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Market Lens

Unlevel Playing Field? What 605s Can Tell Us About Tick Sizes

EXECUTIVE SUMMARY

There has been quite a bit of recent discussion about tick sizes in the equity markets and whether the one-penny minimum quoting increment has made it challenging for exchanges to compete with off-exchange venues for retail flow.

As we discussed in our May 2021 white paper¹, market data clearly shows that certain stocks are tick constrained. Such stocks are regularly quoted in substantial size with approximately a one-penny spread, and market participants would likely quote at even tighter spreads if the minimum quoting increment were reduced.

To improve market efficiency, we recommended **reducing the minimum quoting increment to a half-penny for these tick-constrained stocks.**

Some have gone much further by suggesting that the minimum quoting increment should be reduced for **all** stocks, even those that are not tick-constrained. Some have even proposed that the minimum trading increment be aligned to match the minimum quoting increment. Proponents claim that exchanges cannot compete with off-exchange venues because of the latter's ability to execute "in-between the ticks," whereas exchanges cannot, thus creating an unlevel playing field. However, our analysis demonstrates that there is no benefit to smaller tick increments for stocks with spreads wider than a few pennies.

A LEVEL PLAYING FIELD

First some facts: Minimum quoting and trading increments are universally applied to all market centers. With respect to quoting increments, exchanges and off-exchange venues are both prohibited from quoting, or even ranking, prices for stocks above \$1 in sub-penny increments². Accepting sub-penny orders is prohibited under Rule 612 as well.

In contrast, with respect to trading increments, both exchanges and off-exchange venues are permitted to execute at any price increment. For example, a number of exchanges have programs that allow qualified market makers to provide on-exchange price improvement specifically to retail investors (so-called "Retail Liquidity Programs") with trades executed at increments as narrow as one-tenth of a penny (i.e., a tenth of

¹ <https://s3.amazonaws.com/citadel-wordpress-prd101/wp-content/uploads/sites/2/2021/05/03130457/EnhancingCompetitionTransparencyandResiliencyinUSFinancialMarkets.pdf>.

² With very limited exceptions (such as pricing at the midpoint). In fact, the SEC has brought cases against off-exchange venues that have ranked quotes in sub-penny prices without meeting any of the exceptions.

the minimum quoting increment)³.

While this information is useful, we know that good policy comes from good data analysis, so it's important to look carefully to see if the data suggests that one-penny tick sizes have led to an unlevel the playing field preventing exchanges from providing the same level of execution quality as off-exchange venues.

Though it is possible to use trade data from the SIP, including the TRF, to back out levels of price improvement, this data is not well suited for the task as it is impossible to reconstruct the original orders, the nature of the orders, and how they were handled.

Fortunately, there is public data we can use that directly relates to the issue: Rule 605 execution-quality reports that

ANALYSIS

Below is a summary of the publicly available 605 reports from exchanges and Citadel Securities for the six months of January through June 2022. Data includes all orders categorized as either **Market** or **Marketable Limit**.

every market center publishes monthly. These reports provide an order-based view of quoted-spreads, effective-spreads, and price improvement. Most importantly, every report is produced in accordance with SEC rules, so the data is consistently reported across exchanges and off-exchange venues (including, for example, with respect to the impact of odd-lots).

Our ensuing analysis of these reports shows that Citadel Securities provides more price improvement than exchanges both for stocks that are tick-constrained **and those that are not**. This clearly demonstrates that discrepancies in price improvement for stocks that are not tick-constrained do not result from an unlevel playing field caused by the one-penny minimum quoting increment but must be attributable to other factors.

