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Market Commentary

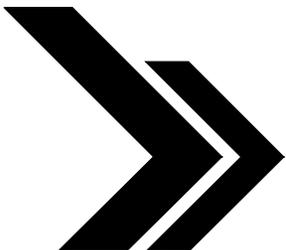
Solo Takeoff

Key takeaways from the fee pilot experiment

- The reduced access fee, and rebate, in general reduced Nasdaq's market share slightly, but not for all names in the pilot
- Nasdaq's quote sizes and time at NBBO decreased more than overall volume
- Inverted exchanges also lost market share in the pilot names
- The results from the pilot should not be extrapolated to illiquid securities
- Nasdaq itself reported that the top 5 liquidity providers dropped from 45 to 28% of liquidity in the pilot names

Amidst the controversy and regulatory debates over stock exchanges' maker-taker pricing models, on February 2, 2015 Nasdaq unilaterally launched a pilot program to significantly reduce its market access fee on 14 symbols.¹ The exchange lowered this fee from 30 mils to 5 mils; it also reduced the rebate to 4 mils for adding displayed liquidity. This provides us with a unique and highly constrained experiment in which we can test the effects of the exchanges' decades-old practice of subsidizing liquidity providers to entice greater liquidity and gain market share.

One month into this pilot program, we have looked at how the market has reacted. Among other topics, the most interesting questions this pilot program may be able to answer are: will Nasdaq indeed lose quoted liquidity by lowering rewards to liquidity providers, and will it also lose volume market share as a result. The main conclusions from our observations so far are as follows:



1. Posted liquidity deteriorated on Nasdaq

- a. Liquidity provision—measured by bid-ask spreads, probability at NBBO and displayed queue lengths—has deteriorated uniquely at Nasdaq.
- b. Other maker-taker exchanges such as BATS have apparently gained some of the posted liquidity Nasdaq has lost. The liquidity provision measures of these exchanges grew to rival Nasdaq's.

2. Volume moved away from Nasdaq to other maker-taker exchanges

- a. Nasdaq has lost market share with respect to dollar volume, number of trades and number of quotes. As a whole, the exchange's dollar volume-based market share has dropped by a few percentage points.
- b. Other maker-taker exchanges have instead gained market share, whereas inverted exchanges have lost market share; results with dark pool market share are mixed.

3. Results are consistent across symbols and time

- a. Interestingly, the above-mentioned results are quite consistent across the pilot symbols regardless of their listed exchange and liquidity segments.
- b. In addition, these observations have largely been consistent throughout February 2015. Therefore, it seems that these outcomes are already fairly conclusive at this point, even though we will still continue to watch the development.

1. Nasdaq Access Fee Pilot Program — The Exchange Makes a Solo Move

In the US stock market, it is common practice for exchanges to charge a fee to participants who cross the spread and take, or “access,” the posted liquidity. This access fee on liquidity takers is in turn used to pay rebates to liquidity providers who post limit orders on the exchange. Although this so called “maker-taker” pricing model has been around for nearly 20 years, it is rather recent that this practice has started to gain criticism from industry experts, as well as heightened attention from regulatory bodies^{2,3}. The critics posit that the maker-taker model distorts the market microstructure and creates a conflict of interest for brokers acting as agents. In response, the SEC is thought to be considering different regulatory actions including lowering the cap on the access fee.

It is under these circumstances that Nasdaq launched a pilot program to reduce the access fee on 14 pilot stocks, shown in Table 1. The access fee was cut from 30 mills, or \$0.0030, per share to 5 mills per share. Correspondingly, the rebate for adding displayed liquidity was reduced to 4 mills per share. Nasdaq has

certainly taken a risk by running this program unilaterally. Whether intended or not, its solo action has created a highly controlled environment in which we can investigate the effects of access fees for the benefit of the industry.

Table 1. Pilot Symbols

The list of symbols in the Nasdaq access fee pilot program consists of 7 stocks listed on the NYSE and 7 stocks listed on Nasdaq.

