



September 21, 2022

Nasdaq

Gamma: The Least Understood Option Greek

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Content
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Options

For the sake of simplicity, the examples included do not take into consideration commissions and other transaction fees, tax considerations, or margin requirements, which are factors that may significantly affect the economic consequences of a given strategy. An investor should review transaction costs, margin requirements and tax considerations with a broker and tax advisor before entering into any options strategy.

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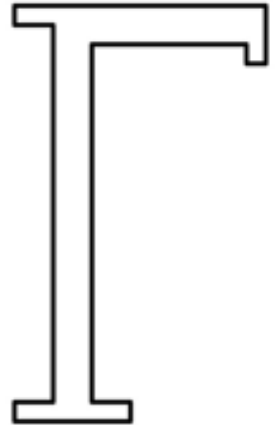
Any strategies discussed, including examples using actual securities and price data, are strictly for illustrative and education purposes and are not to be construed as an endorsement, recommendation or solicitation to buy or sell securities.



Gamma: The Least Understood Greek

Option Greeks: Measurement tools to estimate how changes in model inputs effect option values.

- **Delta** (sensitivity to changes in underlying) is not constant.
- **Gamma** quantifies the rate of change in delta.
- Speed (delta) v. Acceleration (gamma).
- Short-dated at-the-money (ATM) options have the most gamma.
 - At expiration, options have either 100 delta in-the-money (ITM) or 0 delta out-of-the-money (OTM).
- Dealers (liquidity providers) offset delta risks to isolate for other risks which can impact spot market flows.



Nasdaq Spotlights SpotGamma

What is SpotGamma?

- Content/Data/Software provider
 - Editorial content in WSJ, Bloomberg, Reuters, MarketWatch, and Nasdaq in the past month.
 - ~~Fundamental analysis~~
 - ~~Technical analysis~~
 - POSITIONAL ANALYSIS
- Personal Testimonial
 - Use data when considering monthly H/L ranges, support/resistance, breakout/breakdown levels.

Bloomberg
9/8/2022

[Crash-Obsessed Traders Splurge on Options at Two-Decade High](#)

The Wall Street Journal
9/7/2022

[Investors Are Forgoing Crash Insurance in Options Market](#)

Nasdaq
8/31/2022

[How Options Trading Can Impact the Underlying Equity Market](#)

The Wall Street Journal
8/30/2022

[The Options Market Is Accentuating the Swings in Stocks](#)

Bloomberg
8/22/2022

[Nomura Quant Says Options Shift on Wall Street Fuels Stock Rout](#)

Market Watch
8/19/2022

[Friday's \\$2.3 trillion options expiration could remove a critical avenue of support for stocks, analysts say](#)

Reuters
8/19/2022

[Wall Street ends down as yields rise; indexes post weekly losses](#)

Bloomberg
8/18/2022

[A \\$2 Trillion Stock-Options Deadline Is Make-Or-Break Moment for Bulls](#)





How Options Flow Impacts Equities

September 2022
Brent Kochuba, Founder

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HYPOTHETICAL PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH ARE DESCRIBED BELOW. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN. IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL PERFORMANCE RESULTS AND THE ACTUAL RESULTS SUBSEQUENTLY ACHIEVED BY ANY PARTICULAR TRADING PROGRAM. ONE OF THE LIMITATIONS OF HYPOTHETICAL PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR ADHERE TO A 15 PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS WHICH CAN ALSO ADVERSELY AFFECT ACTUAL TRADING RESULTS. THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL PERFORMANCE RESULTS AND ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.

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About SpotGamma

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“If you’re betting on sports, the amount of people on one side of the bet or another can influence the odds, not the outcome... **In the case of options, it can actually change the outcome.**”⁽¹⁾

Steve Sosnick, Chief Strategist at Interactive Brokers

(1) Philips, Matt. How Options Trading Could Be Fueling a Stock Market Bubble, Wall Street Journal, Jan 25, 2021.

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Factors That Determine an Option's Price



Option Price → Hedge Ratio = Delta

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Quick Primer on How Hedging Works

One way to define options “Delta” is as the **share hedge ratio of an option contract**.

Delta equates the number of underlying shares required to hedge the risks of underlying price movement for an options position.

Example Stock:	COIN (Coinbase Global, Inc.)
Option Contract:	\$80 Call Option Expiring on Oct 20th, 2022
Delta Ratio:	.50
Hedging Requirement:	50 shares (.50 x 1 option (x100 multiplier))

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How Hedging Influences Prices

As options trade, dealers & Market Makers have to hedge this **DYNAMIC** risk exposure

Trader Initiates	Dealer Position	Dealer Hedge	Gamma Hedge
Buys Call	Short Call	Buys Stock	Trade With Market
Sells Call	Long Call	Sells Stock	Trade Against Market
Buys Put	Short Put	Sells Stock	Trade With Market
Sells Put	Buys Put	Buys Stock	Trade Against Market

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How Options Orders are Traded

2 CATEGORIES OF OPTIONS TRADES

Large Orders

\$100k+ in premium
Typically funds



Small Orders

<\$100k in premium
Could be funds or retail



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How LARGE Options Orders are Traded

Large Orders (\$100k+ in premium):
Typically funds or private wealth (AKA "Buy Side")

Buy Side Trader



*"I want to buy 10,000
March COIN calls"*

Sell Side Trader
(Bank or other broker)



"OK, I will sell you those at \$10"



Broker now **short** 10,000 COIN calls

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How LARGE Options Orders are Traded

Short 10k Calls



Step 1:

Hedge the position and print* the options trade

Q: What's my Delta?

