

Informed Trading – July 2017

Exchange Fingerprint

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The 12 US stock exchanges exhibit a wide range of trade and quote characteristics. On average, the largest exchanges dominate the NBBO, but some of the smaller venues demonstrate unique behavior, both at the touch and at the midpoint, for different types of stocks and at different times of the day.

In this edition of *Informed Trading*, we discuss nuances of individual exchange's trade and quote characteristics, what we call the exchange *fingerprint*. These characteristics are essential to consider when making trading and quoting decisions.

Key observations:

- Individual venues have varied liquidity breakdowns by trade position (at-the-touch, mid, intra-spread) and %-time at the NBBO. These intraday patterns can inform how to adjust trading strategies across the day.
- While inverted exchanges tend to have shorter queues, this does not always lead to faster fills. It is important to consider time of day and stock characteristics, in particular the stock's tick-constrained level¹.
- Posting orders at certain exchanges can contribute to information leakage. That cost needs to be considered along with the predicted fill speed when choosing a posting venue.



Intraday Venue Liquidity Profiles

As discussed in our previous edition, [Understanding Venue Dynamics](#), the liquidity allocation across different venue types is largely determined by the stock’s liquidity and tick size (namely *tick-constrained level*¹), in conjunction with the venues’ fee/rebate structures. **Exhibit 1** shows the breakdown of dollar trading volume by venue type into 30 minute periods, for NYSE- and Nasdaq-listed securities respectively. Similarly, **Exhibit 2** shows intraday volume profiles for individual venues, together with their market share. Overall, there are several notable observations from these intra-day liquidity profiles:

- The primary (listing) exchange accounts only for ~20-30% of total volume throughout the day.² Its market share is highest immediately after the open and before the close.
- Off-exchange trading venues account for 35-40% of the total volume throughout the day, but their market share drops significantly before the close.
- Combined auction volumes amount to 30-40% of the primary exchange’s volume.
- Inverted (taker-maker) exchanges have distinctively high trading volume toward the end of day; more than one quarter of these exchanges’ volume trades during the last half hour.

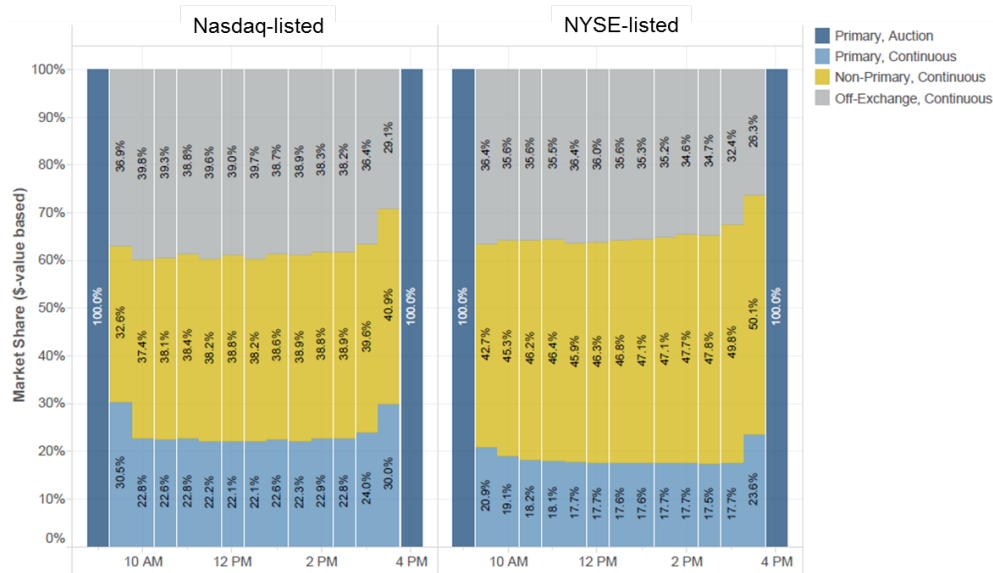


Exhibit 1: Liquidity allocation across venues follows certain patterns during the day. Cross-sectional data is for the top 1000 NYSE- and NASDAQ-listed securities by daily trading value for Dec 2016–Feb 2017.

