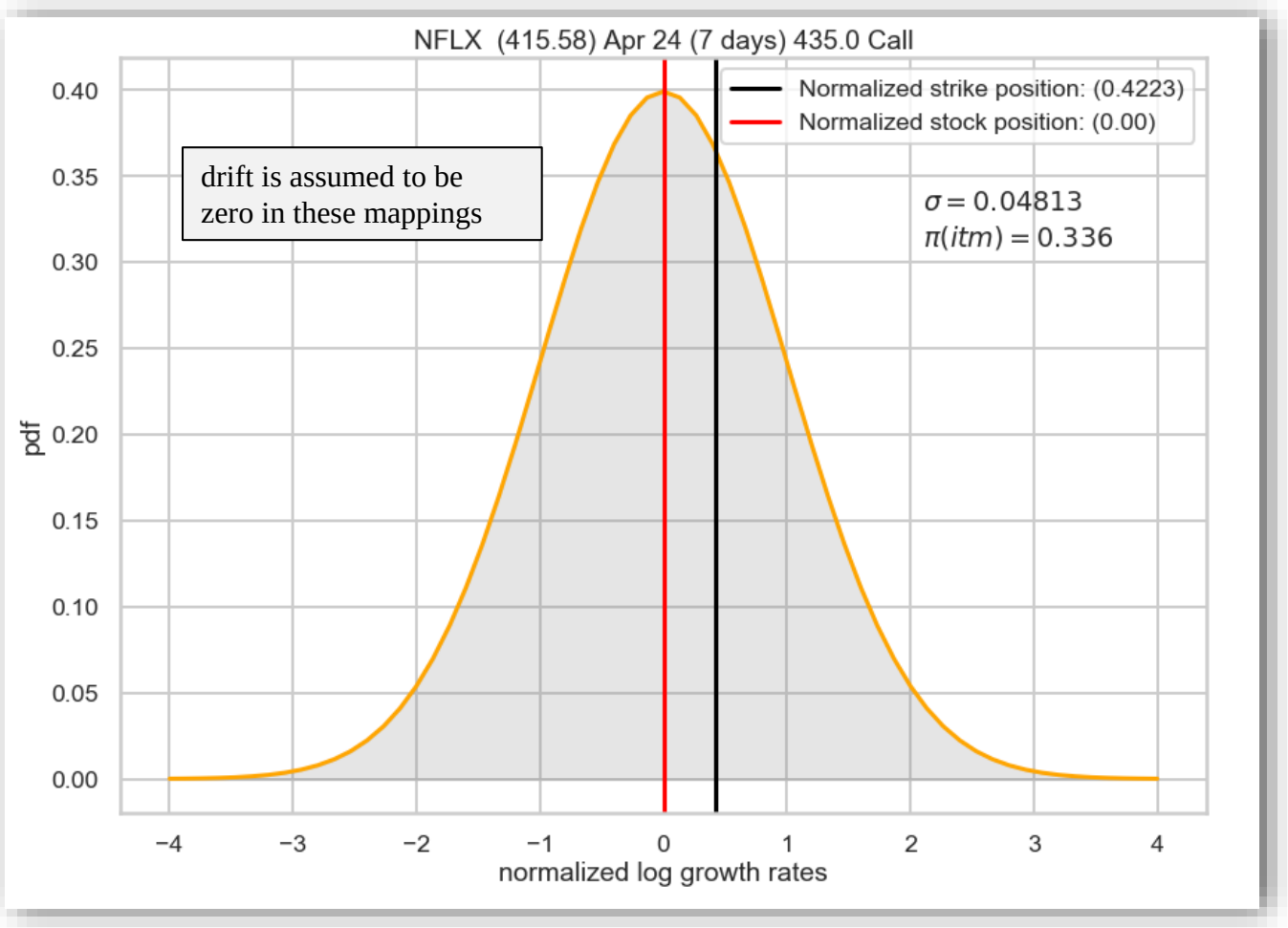
[This was the value that we tracked with the inpos program]



This was half of a strangle that I wanted to do for NFLX earnings on eod Tuesday, April 21. Note that this expires on the following Friday.

This is the Apr 24 2020 (exp) NFLX OOM 435 Call, priced at $17.90 on Friday, Apr 17, when NFLX was $415.58. Assumed sigma was 30-day at **0.04813**.

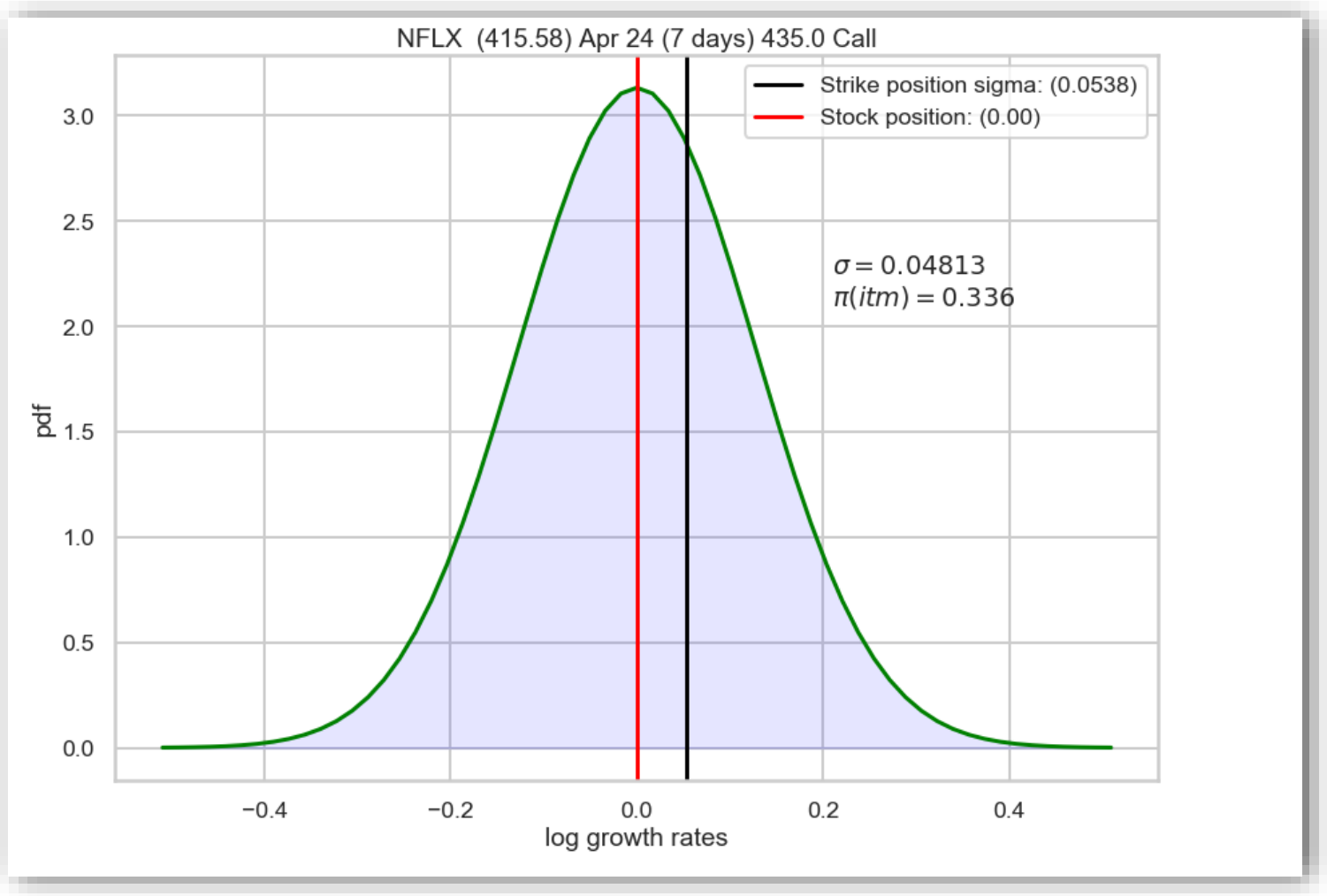
What do we remember about what we initially assumed and solved with our early models ... ?