A: 50 Delta on 10,000 COIN calls means...
50 Delta = 500,000 COIN shares to buy

**Print: Call floor broker which notifies exchanges of the trade*

(Optional) Step 2:

Shop the order

Algo to Access Exchanges

Hedge Funds

"Layoff" Traders

Market Makers

Floor Brokers

Keep on book

Requires continued hedging

SpotGamma Pro

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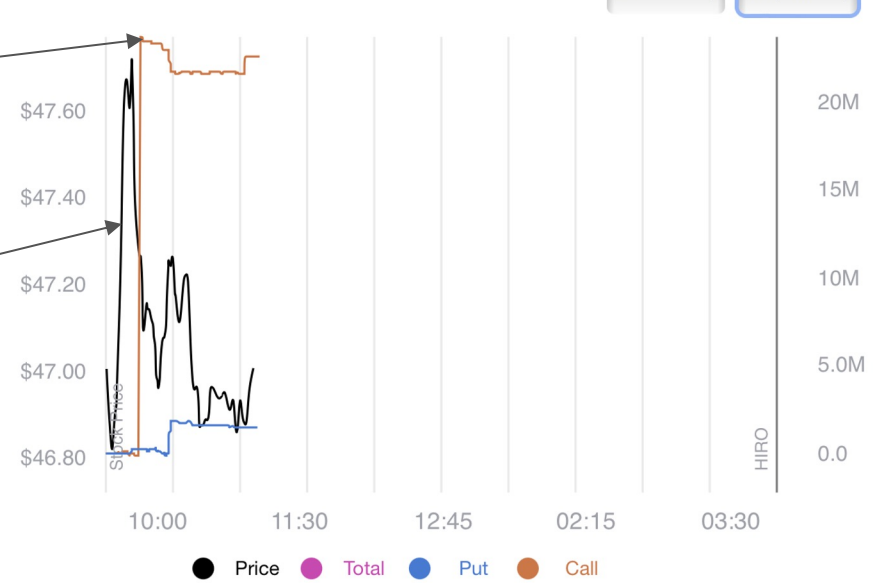
Large Order Hedge Impact

\$20 million estimated hedge impact

Large stock swing just before options trade

Hedge once & done

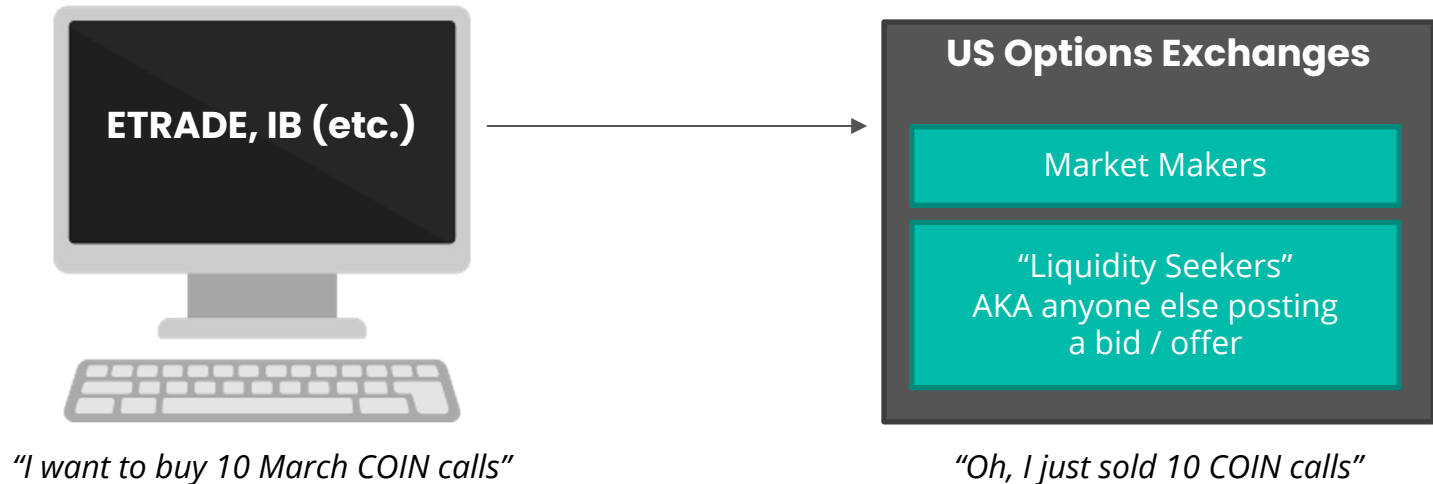
HIRO vs Stock Price Chart



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How SMALL Options Orders are Traded

Small Orders: <\$100k in premium
Could be funds or retail



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How SMALL Options Orders are Traded

Small Orders: <\$100k in premium
Could be funds or retail

Market Makers

Short 10 calls

“The single options trade already happened.”