Source: Instinet

¹ Tick-constrained level refers to how much the stock’s bid-ask spread is constrained by the tick size. In this paper, we call a stock *tick-constrained*, *moderately constrained*, or *non constrained* when the average spread is less than 1.2 ticks, between 1.2 and 2.5 ticks, and greater than 2.5 ticks, respectively. [Understanding Venue Dynamics](#) discusses tick constrained level and how it affects stocks’ trading characteristics.

² NYSE does not trade Nasdaq-listed securities, so Nasdaq captures higher percentages of trading volume of the stocks on itself.



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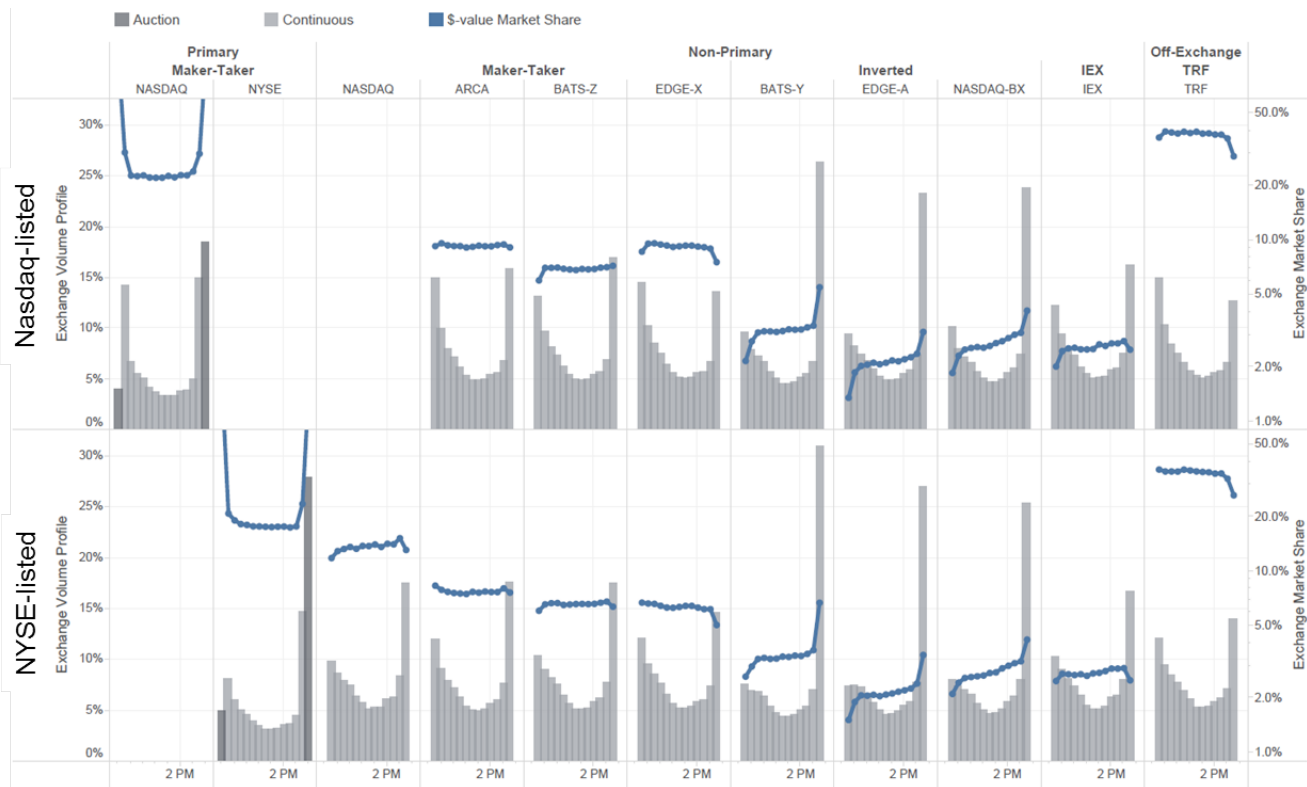


Exhibit 2: Individual exchanges have unique intraday volume profiles, and their market share depends considerably on the time of day. Cross-sectional data are for the top 1000 NYSE- and NASDAQ-listed securities by daily trading value for Dec 2016–Feb 2017.