We assumed Geometric Brownian Motion and compliance with a Weiner Process, and that allowed us to normalize the Gaussian distribution of the log growth rates to a standard normal distribution, as shown here ....

... and that, in turn, allowed us to calculate the probability of being in the money (ITM) at expiry.

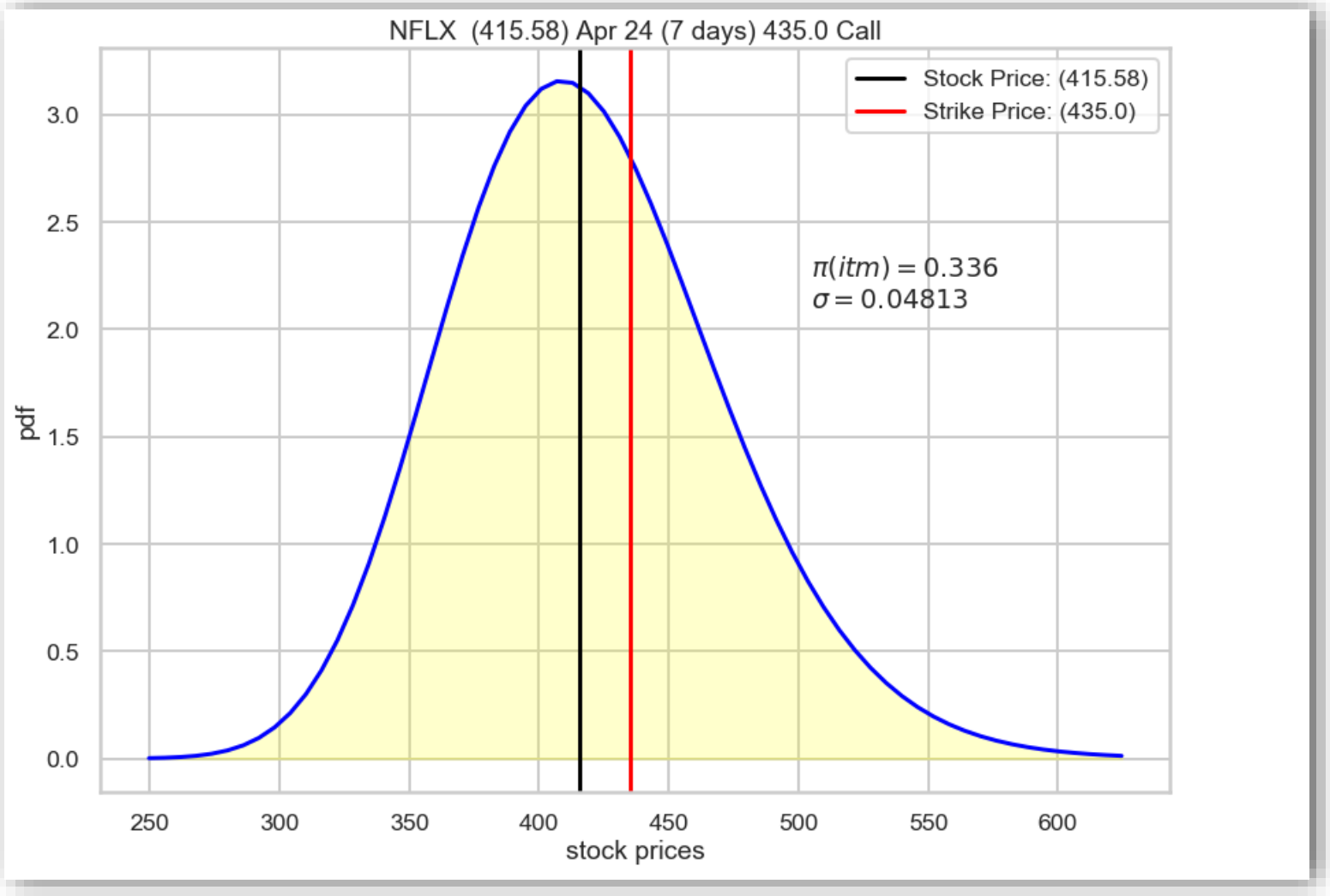
What do we remember about what we initially assumed and solved with our early models ... ?



[Look at the abscissa and ordinate labels and compare them to the standard normal graph].

We also remember that we don't actually need to normalize the log growth rate distribution. We can calculated the same probabilities with the centered normal distribution.

What do we remember about what we initially assumed and (your teacher) solved with our early models ... ?



[Look at the abscissa and ordinate labels and compare them to the normal graph].

We also know that we can transform this back to a mapping of stock prices, which will give us a lognormal distribution. (This is calculated from the stock price median in this context of 415.58).

How did we do this pdf mapping again?

The new methods:

ln_norm_dist (log-normal distribution) accepts a single value for x, mu, and sigma and returns a scalar solution for the pdf. This is ideal for use with a lambda function. See norm_dist.

In [49]:
```
def ln_norm_dist(x: float, mu: float, sigma: float) ->float:
    ln_x = np.log(x)
    always = 1/(math.sqrt(2*math.pi*(sigma**2))*x)
    expo = -((ln_x - mu)**2)/(2*(sigma**2))
    prob_dens_ln = always*math.exp(expo)
    return prob_dens_ln
```

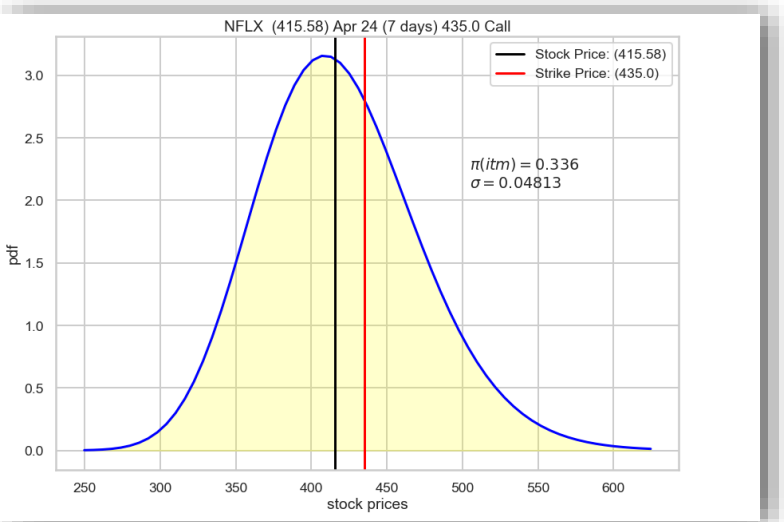
ln_norm_dist_vec (normal distribution) is designed to accept x as a NUMPY ARRAY that has been established with a numpy command like np.linspace(-3,3,61), along with scalars for mu and sigma.This returns another numpy array of the pdf. Note the difference between this and norm_dist. See also stan_nd_vecfor standard normal array. This can be integrated with a lambda function. See norm_dist_vec.

In [50]:
```
def ln_norm_dist_vec(x: np.ndarray, mu: float, sigma: float) ->np.ndarray:
    ln_x = np.log(x)
    always = 1/(math.sqrt(2*math.pi*(sigma**2))*x)
    expo = -((ln_x - mu)**2)/(2*(sigma**2))
    length = x.size
    prob_dens_ln_vec = np.zeros(length)
    prob_dens_ln_vec = always*np.exp(expo)
    return  prob_dens_ln_vec
```

ln_norm_dist_cdf integrates a normal vector using a lambda function and scipy's integration function (which can only take a function as an input). See the explanation for the stan_norm_cdf function (standard normal) in finutil.py because this is easier to understand after seeing that. The output is usually thought of as a probability. Note the use of lambda and its use of z. **Note!** The mean and sigma that are passed to the function is the mean and sigma of the **normal** function, (usually log growth rates) not the sigma of the log fuction. Likewise the "point" is also from that same normal mapping. For example if the mean growth rate is zero, the point of one will produce a 0.50 cdf.