To hedge:

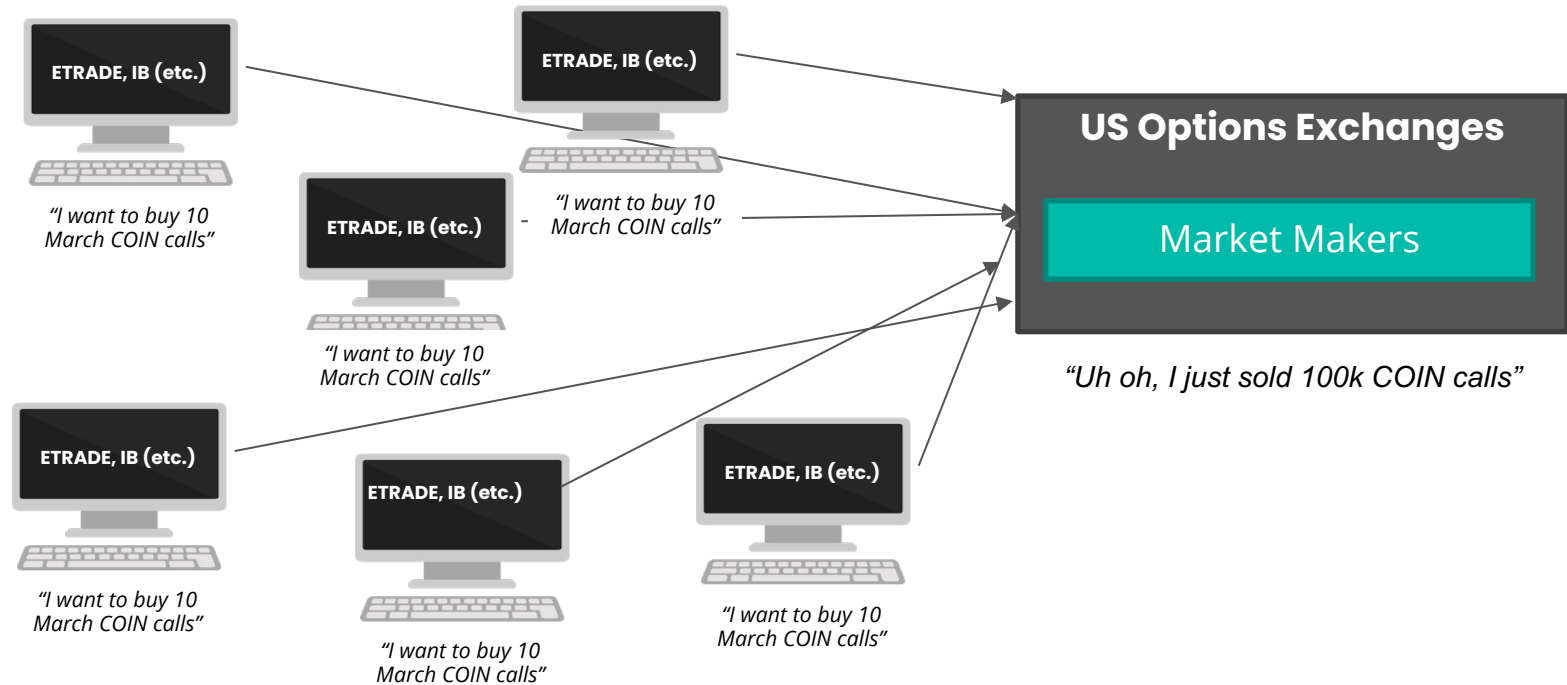
10 calls x 50 Delta

= 500 shares of COIN to buy

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Drips Lead to a Flood



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How SMALL Options Orders are Traded

Small Orders: <\$100k in premium
Could be funds or retail

Market Makers

Short 100k calls

“ALL of these options trades already happened!”

To hedge:

100,000 calls x 50 Delta
= 5,000,000 shares of COIN to buy

Key: buying takes place after trades have fired off!