As the data reveals, Citadel Securities provides very significant price improvement, both on an absolute level (with an Effective/Quoted spread ratio, or E/Q, of 54.3%) as well as on a relative level, compared to the exchanges. Notably, this price improvement is applied to more than 89 billion executed shares, second in size only to Nasdaq. These results are not

VENUE	SHARES EXECUTED	EFFECTIVE SPREAD (CENTS)	QUOTED SPREAD (CENTS)	NET PI (CENTS)	E/Q
CITADEL SECURITIES	89,080,864,992	1.51	2.79	0.64	54.3%
IEX	14,926,776,212	3.51	3.99	0.24	88.0%
CBOE BYX	13,097,308,706	1.61	1.76	0.07	91.5%
NASDAQ BX	4,383,852,535	2.16	2.36	0.10	91.7%
CBOE BZX	46,075,493,957	1.68	1.82	0.07	92.6%
CBOE EDGA	14,642,548,523	1.75	1.86	0.06	93.8%
NASDAQ	123,983,459,943	2.30	2.43	0.07	94.6%
CBOE EDGX	42,077,304,491	2.03	2.10	0.04	96.5%
NASDAQ PSX	9,253,520,564	1.34	1.38	0.02	97.4%
NYSE	64,425,260,026	2.48	2.52	0.02	98.6%
NYSE National	10,330,312,137	1.41	1.42	0.01	99.0%
NYSE Arca	71,919,350,170	2.05	2.00	(0.02)	102.1%
NYSE American	4,634,566,149	1.75	1.65	(0.05)	105.6%
Grand Total	508,830,618,405	2.03	2.33	0.15	87.3%

surprising, as it is well known that order flow segmentation enables wholesalers such as Citadel Securities to provide price improvement to their clients. This segmentation generally allows retail investors to receive better prices than institutional investors, high-frequency trading firms or other market professionals.

The table shows that Citadel Securities provides, on average across all orders, 0.64 cents (64 mills) of price improvement per share. This added up to more than half a billion dollars in savings for retail investors during the first half of 2022, though across all orders the average price improvement is less than one penny per share.

³ For example, see the SEC's 2019 approval of NYSE's proposal to make their Retail Liquidity Program (RLP) pilot, which uses sub-penny prices, permanent: <https://www.sec.gov/rules/sro/nyse/2019/34-85160.pdf>. In the proposal, NYSE notes, "The order flow the Program attracted to the Exchange provided tangible price improvement to retail investors through a competitive pricing process unavailable in non-exchange venues." By approving such a mechanism, the SEC arguably tilted the playing field towards exchanges by granting them a limited exemption to Rule 612 that allowed them to accept sub-penny orders.

As the “unlevel playing field” theory seeking to explain observed differences in execution quality goes, if minimum quoting increments were reduced for all stocks, perhaps to 0.25 cents or even to 0.10 cents, and the minimum trading increment were aligned to this new quoting increment, then exchanges would be able to offer similar “sub-penny” levels of execution quality.

While the key assumptions informing this theory are false, because exchanges are already permitted to trade at sub-penny price increments through their RLP programs, we can nevertheless directly test this theory using 605 data.

Wide-Spread Stocks

As shown in the table above, the average quoted spread across all symbols is 2.33 cents. But not all stocks have quoted spreads of just a few pennies – many trade with much greater quoted spreads, in part because of their higher prices. Below are the same statistics shown in the previous table, but here we include **only the top 50 stocks (by volume) with average quoted spreads of 20 cents or more**. This includes many familiar names, such as Tesla, Amazon, and Google.

VENUE	SHARES EXECUTED	EFFECTIVE SPREAD (CENTS)	QUOTED SPREAD (CENTS)	NET PI (CENTS)	E/Q
CITADEL SECURITIES	795,747,512	19.92	46.42	13.25	42.9%
IEX	185,660,771	37.95	46.68	4.37	81.3%
CBOE BYX	40,273,143	36.96	43.55	3.29	84.9%
NASDAQ BX	26,324,129	34.83	40.52	2.85	86.0%
CBOE EDGA	38,253,938	30.46	33.78	1.66	90.2%
CBOE BZX	218,603,133	32.39	35.31	1.46	91.7%
NASDAQ PSX	18,830,739	40.79	43.99	1.60	92.7%
NASDAQ	1,059,961,888	33.27	35.83	1.28	92.9%
NYSE National	19,447,788	35.40	38.09	1.34	92.9%
NYSE	408,527,560	29.42	30.90	0.74	95.2%
CBOE EDGX	333,148,763	31.81	33.28	0.73	95.6%
NYSE Arca	435,662,909	33.95	35.13	0.59	96.6%
NYSE American	15,116,965	33.20	31.84	(0.68)	104.3%
Grand Total	3,595,559,238	30.09	37.96	3.94	79.3%

This data shows that for wide-spread stocks, Citadel Securities is providing **more than 13 cents of price improvement per share**, compared to less than 4 cents per share across the exchanges. And, similar to the above, Citadel Securities is second only to Nasdaq in terms of total shares executed.