Tested only below and in no other context!

In [51]:
```
def ln_norm_dist_cdf(mu: float, sigma: float, low_lim: float, point: float) ->tuple:
    nd_function = lambda z: ln_norm_dist(z,mu,sigma)
    return scipy.integrate.quad(nd_function,low_lim,point)
```



Define the methods ...

How did we do this pdf mapping again?

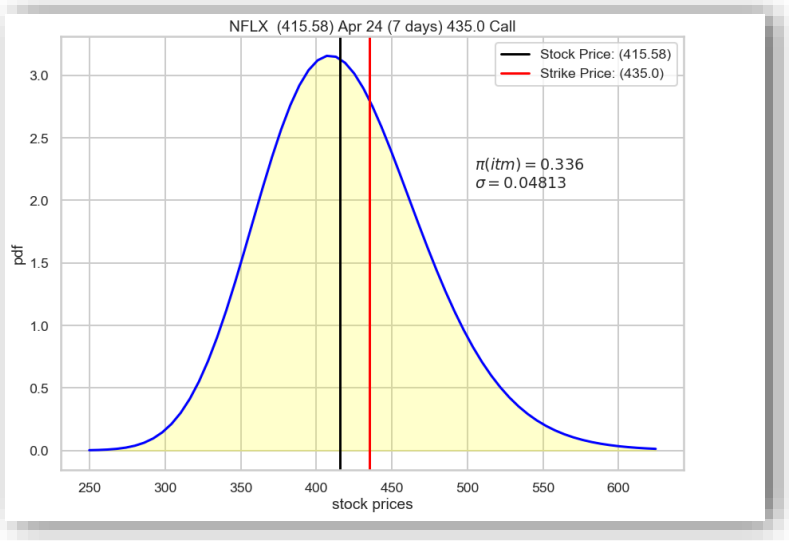
Convert to logs and map the log distribution

Establish the axis upper and lower limits, set up the absissa points and their values, and calculate the cdf.

```
In [74]: low_limit = math.exp(dur_vol*-4.0)
         up_limit = math.exp(dur_vol*3.2)

In [77]: pdf_ben = np.linspace(low_limit,up_limit, num=63, dtype=float)

In [78]: pdf_map = ln_norm_dist_vec(pdf_ben,drift,dur_vol)

In [79]: abscissa = stock_pr*(pdf_ben)
```

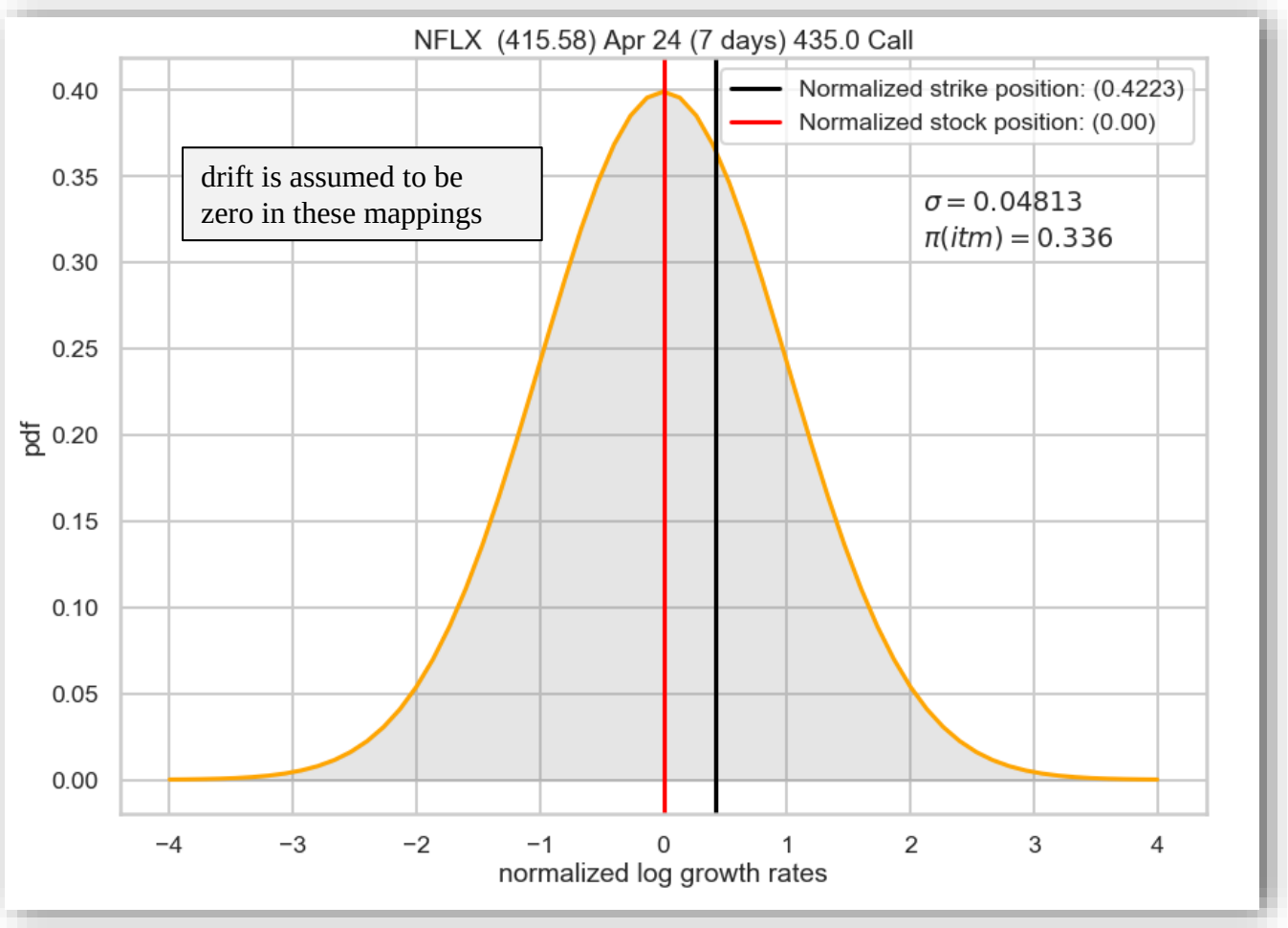
Check the integrator, even though it may not be used in this mapping.

```
In [91]: ln_cdf_point = ln_norm_dist_cdf(drift,dur_vol,low_limit,1.0)
         ln_cdf_point[0]

Out[91]: 0.4999683287581667
```