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A Sea of Small Trades

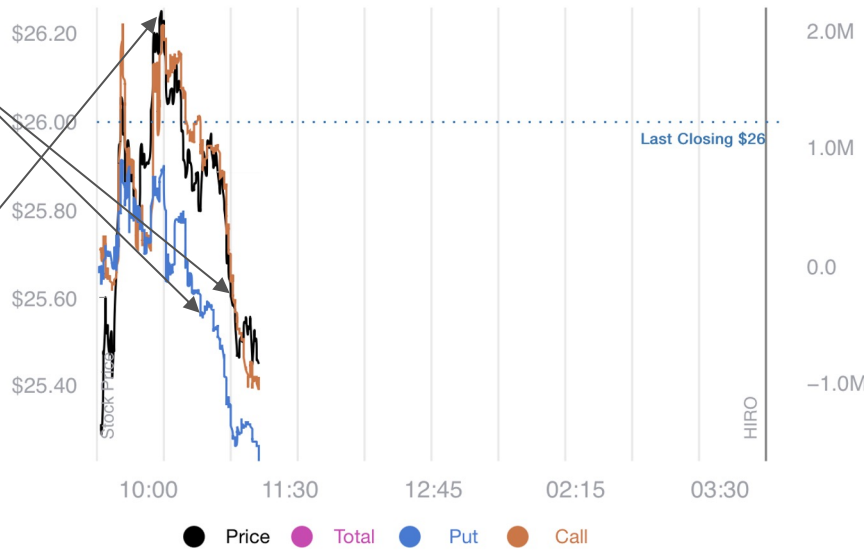
~\$7 million persistent hedge pressure

HIRO options flow turned negative...so did stock

Continuous flow = continuous hedging

HIRO vs Stock Price Chart

NIO Put/Call



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SpotGamma HIRO Indicator

Lifting the Veil on Real-Time Hedging

HIRO is designed to address:

What is happening *right now* to help to reveal *when and where* options activity may be moving stock prices

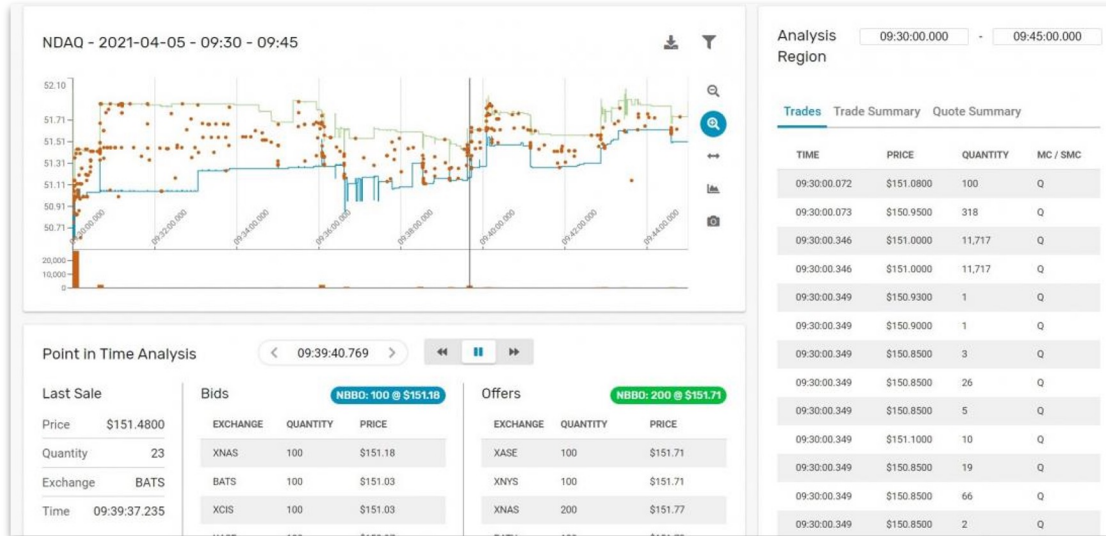
HIRO is a Delta-based signal that reveals the prospective dealer hedging impact of options that are trading *in real time*

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Nasdaq Market Replay Overview

Nasdaq Market Replay is a cloud-based replay and analysis tool, allowing users to view the consolidated order book and trade data for Nasdaq-, NYSE- and other regional exchange-listed securities at any point in time. As a cloud application, Market Replay allows for faster query speeds and less administrative burden.



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HIRO & Deltas in Action

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(1) Coinbase (COIN) on 9/14

HIRO vs Stock Price



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(1) Coinbase (COIN) on 9/14

HIRO vs Stock Price

COIN Put/Call



HIRO Indicator

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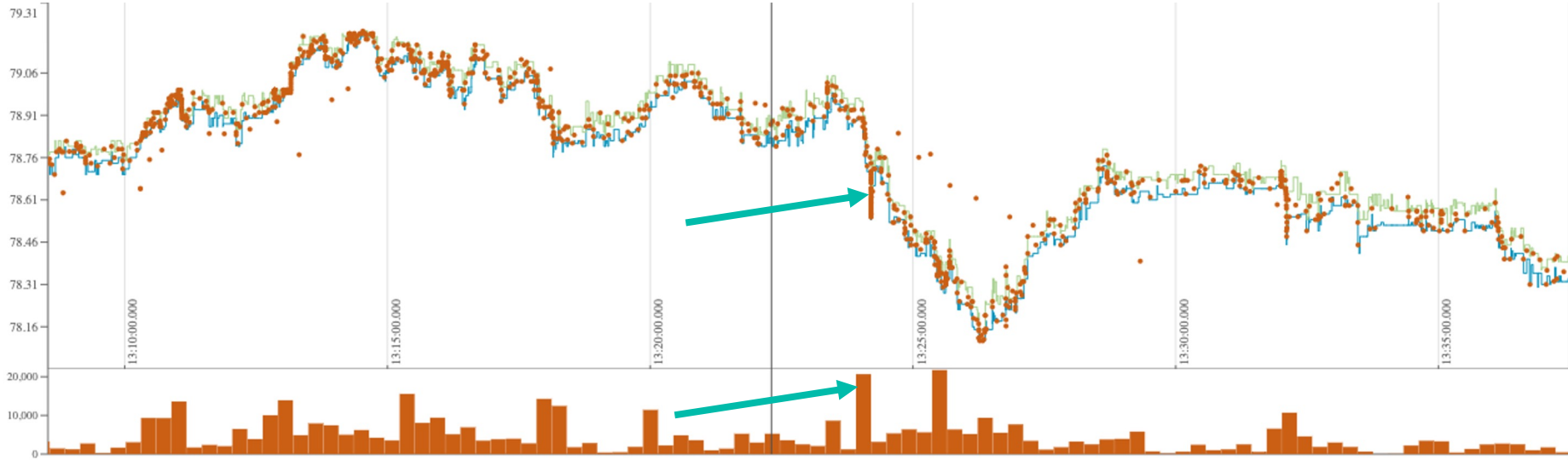
(1) COIN Call Sweeping from 13:22 - 13:25