NYSE-listed symbols					Nasdaq-listed symbols				
Symbol	Price (\$)	Daily Traded Value (\$M)	Viscosity	30 mils / Price (Bps)	Symbol	Price (\$)	Daily Traded Value (\$M)	Viscosity	30 mils / Price (Bps)
BAC	16.63	1,733.7	11.41	1.80	AAL	48.01	639.3	1.69	0.62
GE	25.17	947.2	10.83	1.19	FEYE	43.84	367.8	1.14	0.68
KMI	42.10	461.1	3.75	0.71	GPRO	50.92	389.2	0.72	0.59
RAD	8.20	193.9	10.88	3.66	GRPN	8.06	123.1	9.44	3.72
RIG	19.05	239.7	2.84	1.57	MU	32.33	805.3	3.13	0.93
S	5.18	89.7	14.28	5.79	SIRI	3.89	142.0	34.28	7.71
TWTR	48.03	1,287.7	1.62	0.62	ZNGA	2.32	41.1	16.43	12.93

Source: Instinet

When analyzing market data, we focused on finding answers to a few key questions:

Q1. How does posted liquidity change on Nasdaq?

Since the lower rebate for adding liquidity means a lower incentive for liquidity providers, liquidity-providing activities on Nasdaq are likely to decrease. Consequently, at Nasdaq we expect to see bid-ask spreads widen, queue lengths shorten, and a lower probability of the exchange providing National Best Price (bid or offer), among other effects.

Q2. Does Nasdaq gain or lose market share?

While liquidity providers will be less attracted to Nasdaq, liquidity takers should favor the exchange given the reduced access fee. It is unclear which force might be more powerful, but we expect shifts between Nasdaq, traditional maker-taker exchanges and inverted, taker-maker exchanges for the pilot names.

Q3. Are changes consistent across stocks?

As the access fee and rebate are fixed amounts, regardless of stock price, they represent larger proportions per capita with lower priced stocks (see Table 1). As a result, we expect that the impact of Nasdaq having reduced its access fee depends on a stock's price, trading and quoting activity. With this in mind, we observe these liquidity shifts with respect to a stock's "viscosity," a liquidity measure we developed that takes into account both price and liquidity of a stock. In a nutshell, this metric is larger for lower priced and more frequently traded stocks, and indicates how much the stock's bid-ask spread is constrained by the tick size. The viscosity values for the pilot symbols are also shown in Table 1.

2. Posted Liquidity — Providers Move away from Nasdaq

Figures 1 and 2 show the exchange-by-exchange probability at NBBO and displayed queue lengths of the NYSE-listed pilot symbols. The data are from January 5th to February 27th, and the statistics are averaged weekly. The numbers are further averaged within each stock group based on viscosity. For clarity's sake, we display only the results of Nasdaq, NYSE and BATS. Although only results from NYSE-listed stocks are shown, the following observations also apply to Nasdaq-listed stocks. We have also analyzed the bid-ask spreads and found that they are highly negatively correlated to the probability at NBBO.

First and foremost, it is evident that all of these liquidity measures deteriorated at Nasdaq at the beginning of the pilot program and have stayed at such levels since. Second, the liquidity measures of lower viscosity stocks have significantly improved on BATS after the start of the pilot program. This suggests that at least some participants have shifted their liquidity providing activity from Nasdaq to BATS. More detailed observations are:

1. Higher viscosity stocks ($\rho \geq 5$)

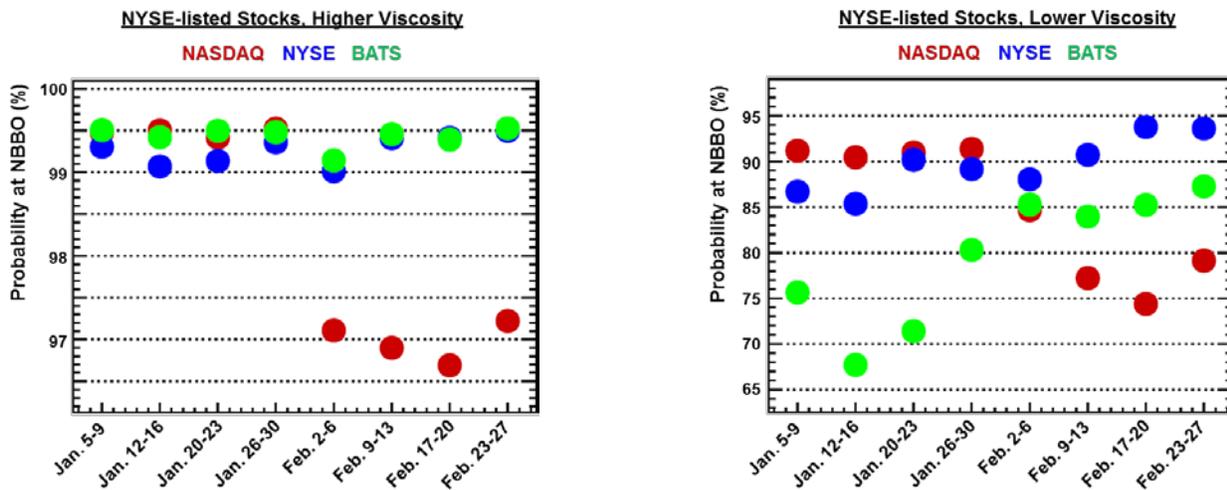
The liquidity measures were at similar levels among Nasdaq, NYSE and BATS before the pilot program started. And those of Nasdaq worsened unilaterally while those at the other exchanges remained virtually unchanged. On Nasdaq, bid-ask spreads widened by ~5%, probability at NBBO dropped from ~99.5% to 97% and the displayed queue lengths decreased by 20–30%.

2. Lower viscosity stocks ($\rho < 5$)

At Nasdaq, bid-ask spreads widened by 10–40%; probability at NBBO dropped from ~90% to ~75%; and the displayed queue lengths shortened by 20–30%. While liquidity provision at BATS was certainly inferior to the top two exchanges in January, it has improved considerably in February, rivaling Nasdaq. Apparently, BATS picked up some of the posted liquidity Nasdaq has lost due to the pilot program.

Figure 1. Probability at NBBO by Exchange, NYSE-listed Stocks

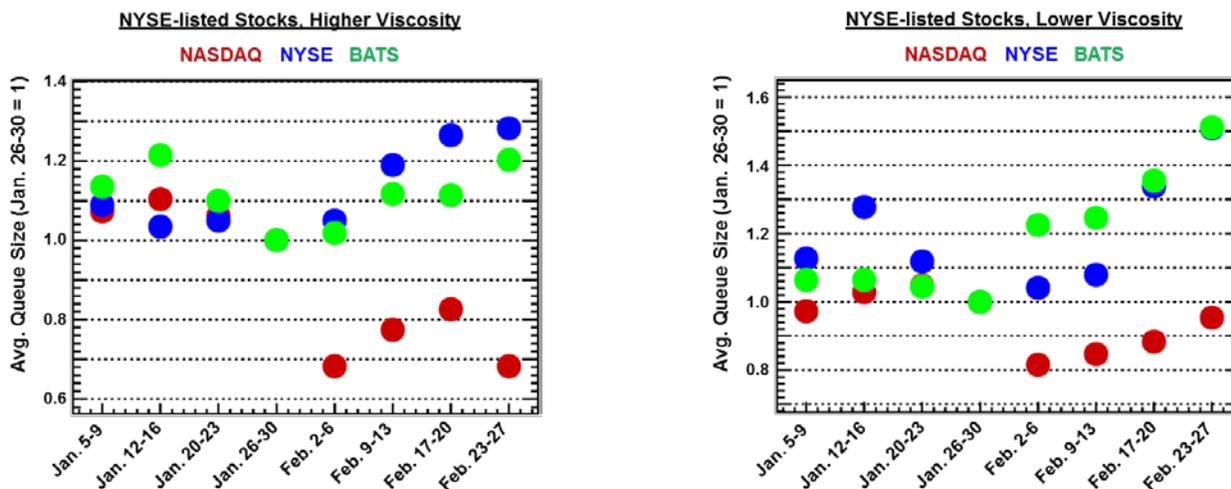
For each exchange and side (bid or offer), we compute the percentage of time the exchange provided the National Best Price. The probability at NBBO is the average of the two sides.



Source: Instinet

Figure 2. Displayed Queue Length by Exchange, NYSE-listed Stocks

For each stock and exchange, the weekly average queue length is normalized to that of January 26-30, 2015, and then the normalized queue lengths are averaged over the stock group.