Source: Instinet

Liquidity Breakdown by Trade Position

In addition to the overall volume, the relative prices (vs NBBO) at which trades occur is an important liquidity measure when making venue routing decisions. **Exhibit 3** shows how much of each exchange’s total volume is executed at “the touch” (either the NBB or the NBO), “the mid” (the mid-point of the NBBO) and “the inside-spread” (at a price between the NBB and the NBO excluding the mid-point). It also shows the percentage time each exchange provides displayed quotes at the NBBO.

The measures reveal the unique characteristics of individual exchanges and the effects of the fee/rebate models:

- Trading at the maker-taker exchanges is predominantly (85-90%) executed at the touch. The likelihood of maker-taker exchanges providing the NBBO is also high.
- The liquidity breakdown of maker-taker venues shows little variation throughout the day. Their percentage times at the NBBO are also relatively consistent across time of day.
- In contrast, the liquidity profiles of inverted exchanges are characterized by smaller shares of at-the-touch volume and larger shares of intra-spread trading.



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- The liquidity profiles of the inverted exchanges are also highly variable throughout the day, as the liquidity shifts from intra-spread to at-the-touch as the day progresses.
- These shifts are consistent with the sharp increase in displayed quotes at inverted exchanges.
- IEX exhibits a very distinct liquidity profile, as its trading volume is predominantly executed at the mid-point, while at-the-touch volume only accounts for ~40%.
- IEX provides displayed quotes at the NBBO only 10-40% of the time, the lowest of all lit exchanges. Overall, IEX seems to have retained many of the liquidity features it developed as a dark pool. Together with its innovative offerings, such as the speed bump and D-peg order type, IEX's abundant mid-point liquidity will likely continue to attract certain investment flows.