Time	Symbol	Contracts	Price	Bid/Ask	Delta	Delta Notional	IV	Stock Px
13:25:24	21 OCT 22 75 C	150	11.35	11.30x11.55	0.6229	\$ 732,998	96.44%	78.45
13:25:10	16 SEP 22 80 C	3	1.95	1.93x1.95	0.425	\$ 10,002	109.97%	78.45
13:25:10	16 SEP 22 80 C	1	1.95	1.93x1.98	0.425	\$ 3,334	109.97%	78.45
13:25:10	16 SEP 22 80 C	1	1.93	1.93x1.98	0.4242	\$ 3,328	109.11%	78.45
13:25:08	16 SEP 22 80 C	73	1.93	1.93x1.94	0.4242	\$ 242,933	109.11%	78.45
13:25:08	16 SEP 22 80 C	21	1.93	1.93x1.94	0.4242	\$ 69,885	109.11%	78.45
13:25:08	16 SEP 22 80 C	1	1.93	1.93x1.99	0.4242	\$ 3,328	109.11%	78.45
13:25:08	16 SEP 22 80 C	1	1.93	1.93x1.99	0.4242	\$ 3,328	109.11%	78.45
13:25:08	16 SEP 22 80 C	1	1.93	1.93x1.99	0.4242	\$ 3,328	109.11%	78.45
13:25:08	16 SEP 22 80 C	3	1.93	1.93x1.99	0.4242	\$ 9,984	109.11%	78.45
13:25:04	16 SEP 22 85 C	1	0.62	.62x.68	0.1807	\$ 1,418	109.98%	78.45
13:24:13	16 SEP 22 80 C	1	2.02	1.96x2.13	0.4479	\$ 3,534	104.61%	78.9
13:24:12	16 SEP 22 80 C	1	2.03	2.03x2.05	0.4482	\$ 3,536	105.03%	78.9
13:24:12	23 SEP 22 85 P	1	9	8.70x9.00	-0.6381	\$ (5,035)	106.17%	78.9
13:23:36	23 SEP 22 80 C	332	4.59	4.50x4.70	0.5004	\$ 1,310,954	101.57%	78.91
13:23:36	23 SEP 22 86 C	332	2.41	2.35x2.47	0.3226	\$ 845,151	99.79%	78.91
13:23:31	23 SEP 22 80 C	1	4.59	4.50x4.70	0.5004	\$ 3,949	101.57%	78.91
13:23:31	23 SEP 22 86 C	1	2.41	2.35x2.47	0.3226	\$ 2,546	99.79%	78.91
13:23:31	23 SEP 22 80 C	17	4.59	4.50x4.70	0.5004	\$ 67,127	101.57%	78.91
13:23:31	23 SEP 22 86 C	17	2.41	2.35x2.47	0.3226	\$ 43,276	99.79%	78.91
13:22:52	23 SEP 22 80 C	11	4.56	4.45x4.65	0.4987	\$ 43,260	101.46%	78.8599
13:22:52	23 SEP 22 86 C	11	2.39	2.32x2.47	0.3209	\$ 27,837	99.70%	78.8599
13:22:52	23 SEP 22 80 C	40	4.56	4.45x4.65	0.4987	\$ 157,310	101.46%	78.8599
13:22:52	23 SEP 22 86 C	40	2.39	2.32x2.47	0.3209	\$ 101,225	99.70%	78.8599
13:22:51	23 SEP 22 86 C	25	2.37	2.32x2.47	0.3199	\$ 63,068	99.25%	78.8599
13:22:51	23 SEP 22 86 C	28	2.37	2.32x2.45	0.3199	\$ 70,636	99.25%	78.8599
13:22:51	23 SEP 22 86 C	25	2.38	2.32x2.47	0.3204	\$ 63,167	99.48%	78.8599
13:22:51	23 SEP 22 80 C	25	4.57	4.45x4.65	0.4989	\$ 98,358	101.66%	78.8599
13:22:51	23 SEP 22 80 C	28	4.57	4.50x4.65	0.4989	\$ 110,161	101.66%	78.8599
13:22:51	23 SEP 22 80 C	25	4.58	4.45x4.65	0.499	\$ 98,378	101.86%	78.8599
13:22:51	23 SEP 22 86 C	14	2.37	2.32x2.47	0.3199	\$ 35,318	99.25%	78.8599
13:22:51	23 SEP 22 86 C	14	2.38	2.32x2.47	0.3204	\$ 35,373	99.48%	78.8599
13:22:51	23 SEP 22 80 C	14	4.57	4.45x4.65	0.4989	\$ 55,080	101.66%	78.8599
13:22:51	23 SEP 22 80 C	14	4.58	4.45x4.65	0.499	\$ 55,092	101.86%	78.8599
13:22:51	23 SEP 22 86 C	16	2.37	2.32x2.47	0.3199	\$ 40,364	99.25%	78.8599
13:22:51	23 SEP 22 80 C	16	4.57	4.45x4.65	0.4989	\$ 62,949	101.66%	78.8599