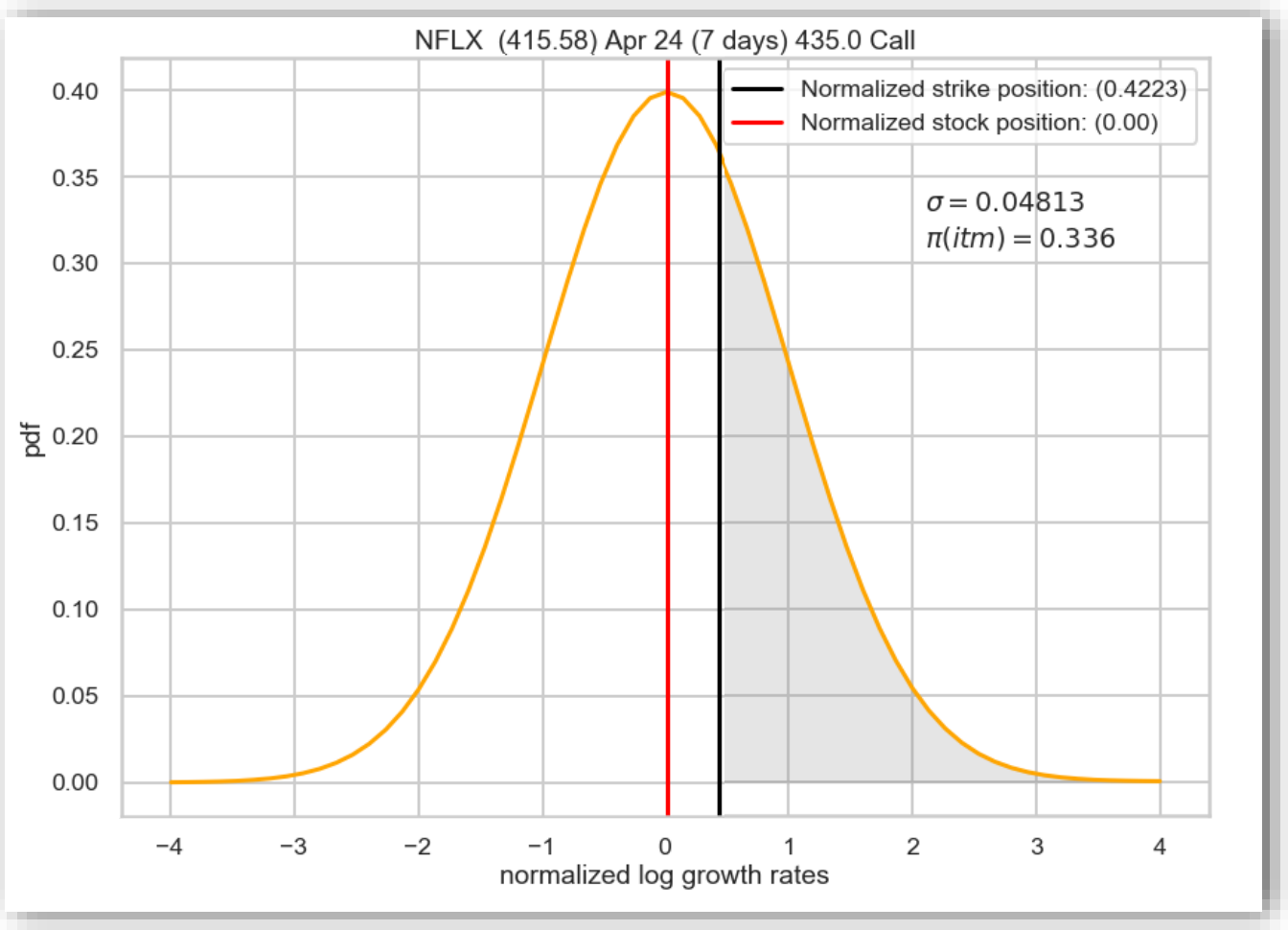
Apply the methods ...

If we were to integrate this pdf from -4 to +4, what value would we get ?



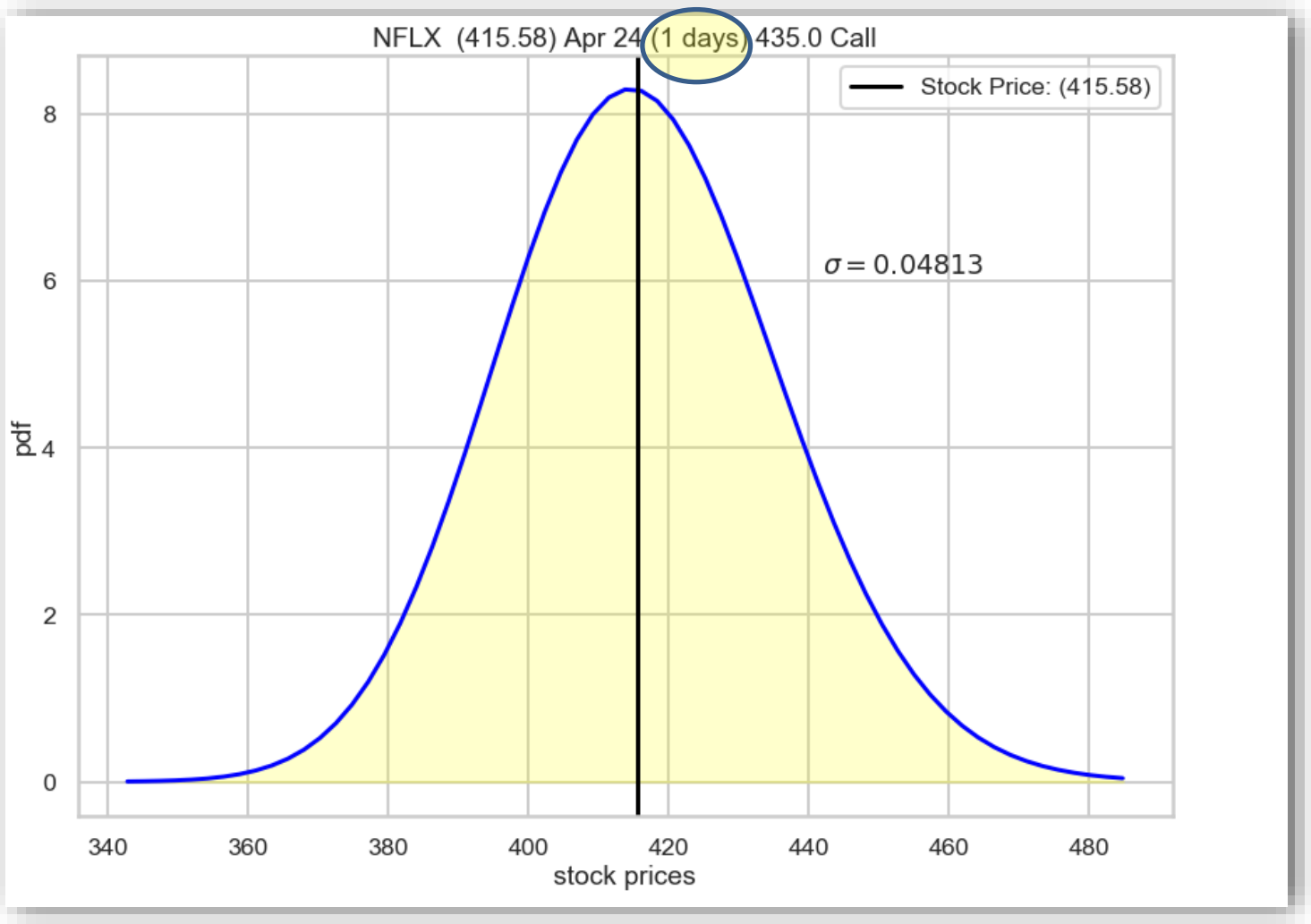
... one.

... and how did we get the probabilty of being ITM ?



... we integrated (kind of) up to the black line, and then subtracted that from one.

If we were to integrate this pdf from 340 to 490, what value would we get ?