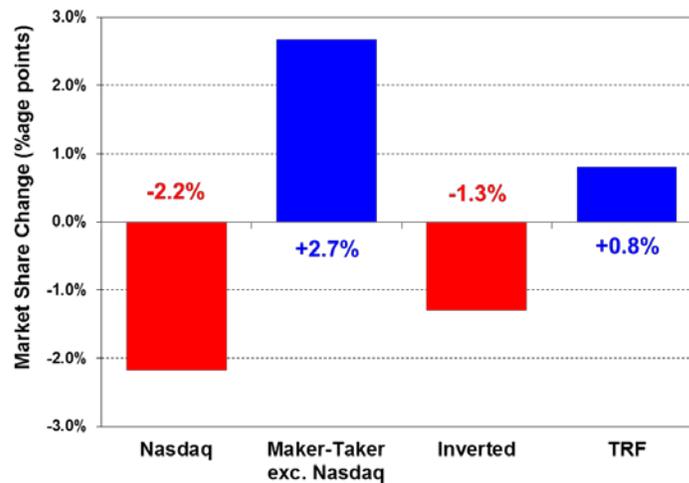
Source: Instinet

3. Market Share — Nasdaq Loses and Maker-Taker Wins

Figure 3 illustrates the shifts in overall dollar volume-based market share of each venue type comparing January with February. Also, Figure 4 shows the stock-by-stock differential market share. The market share is based on the dollar value traded during continuous trading sessions between 9:35 and 15:55 each trading day; auction volumes are not included. Market share in January, as a percentage, is subtracted from that in February. Table 2 summarizes the original market share numbers.

Figure 3. Shift in overall volumes, January vs February

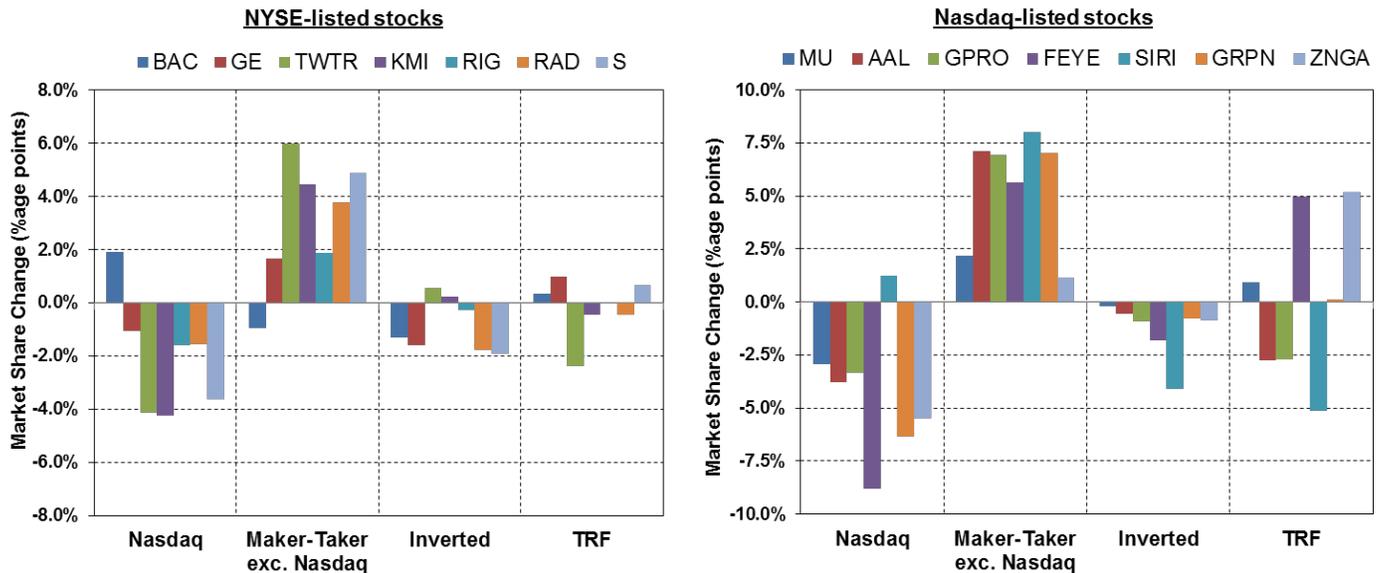
Dollar volume-based market share of each venue type, as a percentage, is computed for January (Jan. 5-30) and February (Feb. 2-27), and January is subtracted from February. “Maker-Taker” represents the exchanges with a maker-taker pricing model, while “Inverted” represents those with a taker-maker pricing model. TRF stands for trade reporting facility and represents the off-exchange volume. The volumes are those of continuous trading sessions between 9:35 and 15:55 each day and do not include auctions.