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(1) Coinbase (COIN) on 9/14



Market Replay

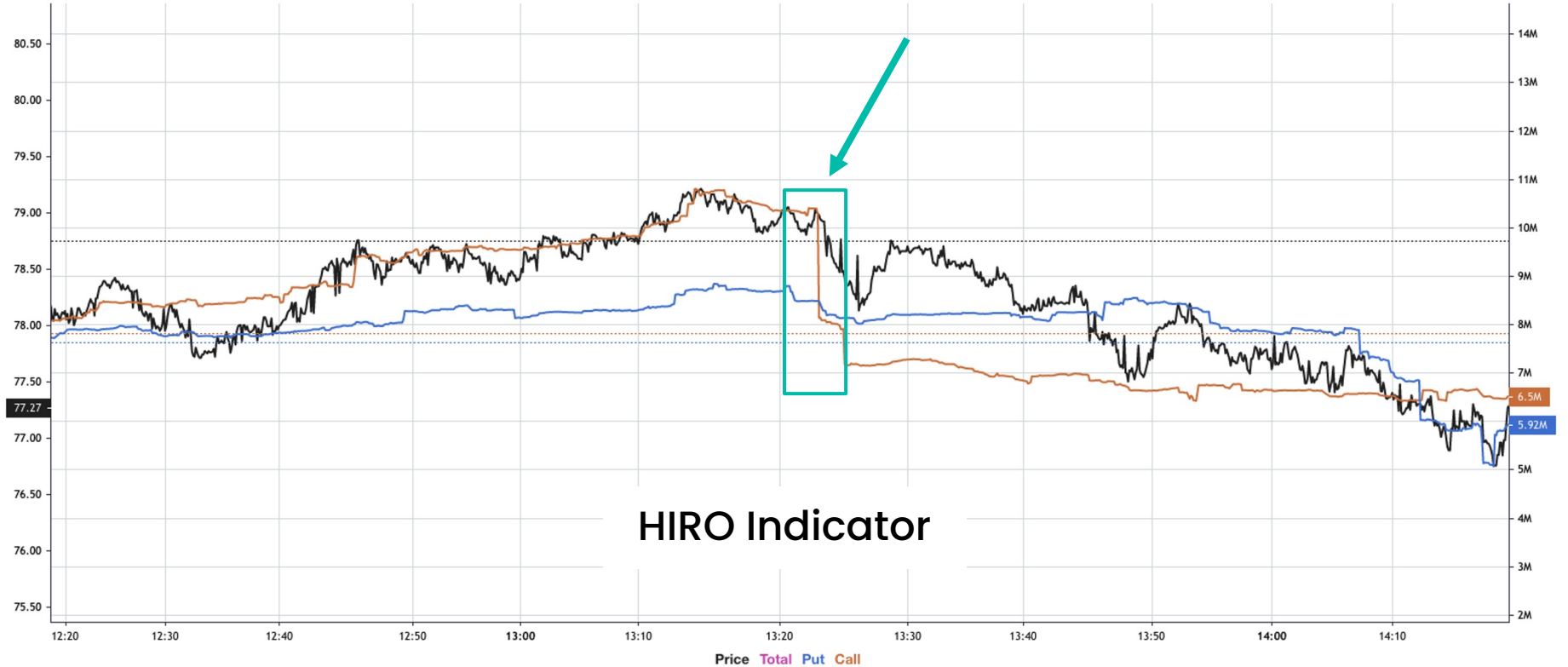
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(1) Coinbase (COIN) on 9/14

HIRO vs Stock Price

COIN Put/Call



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(2) Put Sellers Spark QQQ Rally on 9/14

HIRO vs Stock Price

QQQ Total



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(2) QQQ Rally on 9/14 Applies Hedging Strategy

As options trade, dealers & Market Makers have to hedge this **DYNAMIC** risk exposure