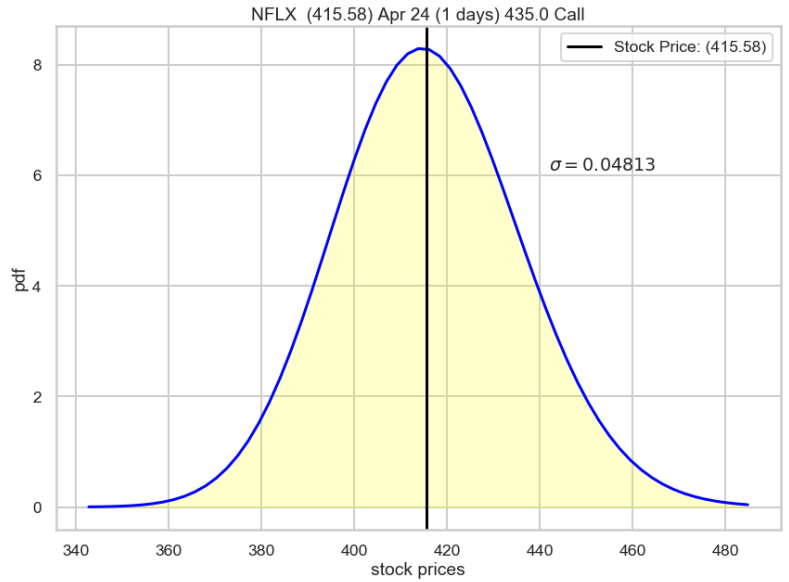


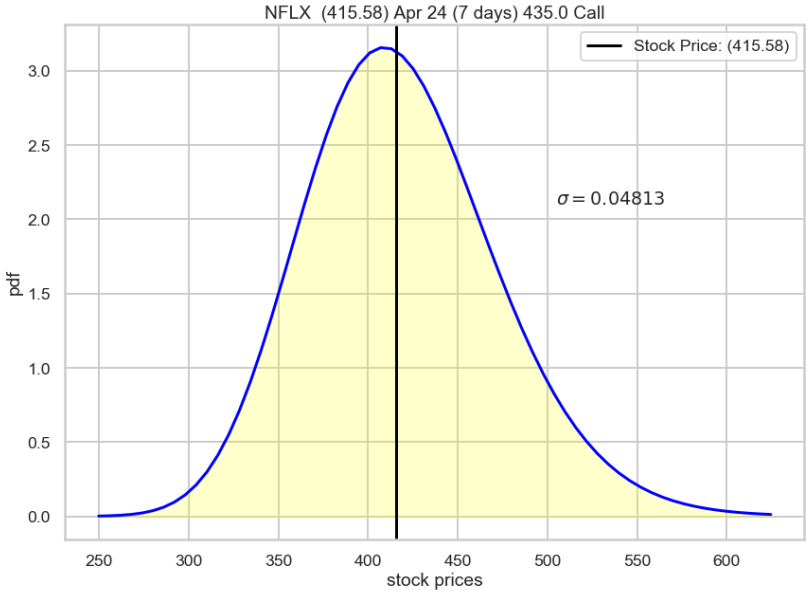
... we would get 415.58

If our model is a good model, this is how a stock looks to an efficient market.

(... and this is an ideal. We are going to ignore Kurtosis).

... same for the 7-day variety (when zero drift)?

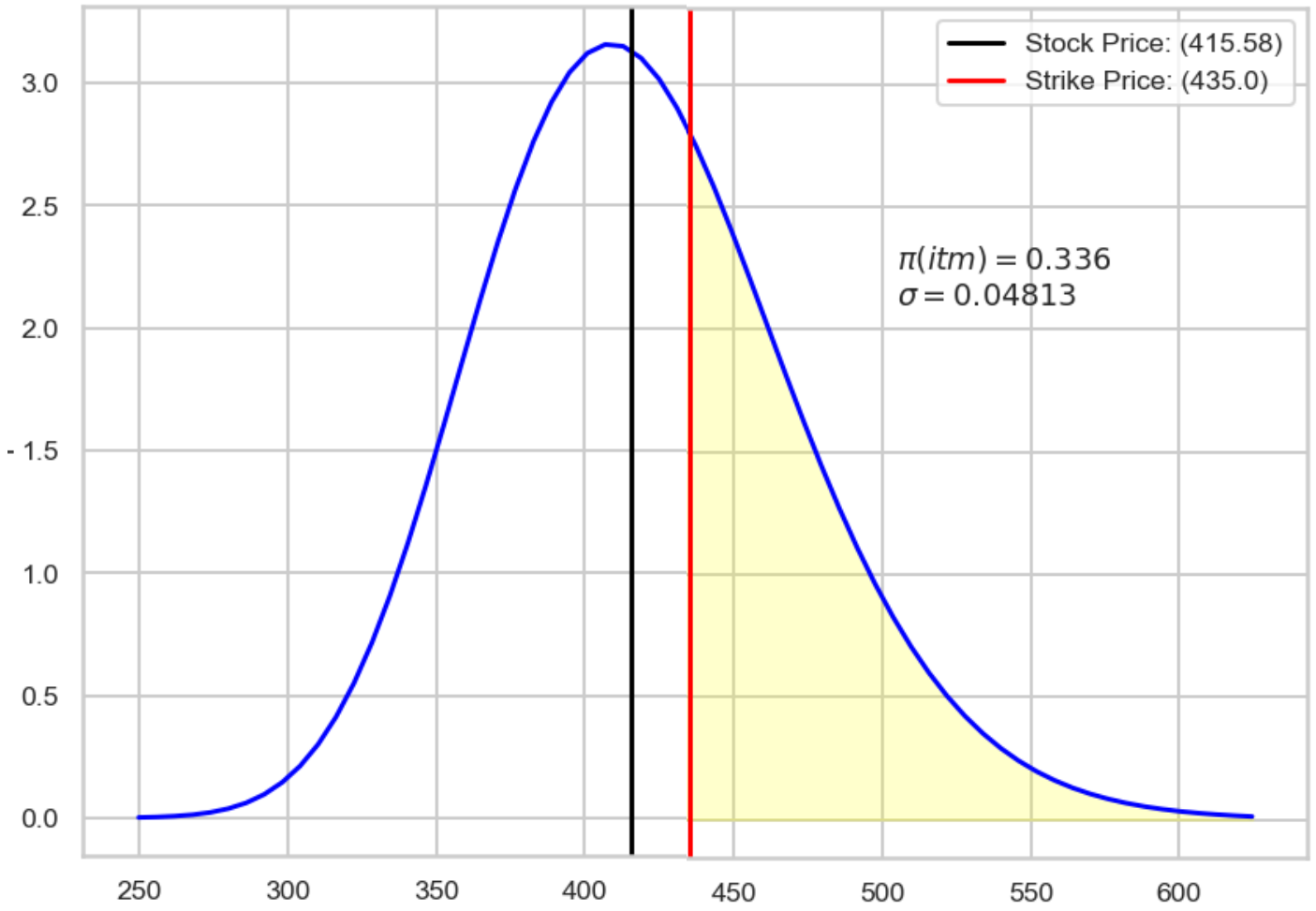




... we would get 415.58

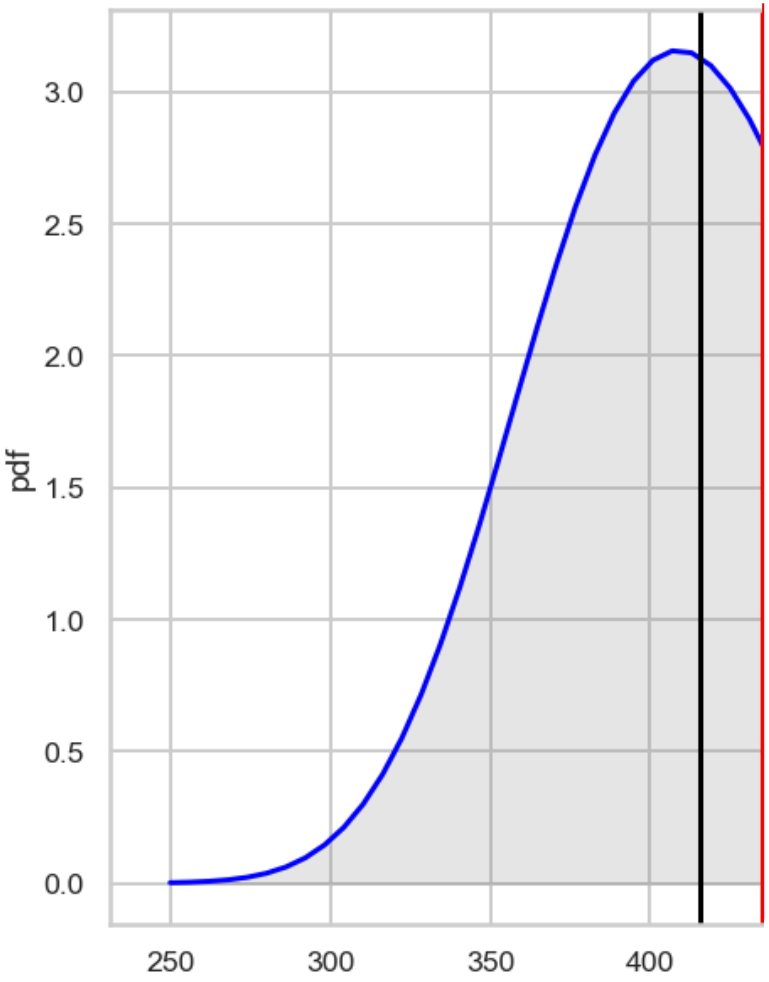
(... duration volatility equals).