Source: Instinet

Figure 4. Symbol based change in Market Share, January vs February

These charts are the same as Figure 3 but for individual symbols.



Source: Instinet

Nasdaq has lost the overall market share by 2.2 percentage points from January to February. The exchange has also lost market share in 12 out of the 14 pilot symbols, and in 9 symbols the loss is even larger than 3 percentage points. If aggregated by the listed exchange, Nasdaq' market share has dropped from 11.4% to 10.3% and from 21.5% to 17.6% in the NYSE- and Nasdaq-listed pilot symbols, respectively.

Figure 3, 4 and Table 2 show that other maker-taker exchanges have gained market share, and that the marginal increases are more or less the same as Nasdaq's loss. In aggregate, the maker-taker exchanges' market share has increased from 40.2% to 41.8% and from 29.0% to 33.4% with the NYSE- and Nasdaq-listed pilot symbols, respectively. This indicates that as participants shifted their liquidity provision away from Nasdaq toward the other maker-taker exchanges, the trading volume has also followed suit.

The inverted exchanges as a group have lost market share in 12 out of the 14 pilot symbols. We presume this is because some liquidity takers favoring lower access fees shifted their trading from inverted exchanges to Nasdaq and/or dark pools. The changes in dark pool market share are mixed across symbols, and it is too early at this point to draw any conclusions as to whether lowering access fees would bring volume back to lit exchanges.

Table 2. Dollar Volume Market Share – January vs February

Dollar volume-based market share of each venue type is shown for January (Jan. 5-30) and February (Feb. 2-27). “Maker-Taker” represents the exchanges with a maker-taker pricing model, while “Inverted” represents those with a taker-maker pricing model. TRF stands for trade reporting facility and represents the off-exchange volume. The volumes are those of continuous trading sessions between 9:35 and 15:55 each day and do not include auctions.

Symbol	Nasdaq		Maker-Taker		Inverted		TRF		February minus January			
	Jan	Feb	Jan	Feb	Jan	Feb	Jan	Feb	Nasdaq	Maker-Taker	Inverted	TRF
BAC	8.5%	10.4%	45.2%	44.3%	12.1%	10.8%	34.2%	34.5%	1.9%	-0.9%	-1.3%	0.3%
GE	10.6%	9.6%	39.5%	41.2%	12.4%	10.8%	37.4%	38.4%	-1.1%	1.7%	-1.6%	1.0%
TWTR	13.8%	9.7%	32.9%	38.9%	4.3%	4.9%	48.9%	46.5%	-4.2%	6.0%	0.6%	-2.4%
KMI	17.6%	13.3%	37.5%	42.0%	7.2%	7.5%	37.7%	37.2%	-4.2%	4.5%	0.2%	-0.4%
RIG	14.4%	12.8%	40.4%	42.3%	6.2%	5.9%	39.1%	39.1%	-1.6%	1.9%	-0.3%	-0.0%
RAD	8.3%	6.7%	37.3%	41.1%	8.8%	7.1%	45.6%	45.1%	-1.6%	3.8%	-1.8%	-0.5%
S	13.2%	9.6%	36.8%	41.7%	8.2%	6.3%	41.8%	42.4%	-3.6%	4.9%	-1.9%	0.7%
XNYS-Sum	11.4%	10.3%	40.2%	41.8%	9.8%	8.4%	38.6%	39.6%	-1.1%	1.5%	-1.4%	0.9%
MU	22.1%	19.2%	31.7%	33.9%	7.6%	7.4%	38.6%	39.5%	-2.9%	2.2%	-0.2%	0.9%
AAL	21.1%	17.3%	29.7%	36.8%	6.1%	5.5%	43.2%	40.4%	-3.8%	7.1%	-0.6%	-2.8%
GPRO	21.7%	18.4%	25.2%	32.1%	4.2%	3.3%	49.0%	46.3%	-3.3%	6.9%	-0.9%	-2.7%
FEYE	25.7%	16.9%	24.2%	29.8%	5.9%	4.1%	44.2%	49.2%	-8.8%	5.7%	-1.8%	5.0%
SIRI	13.6%	14.8%	22.5%	30.6%	19.3%	15.2%	44.6%	39.5%	1.2%	8.0%	-4.1%	-5.1%
GRPN	21.3%	14.9%	30.0%	37.0%	8.7%	7.9%	40.0%	40.1%	-6.3%	7.0%	-0.8%	0.1%
ZNGA	17.5%	12.1%	27.4%	28.6%	9.6%	8.7%	45.4%	50.6%	-5.5%	1.1%	-0.9%	5.2%
XNGS-Sum	21.5%	17.6%	29.0%	33.4%	7.3%	6.1%	42.2%	42.9%	-3.8%	4.4%	-1.2%	0.7%