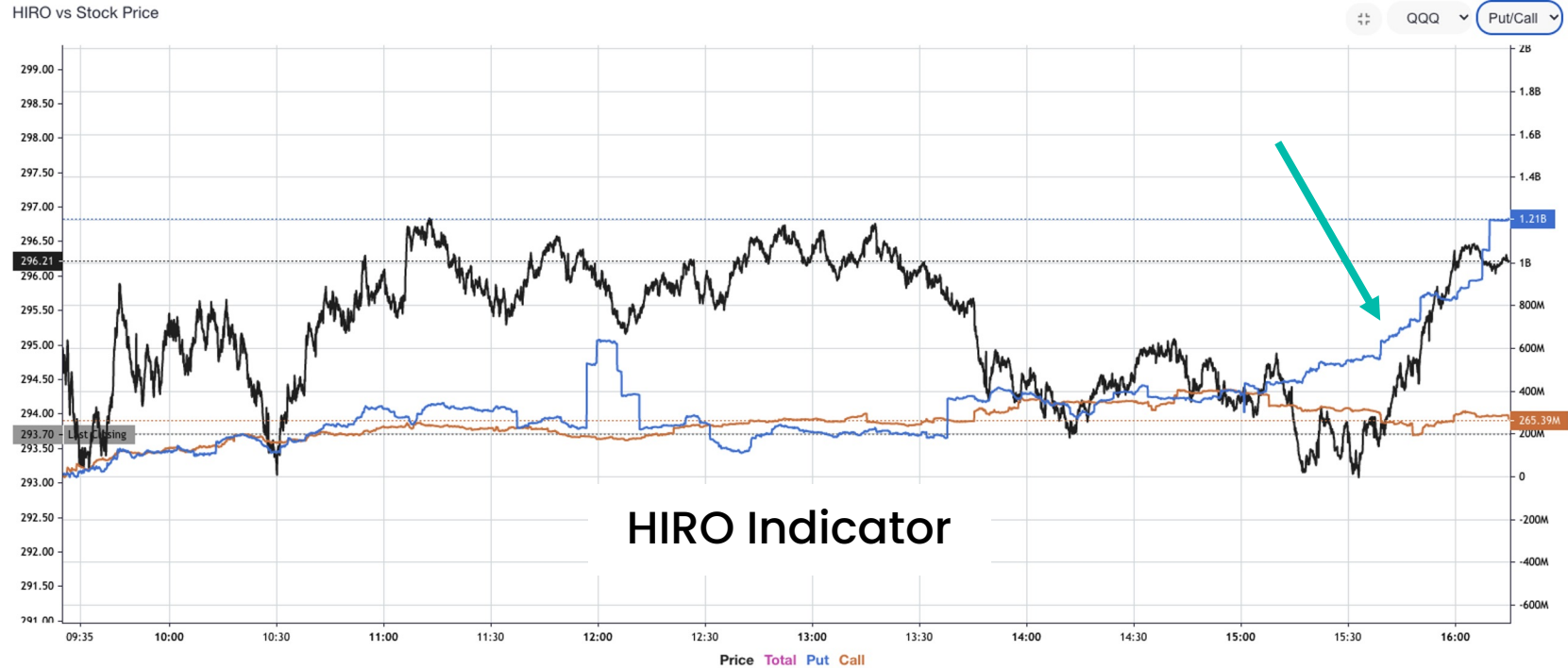
Trader Initiates	Dealer Position	Dealer Hedge	Gamma Hedge
Buys Call	Short Call	Buys Stock	Trade With Market
Sells Call	Long Call	Sells Stock	Trade Against Market
Buys Put	Short Put	Sells Stock	Trade With Market
Sells Put	Buys Put	Buys Stock	Trade Against Market

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(2) Put Sellers Spark QQQ Rally on 9/14

HIRO vs Stock Price



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(2) Traders Cover Short Dated Puts on 9/14