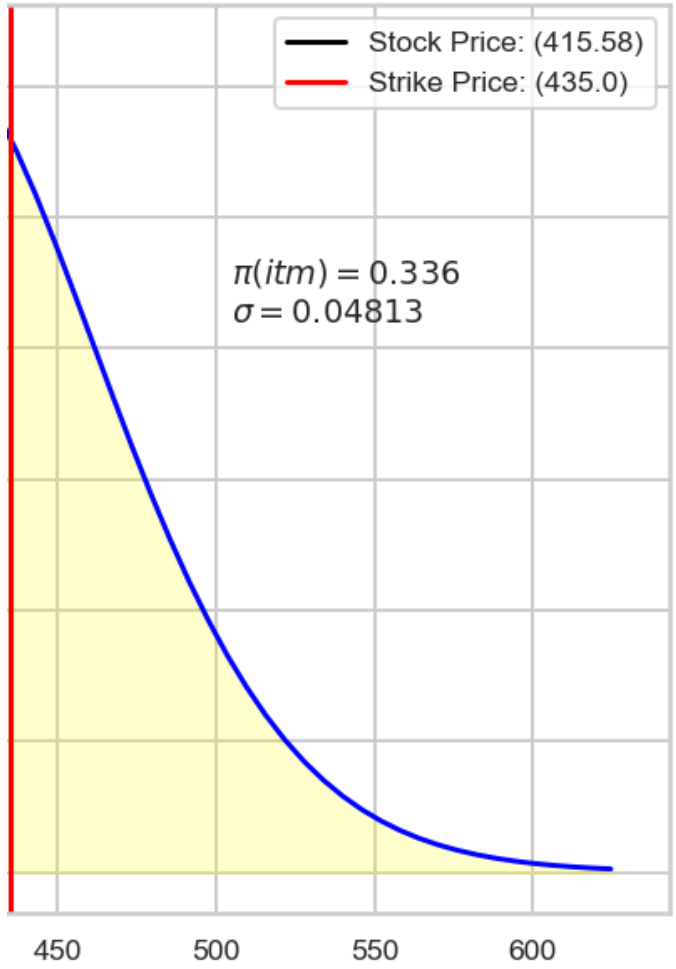
... and how do we regard our stock if we write this option against it??



We have created two tranches in this distribution ...

... and how do we regard our stock if we write this option against it??





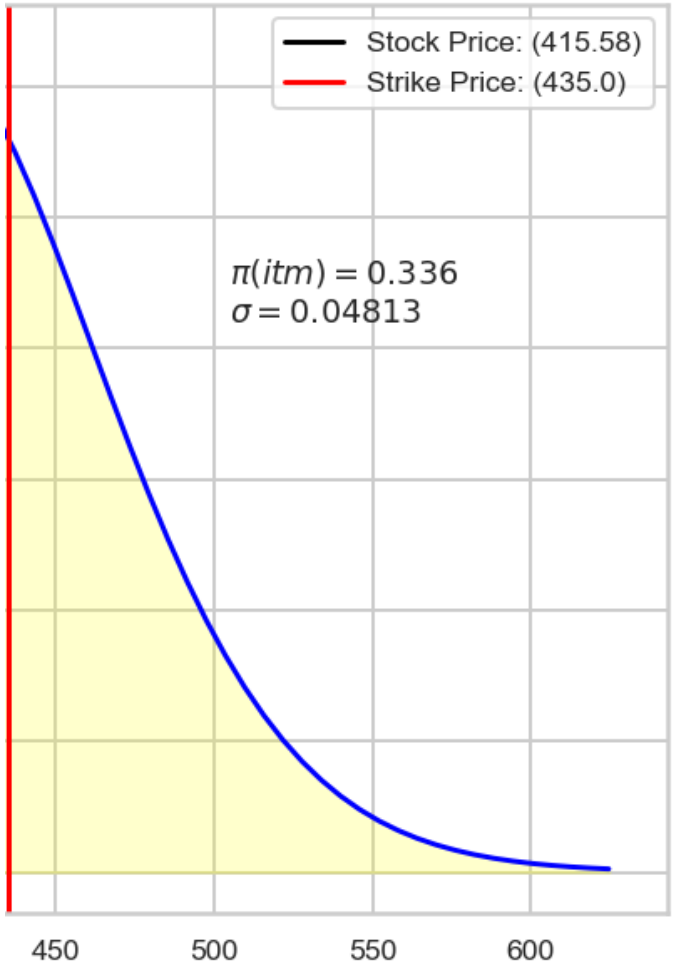
We have created two tranches in this distribution ...

... and both of these tranches have a specific expected value which can be estimated through integration or equivalent .

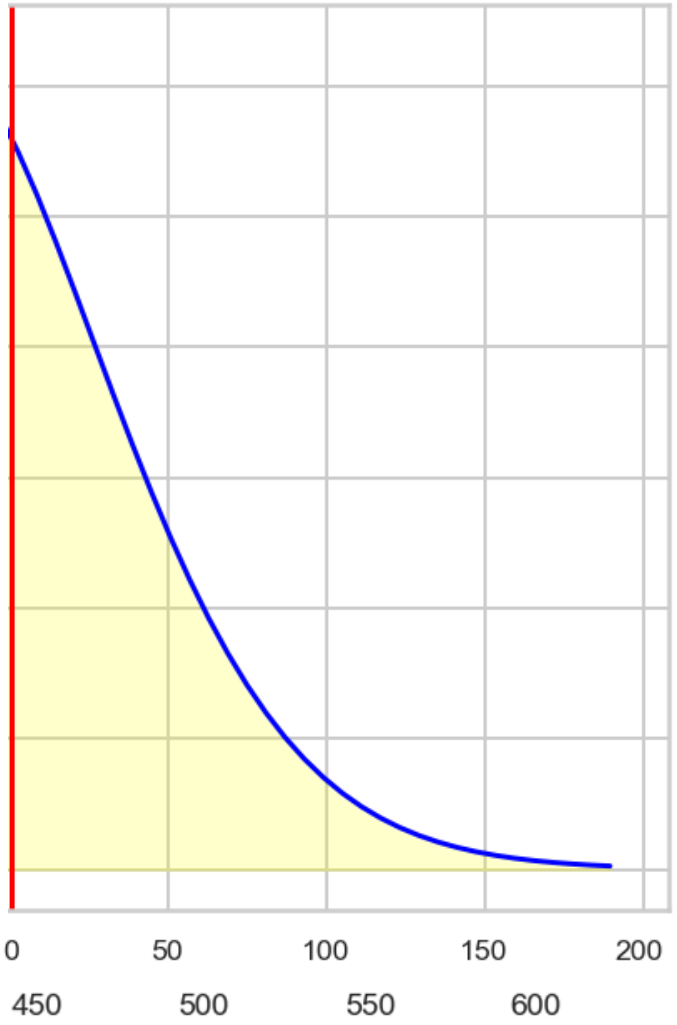
If our model is good, and this tranche is priced at the value of our model, then this is an example of an efficient market.