Source: Instinet

4. Delving Deeper — New Access Fee Impacts Price Grids

The US stock exchanges adopted a single tick size of 1¢ universally for stocks above \$1. However, as Figure 5 illustrates, access fees and rebates modify this rather rigid pricing system by effectively adding price levels in between the nominal price grids. For instance, when a trader buys a stock at \$10.00 by providing liquidity, she can send a limit order either to a maker-taker exchange where, if her order is filled, her effective transaction price will be \$9.997 (\$10 less the rebate) or to an inverted exchange where the effective price will

be \$10.002 (\$10 plus the fee). Obviously, the lower the stock price, the larger the percentage intervals between these “effective price grids” due to the fixed access fee and rebate per share. As such, these effective price levels have greater economic significance in trading. They are also more important to consider when bid-ask spreads are constrained by tick size, as the fee and rebate have greater proportional values to the bid-ask spreads.

From this perspective, we would like to further discuss some of the findings in previous sections.

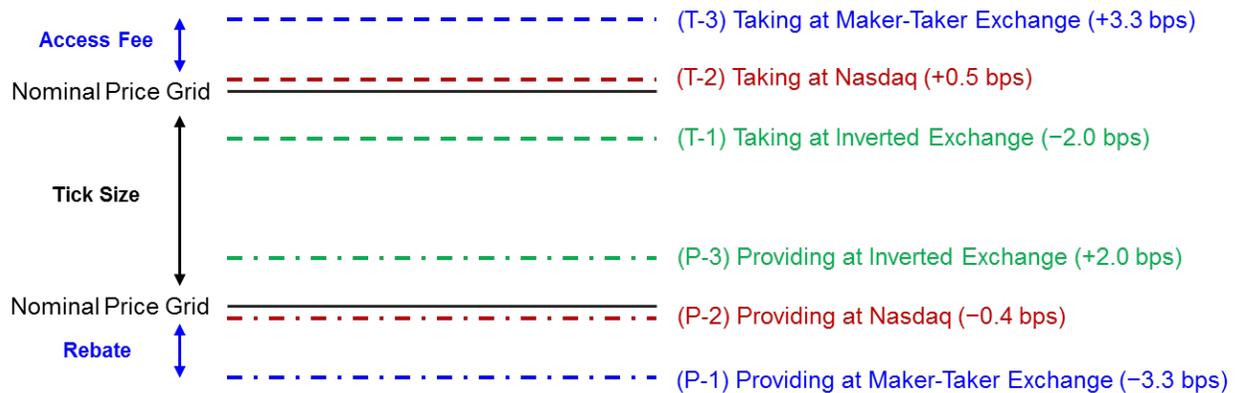
Firstly, inverted exchanges as a group have lost market share in 12 out of the 14 pilot symbols; as a whole, their market share has dropped by 1.4 and 1.2 percentage points in NYSE- and Nasdaq-listed symbols, respectively. We speculate that this is because some liquidity takers have shifted their trading from inverted exchanges to Nasdaq, as a new price level for taking, T-2 in Figure 5, has emerged due to the pilot program. Taking liquidity at level T-2 is less favorable than taking at T-1, but it would still significantly improve the transaction price compared with trading at T-3. In addition, Nasdaq likely offers more abundant liquidity than inverted exchanges, *i.e.* the probability at NBBO and the average queue lengths at Nasdaq are greater than those at inverted exchanges. With this trade-off in mind, we hypothesize that Nasdaq has come to provide some liquidity takers with a better alternative than inverted exchanges, and that this has led to the latter’s loss of market share.