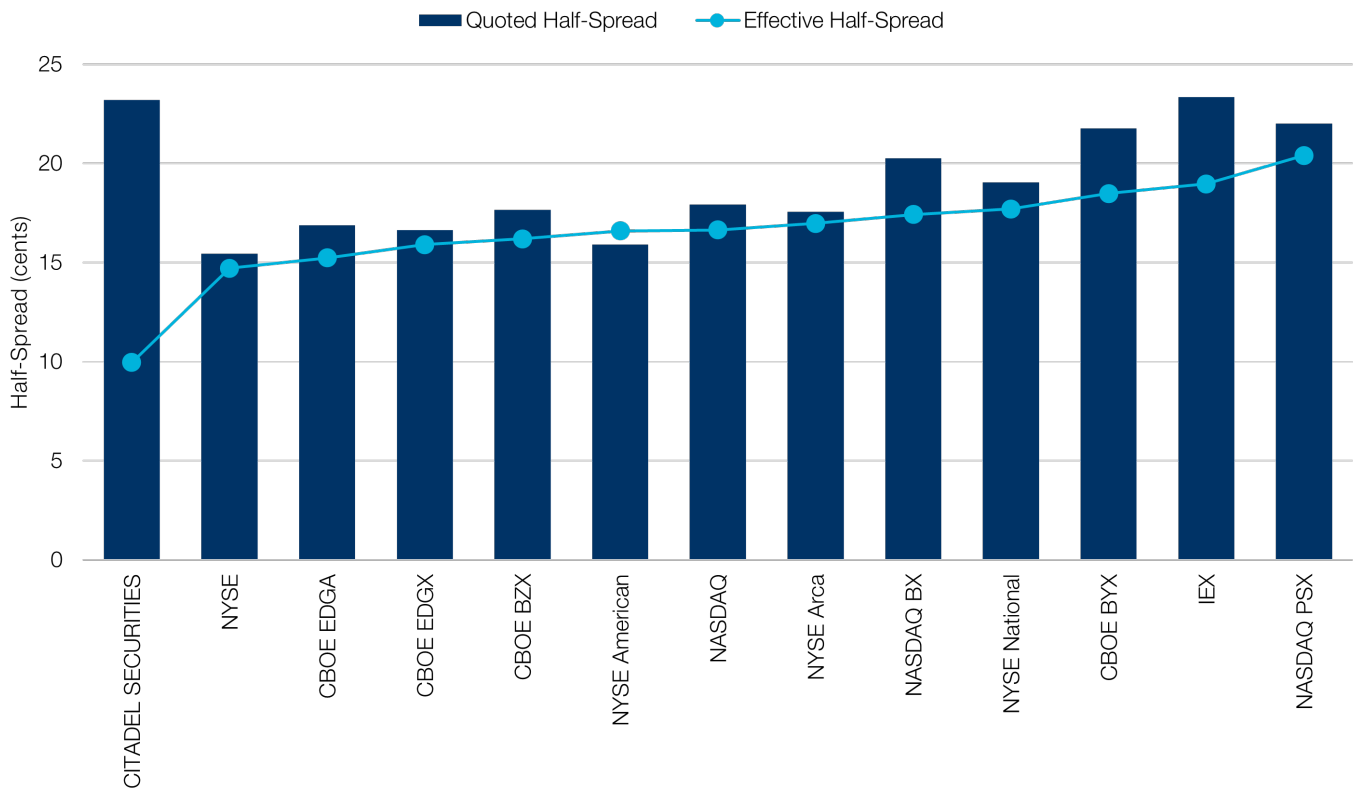
Most importantly, we see that executions in these stocks are no way constrained by tick sizes with respect to either quoting or trading. There is plenty of room for participants on exchanges to improve the displayed market price by 1, 5, or even 10 pennies to provide the same level of execution quality as Citadel Securities, but they have not done so.