... and what is the value of the call option?

This is the tranche value ...



This is the call option value ...

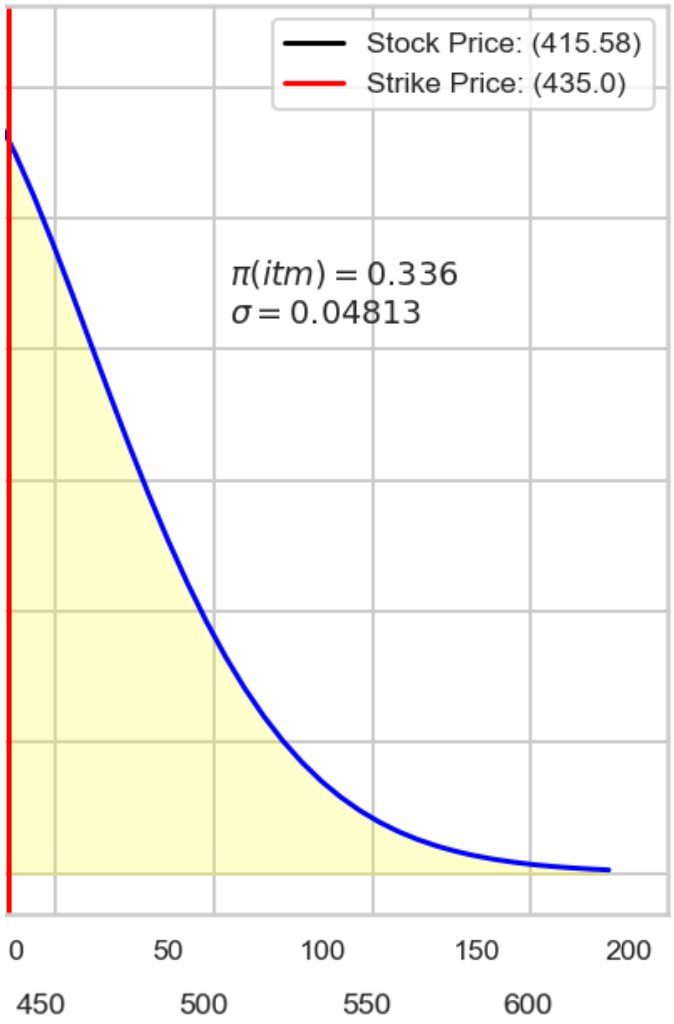


The tranche is not the call option. The call option is a special contract that gives you the option of buying the tranche at a price equal to the strike price.

So the call option is equal to the tranche less $435.

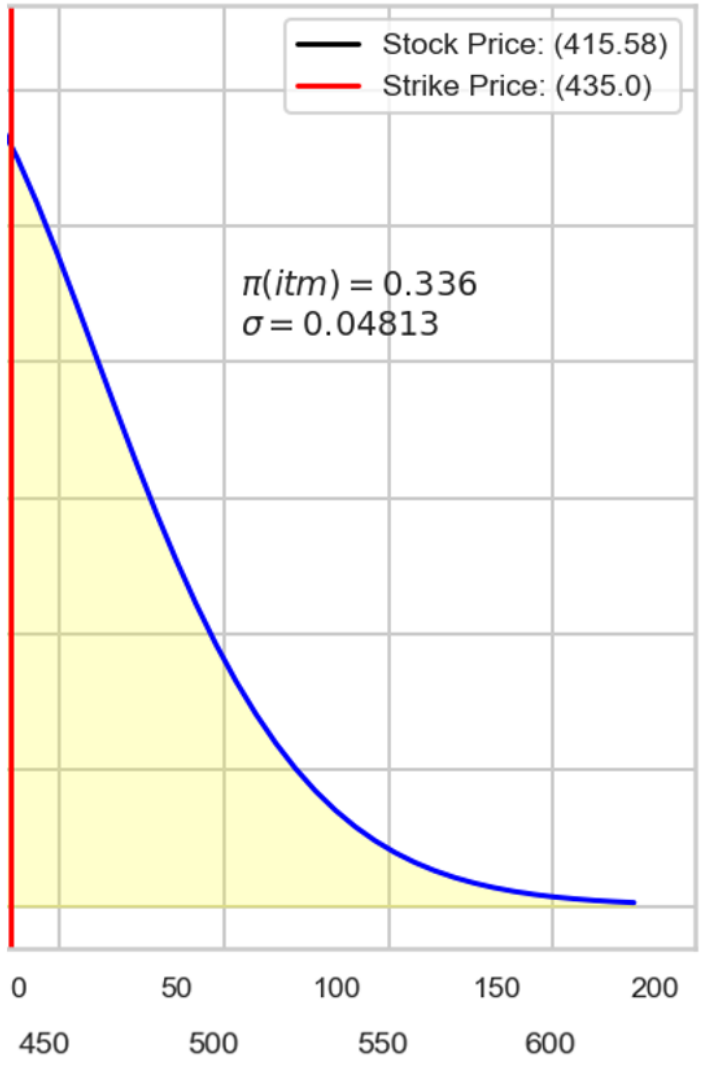
This result in the call option distribution shown on the right. The upper axis shows the payoff (and the cdf is mapping that value) and the lower axis shows the price array associated with that payoff.

Let's see what Spock has to say ..



If your tranche is priced efficiently given market conditions, and you should assume that it is, and if this condition is typical of all tranches that you price, you have no reason to expect profits by virtue of trading these tranches.

Let's see what Spock has to say ..

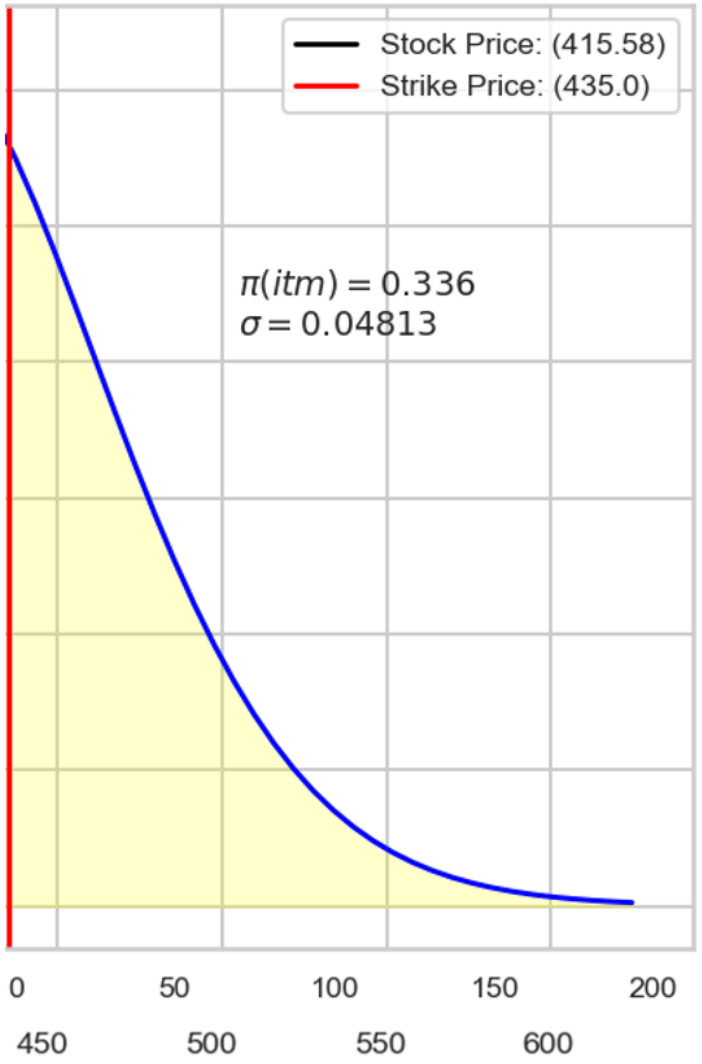


On the other hand, if you can find model-based evidence that this option is mis-priced, even if momentarily or perhaps because of a deficiency in someone else's model, then if you trade correctly with that information, profits become probable.