Secondly, contrary to the overall trend, Nasdaq has gained market share in BAC and SIRI, two of the most HFT-favored symbols among all US stocks. It should also be pointed out that these symbols’ liquidity provision measures—bid-ask spreads, probability at NBBO and displayed queue lengths—have deteriorated at Nasdaq, just as the other pilot symbols’. This clearly indicates that Nasdaq’s market share with these symbols is not constrained by the liquidity provision at the exchange, but rather, it depends primarily on liquidity taking occurring at the exchange. This idea is further supported by the fact that these stocks are ranked 1st and 3rd among the pilot symbols in terms of the market share of inverted exchanges (see Table 2), which indicates that there is a greater demand for liquidity taking at a better price than that offered by maker-taker exchanges (T-3 in Figure 5). It will be interesting to see whether this trend continues to exist as the market participants’ reactions to the experiment develop.

Thirdly and lastly, Nasdaq reported that its top five liquidity providers accounted for 45.2% of the liquidity providing volume executed on Nasdaq in the pilot symbols in January and 28.4% in February.⁴ The top liquidity providers that conducted large changes to their liquidity provision in the pilot symbols are considered “rebate sensitive” traders⁴; in other words, they are presumably ultra low-latency traders engaging in rebate-arbitrage strategies. The considerable drop of their market share in liquidity provision means that a more diversified set of traders can provide liquidity on the exchange. This could mean better opportunities for non-low-latency traders, representing a much larger base of investors who are simply willing to save bid-ask spreads in trading.

Figure 5. Access Fee/Rebate and Price Grids

This represents a schematic diagram of effective price grids formed by tick size, access fees and rebates. Black lines represent the price grids due to the tick size, and color lines represent additional, effective price levels formed by exchanges' access fees and rebates. The proportional fee and rebate amounts are noted in basis points (bps) with a buy transaction of a \$10 stock and an access fee and rebate of 30 and 20 mills per share for maker-taker and inverted exchanges, respectively; the fee and rebate in the pilot program are used for Nasdaq. The intervals between price grids in this illustration are approximately proportional to the actual scale. T-1,2,3 and P-1,2,3 denote price levels for liquidity Taking and Providing, respectively, and are numbered from the least (1) to the most expensive (3) levels. Price levels T-2 and P-2 have emerged due to the pilot program.



Source: Instinet

5. Implications and Further Research — Keeping an Eye on Nasdaq’s Solo Flight

The Nasdaq access fee pilot program surely has contributed, and will further contribute, to understanding the effects of market access fee and rebate for the benefit of the whole stock trading industry. The observations so far have made clear that subsidizing liquidity provision does indeed play a significant role in attracting more liquidity providers and helps exchanges gain greater market share. This demonstrates that exchanges do not have an economic incentive to materially reduce their access fees and rebates and that regulators would have to impose a lower cap on the access fee if they were to pursue correcting the market distortion and thus mitigate the “agents’ conflict of interest.”

As we have seen, the shifts of liquidity, mostly from Nasdaq to other maker-taker exchanges, have largely been consistent across the pilot symbols over the weeks in February. It is also clear that the changes

happened solely at Nasdaq. Therefore, we think that the above-mentioned outcomes are fairly statistically robust and conclusive for the pilot symbols. However, the observed trends may be temporary and could change in coming weeks, as we suppose that many market participants are still testing the waters and figuring out how the whole market reacts to the new rule.

We have observed varying degrees of shifts in posted liquidity in different liquidity segments even within these limited set of symbols, consisting only of liquid stocks. Therefore, we question whether or how much our conclusions would apply to illiquid stocks. In fact, the proposed tick size pilot program will widen tick size for illiquid stocks.^{5,6} Similarly, we think it is advisable to run another pilot program covering a broader set of symbols in different liquidity and/or price segments, especially illiquid stocks.

Besides the metrics covered in this report, it will be interesting to investigate how the reduced access fee changes other aspects of market quality, such as adverse selection, market impact, fill ratio and so on. Even though it will take at least months for data to accumulate allowing us to draw any meaningful conclusions on these topics, it will be worth keeping an eye on Nasdaq while its pilot program flies solo.

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