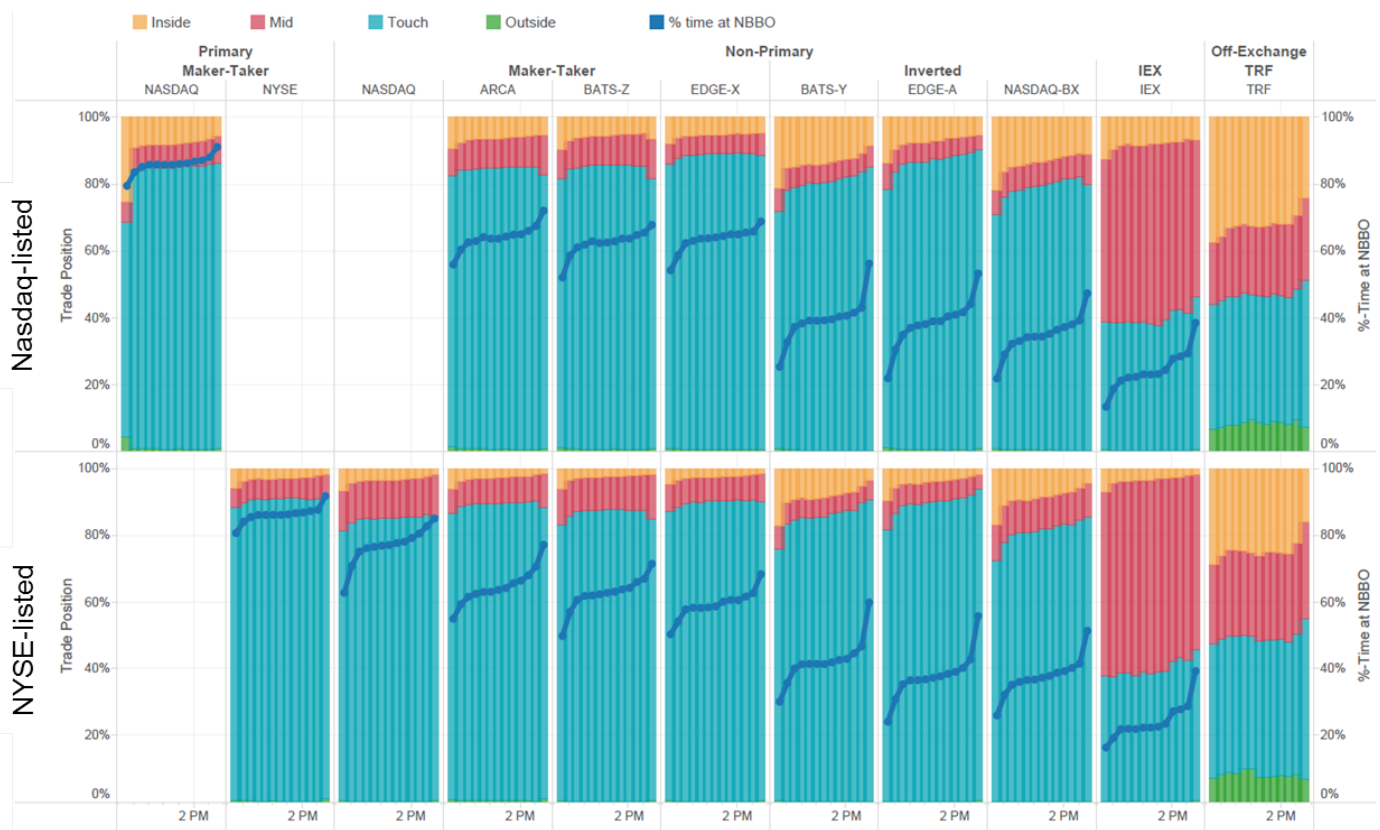


Exhibit 3: Breakdown of individual exchanges' trading volume by trade prices with respect to the NBBO. While trading at the NBBO is predominant for most exchanges, the majority of the liquidity at IEX is mid-point liquidity. Cross-sectional data is for the top 1000 NYSE- and NASDAQ-listed securities by daily trading value for Dec 2016–Feb 2017.

Source: Instinet



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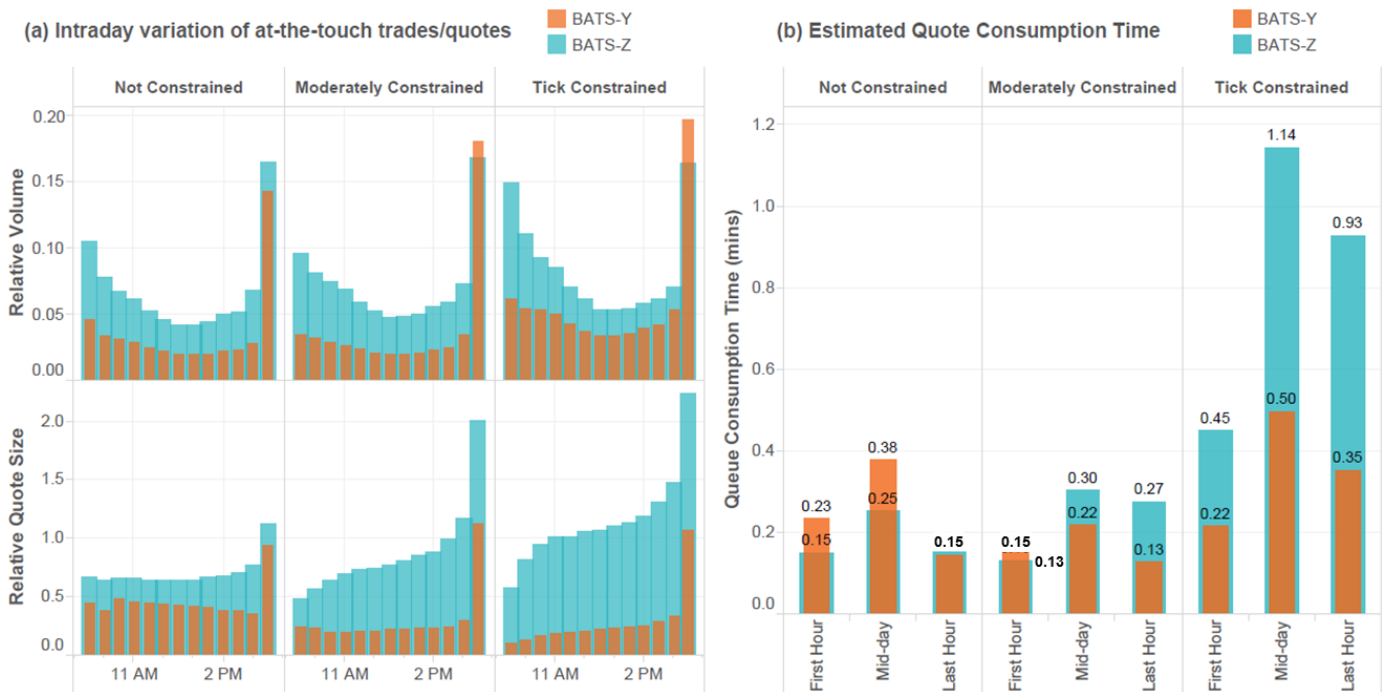