Remember, it takes time for markets to get to efficiency.

One important qualification: insurance hedge values allow profits even in efficient markets.

Is this call inherently more valuable if we write it instead of buy it?

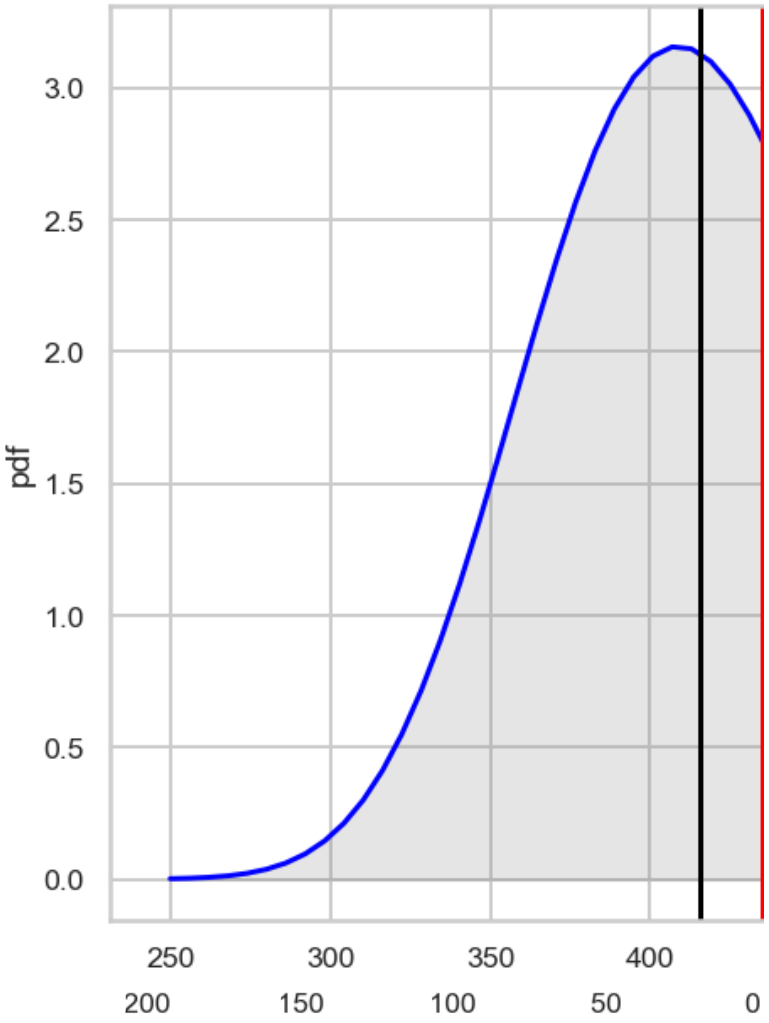


No.

But it has a premium! Doesn't that matter?

I said NO!

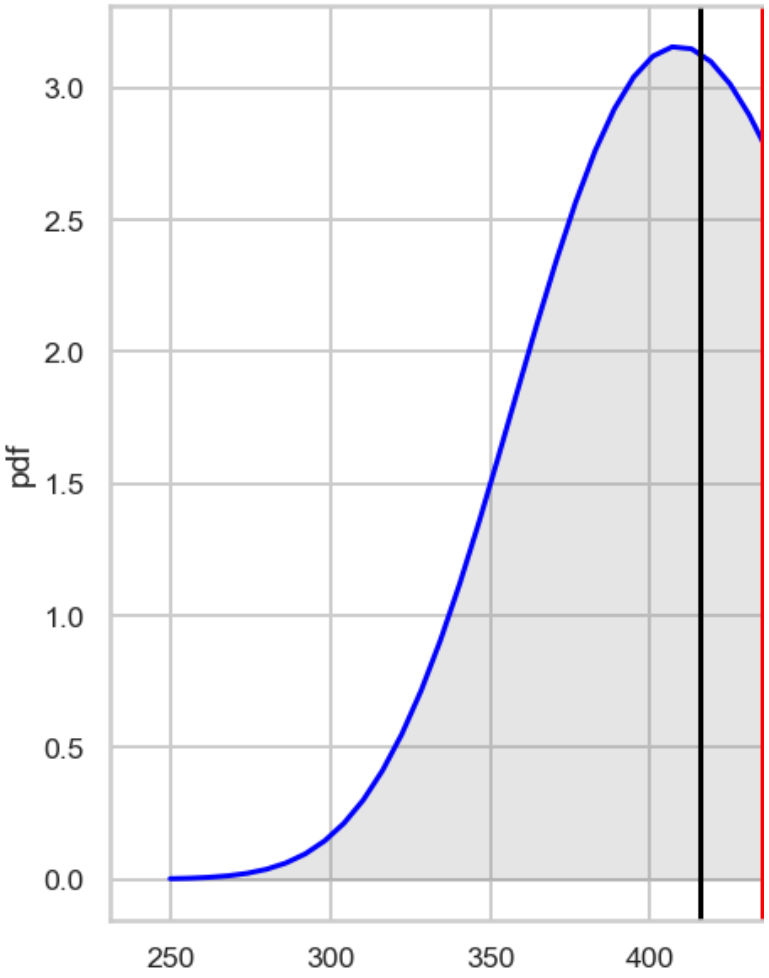
What is this?



The unadjusted mapping is a tranche.

For the abscissa, if you take 435 and subtract the values along the original abscissa, then you have the Apr 24 435 put. It is worth its integration value (one would have to integrate in reverse or mirror the image and integrate normally).

Is this put inherently more valuable if we write it instead of buy it?



No.

What if the IV rank is high?

If the IV rank merely reflects an increase in the volatility of the underlying stock, which would be reflected as a wider distribution in this context, then, **no**!

So how can we tell if an asset is mis-priced?

Note: No one is suggesting that these mapping models are used to find price anomalies. They are used here to illustrate the concept.

Question: Which measure of daily volatilities were we using in this model?

We used what we thought was the appropriate historical volatility for the trade.

This was not an academic example.

Remember, this was an actual strangle example.

We went to a lot of trouble to develop various measures of **historical volatility** and good ways to measure comparative **implied volatility**. Can you figure out a way to use these in combination to answer this question:

Is this option being priced at an efficient price (it's expected value is equal to its price) or do we have a trading profit opportunity?

Key take-aways that you *must* understand ...

1. An option can be thought of as a portion of a log-normal density distribution with measurable and understandable properties.

2. An option can be thought of as a tranche taken from that distribution. If it is a call, the other portion of the tranche is a put at the same strike. (And if the call is ITM, the put is OTM).

3. Markets do tend to efficiency (through arbitrage), although as external events change it takes time to get to efficiency.

4. There is no inherent logical reason to believe that writing puts or calls is profitable or more profitable than buying the same just because the options have a premium.
   - options in a perfectly efficient market will have premium
   - options in an imperfect market that are money losers if the write them will also have premiums.

5. One model-based way to evaluate transitional or anomalous options is to tediously compare appropriate measures of the volatility of the underlying to approporate measure of IV.

... but don't forget kurtosis, poor fit and the like.

You should understand by now that we are still talking about the horse-racing model.

That's it ...