Absolute value of options traded

Absolute Delta I												
Row Labels	14 SEP	16 DEC	16 SEP	18 NOV	19 SEP	20 JAN	21 OCT	21 SEP	23 SEP	30 SEP	Grand Total	
+ <1/0/00												
+ 9 AM	\$ 311,890,726	\$ 33,128,011	\$ 214,103,164	\$ 63,526,633	\$ 142,392,411	\$ 24,997,586	\$ 122,476,130	\$ 112,733,165	\$ 200,049,992	\$ 121,069,859	\$ 1,682,853,179	
+ 10 AM	\$ 363,343,840	\$ 123,859,870	\$ 266,996,832	\$ 86,104,506	\$ 240,240,938	\$ 42,420,802	\$ 223,188,182	\$ 104,907,268	\$ 207,769,523	\$ 250,230,562	\$ 2,298,854,639	
+ 11 AM	\$ 177,058,256	\$ 110,257,557	\$ 298,675,700	\$ 43,794,456	\$ 133,179,658	\$ 25,275,895	\$ 135,485,574	\$ 130,456,877	\$ 154,226,611	\$ 130,721,962	\$ 1,497,132,621	
+ 12 PM	\$ 227,901,213	\$ 50,030,645	\$ 213,264,035	\$ 51,215,545	\$ 68,675,514	\$ 5,579,740	\$ 140,630,177	\$ 42,623,817	\$ 147,932,712	\$ 105,850,031	\$ 1,186,601,024	
+ 1 PM	\$ 387,691,677	\$ 32,451,584	\$ 311,612,296	\$ 28,814,465	\$ 137,165,555	\$ 65,039,195	\$ 332,654,623	\$ 123,582,849	\$ 116,757,626	\$ 97,963,509	\$ 1,808,884,480	
+ 2 PM	\$ 415,195,103	\$ 38,483,715	\$ 485,811,151	\$ 49,411,642	\$ 164,444,560	\$ 7,655,272	\$ 121,392,677	\$ 53,483,174	\$ 204,640,110	\$ 107,811,237	\$ 1,991,079,846	
+ 3 PM	\$ 1,144,939,952	\$ 48,860,809	\$ 2,343,141,326	\$ 68,048,437	\$ 234,838,321	\$ 13,961,138	\$ 237,359,654	\$ 166,554,082	\$ 482,479,628	\$ 285,832,454	\$ 5,393,738,350	
:00	\$ 37,658,190	\$ 356,489	\$ 673,619,407	\$ 924,898	\$ 6,802,642	\$ 612,111	\$ 7,949,162	\$ 18,101,606	\$ 39,873,333	\$ 3,704,203	\$ 799,729,298	
:05	\$ 40,853,961	\$ 468,110	\$ 41,356,501	\$ 1,829,167	\$ 6,468,676	\$ 86,817	\$ 4,639,725	\$ 19,937,844	\$ 24,992,428	\$ 42,405,279	\$ 239,589,406	
:10	\$ 22,260,178	\$ 1,729,698	\$ 41,020,868	\$ 2,870,609	\$ 7,879,364	\$ 1,835,160	\$ 8,386,555	\$ 33,696,231	\$ 14,190,863	\$ 6,056,308	\$ 161,334,841	
:15	\$ 125,595,974	\$ 5,731,338	\$ 152,415,746	\$ 2,729,533	\$ 21,026,270	\$ 1,133,861	\$ 24,998,486	\$ 39,240,938	\$ 18,393,871	\$ 17,125,742	\$ 438,348,007	
:20	\$ 85,563,209	\$ 1,075,218	\$ 85,405,567	\$ 4,698,295	\$ 8,666,090	\$ 1,079,665	\$ 12,036,136	\$ 4,810,218	\$ 163,496,501	\$ 157,898,703	\$ 538,044,142	
:25	\$ 94,890,064	\$ 472,133	\$ 78,804,108	\$ 3,238,387	\$ 10,761,744	\$ 818,097	\$ 11,816,290	\$ 4,718,610	\$ 18,326,186	\$ 2,003,413	\$ 245,833,270	
:30	\$ 125,940,940	\$ 1,167,499	\$ 103,027,260	\$ 7,233,231	\$ 13,609,988	\$ 2,169,122	\$ 11,287,814	\$ 7,508,516	\$ 13,302,754	\$ 9,521,833	\$ 341,195,427	
:35	\$ 71,310,227	\$ 11,550,899	\$ 84,913,208	\$ 16,620,685	\$ 14,137,740	\$ 1,033,734	\$ 6,953,026	\$ 2,845,368	\$ 107,569,688	\$ 3,683,884	\$ 344,236,476	
:40	\$ 112,575,973	\$ 7,016,619	\$ 128,660,752	\$ 4,848,910	\$ 28,332,651	\$ 1,410,890	\$ 21,270,694	\$ 3,953,511	\$ 16,227,157	\$ 10,759,865	\$ 370,179,984	
:45	\$ 166,135,301	\$ 720,086	\$ 258,787,415	\$ 3,268,566	\$ 20,475,287	\$ 271,588	\$ 71,998,265	\$ 7,478,421	\$ 26,151,129	\$ 7,116,594	\$ 617,134,917	
:50	\$ 135,568,859	\$ 7,092,502	\$ 477,896,878	\$ 14,756,279	\$ 28,909,194	\$ 654,913	\$ 16,181,708	\$ 12,384,679	\$ 21,810,698	\$ 13,746,784	\$ 761,646,688	
:55	\$ 126,587,075	\$ 11,480,218	\$ 217,233,616	\$ 5,029,877	\$ 67,768,675	\$ 2,855,182	\$ 39,841,793	\$ 11,878,140	\$ 18,145,021	\$ 11,809,845	\$ 536,465,895	
+ 4 PM	\$ 260,401,094	\$ 1,699,541	\$ 512,832,139	\$ 2,207,276	\$ 41,383,401	\$ 1,210,376	\$ 8,464,937	\$ 14,705,904	\$ 10,529,234	\$ 55,839,229	\$ 919,202,138	
Grand Total	\$ 3,288,421,860	\$ 438,771,734	\$ 4,646,436,642	\$ 393,122,960	\$ 1,162,320,359	\$ 186,140,004	\$ 1,321,651,954	\$ 749,047,137	\$ 1,524,385,437	\$ 1,155,318,843	\$ 16,778,346,278	

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