Below is a graphical representation of the above data, but where effective and quoted spreads have been converted to half-spreads so that PI and tick increments are clearly comparable.

As the chart illustrates, the effective spread of Citadel Securities executions is at least 5 cents (five full price increments) better than the quoted spread (and effective spread) on any exchange; **and with respect to a number of exchanges it's better by 10 cents or more.**

Also note that average quoted spreads are significantly greater for Citadel Securities' executions than for many exchanges. Thus, when retail investors tend to trade, there is even more room for market participants on exchanges to improve on the displayed market price, if they wanted to do so.

Price Improvement for Top 50 Stocks with Quoted Spreads > 20 cents



The above analysis directly informs the debate as to whether narrowing the minimum quoting increment to 0.25 or 0.10 cents and aligning the minimum trading increment with this quoting increment would “level the playing field” and enable market participants on exchanges to execute more aggressively.

As the data reveals, in stocks that are completely unconstrained by the minimum quoting increment, and for which price improvement is provided in several cents rather than sub-pennies, the playing field is already level. **Market participants on exchanges nevertheless do not quote or execute at prices that are anywhere near the prices Citadel Securities provides to retail investors.**

The significant difference in execution quality between exchanges and off-exchange venues, must therefore be driven by other factors, such as order segmentation, not minimum quoting or trading increments.

CONCLUSION

The effect of broadly eliminating the one-penny minimum quoting increment to which all market centers are currently subject can have many negative unintended consequences. As the SEC noted in its approval of the NYSE RLP program, widespread sub-penny quoting can lead to flickering quotes, reduced liquidity, higher transactions costs, and potentially increased fragmentation in the securities markets.⁴

Proponents claim that such a change is needed to “level the playing field” between exchanges and off-exchange venues so that exchanges can provide the same level of price improvement as wholesalers. As this analysis shows, public 605 data does not support this claim – even when unconstrained by the one-penny quoting rule, market participants on exchanges still do not quote or execute at prices that are as good as what can be achieved by wholesalers filling retail orders. As the debate about tick-size reform continues, we should bear in mind that any changes to the one-penny minimum quoting increment will not necessarily result in exchanges offering more competitive pricing.

For more insights, go to citadelsecurities.com.

⁴ See *id.* at 60

METHODOLOGY

All data used in these analyses was sourced directly from the 605 reports published by each firm on their respective web sites. See [“SEC Staff Legal Bulletin No. 12R, and Appendices A and B”](#) for details regarding the content and format of these reports.

The analysis covers all Market (F5=11) and Marketable Limit (F5=12) orders. Derived values are as follows:

- Shares Executed = F10 + F11
- Total Net PI (\$) = (F19 x F20) – (F24 x F25)
- Total Effective Spread (\$) = F18 x (F10 + F11)
- Total Quoted Spread (\$) = 'Total Effective Spread (\$)' + 2 x 'Total PI (\$)'
- E/Q = 'Total Effective Spread (\$)' / 'Total Quoted Spread (\$)'
- Net PI (cents) = 'Total Net PI (\$)' / 'Shares Executed' x 100
- Effective Spread (cents) = 'Total Effective Spread (\$)' / 'Shares Executed' x 100
- Quoted Spread (cents) = 'Total Quoted Spread (\$)' / 'Shares Executed' x 100
- Effective Half-Spread (cents) = 'Effective Spread (cents)' / 2
- Quoted Half-Spread (cents) = 'Quoted Spread (cents)' / 2

Where 605 field numbers are defined as follows:

- F5: Order Type Code
- F10: Market Center Executed Shares
- F11: Away Executed Shares
- F18: Average Effective Spread (\$)
- F19: Price-Improved Shares
- F20: Price Improved Average Amount (\$)
- F24: Outside-the-Quote Shares
- F25: Outside-the-Quote Average Amount (\$)

Average values used in the tables are the result of summing additive quantities, such as Total Net PI (\$), and then dividing by Shares Executed, for any level of aggregation.