Exhibit 4: (a) Intraday profiles of trading volume at the touch (upper panel) and the average quote size at the NBBO (lower panel) for BATS-Y and BATS-Z. The volume profiles are normalized to the average 30-minute aggregate volume at the touch. The quote sizes are normalized to the mean quote size across venues. (b) Estimated quote consumption time for BATS-Y and BATS-Z computed from each venue’s average quote size at the NBBO and at-the-touch trading volume. Cross-sectional data is for the top 1000 NYSE- and NASDAQ-listed securities by daily trading value for Dec 2016–Feb 2017.

Source: Instinet

Trade Speed and Quote Size at the NBBO

One of the applications of the venue liquidity profiles is to estimate an average waiting time for a passive posting to be filled. **Exhibit 4a** compares BATS-Y (inverted) with BATS-Z (maker-taker) for their at-the-touch volume and displayed quote size at the NBBO. We present the measures in 30-minute buckets and for three stock groups defined by their *tick-constrained levels*¹. **Exhibit 4b** shows an estimated quote consumption time derived from these measures.³

- As the stock becomes more tick-constrained, BATS-Y’s at-the-touch volume approaches BATS-Z’s. BATS-Y even surpasses BATS-Z by at-the-touch volume during the last half hour.
- Conversely, the difference between BATS-Y and BATS-Z based on average quote size at the NBBO widens as the stock becomes more tick constrained.

³ The quote consumption time here is defined as the ratio of the quote size at the NBBO vs the trading volume at the NBBO and can be considered as an average time.



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- As a result of these shifts, while BATS-Z's quote consumption times are shorter for the non tick-constrained group, those for BATS-Y are shorter for the tick-constrained group. Also, BATS-Y's quote consumption times are generally more competitive vs BATS-Z's during later times of the day.

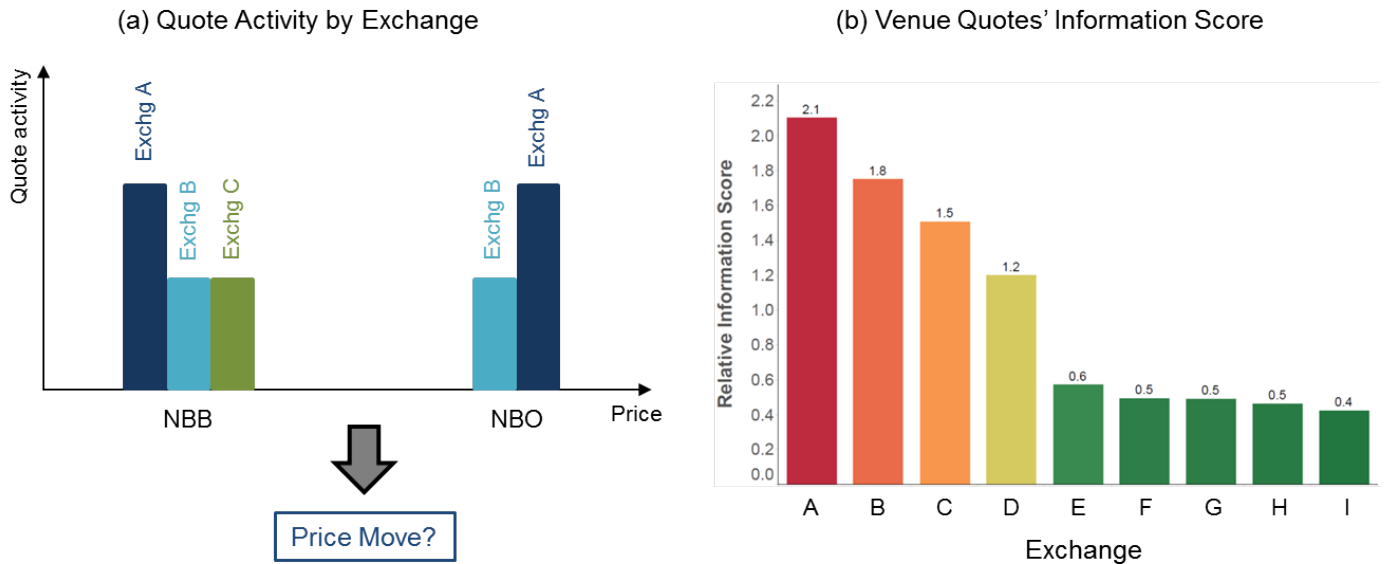


Exhibit 5: (a) A schematic drawing of quote activity at the NBBO by venue, illustrating a situation in which the activity of Exchg C is stronger at the NBB than at the NBO. (b) The Relative Information Score by venue, an Instinet's proprietary metric of how much a quote activity imbalance at a venue predicts the future return. Cross-sectional data is for the top 1000 NYSE- and NASDAQ-listed securities by daily trading value for Dec 2016–Feb 2017.

Source: Instinet

Information Content in Venue Quote Activity

Another key consideration in venue choice is how a posting might affect the market. Posting a displayed quote exposes the intention to trade. Posting on different markets at different times can increase or decrease the information content of a particular displayed post. In general, there is less information when placing orders on deeper queues, but, everything else equal, your fill probability also decreases.

Exhibit 5a is a schematic drawing illustrating a situation in which venues have different levels of activity at the NBBO. In particular, it illustrates that Exchg C's quote activity at the NBB is greater than at the NBO (there is an imbalance in Exchg C's quote activity).

We adopted a proprietary definition to measure such imbalances in venues' quote activity and analyzed it as a future price indicator. Although we used a universal measure of imbalance for all venues, we found that its predictive power differed considerably across exchanges, as shown in **Exhibit 5b**. The higher the Relative Information Score, the more a venue's quotes might predict future price moves.

This underscores the fact that trading algorithms should be cognizant not only of the benefit of posting on a venue (e.g. fill speed, fill quality, etc.), but also of the potential consequences of their interaction with the market.

Implications to Venue Selection

Our observations from the previous two sections have important implications to optimizing venue selection in trading algorithms. Our results for quote consumption time indicate that, contrary to what many believe, the lure of a taking rebate is not always sufficient to improve fill times by using an inverted exchange. When stocks are not tick-constrained, the greater trading activity at maker-taker exchanges can compensate for the comparatively longer queues, resulting in passive fills from maker-taker venues actually being faster.

Furthermore, the quote activity information score indicates that posting orders at certain exchanges comes at a cost. Therefore, in order to choose an appropriate venue, one needs to balance each venue's benefit (fill speed) and cost (information leakage). Also note that the benefit and cost values depend on the stock's trading characteristics and time of day.

Summary and Conclusion

US stock exchanges are quite diverse not only in overall trading volume, but also in the type of liquidity offered. Seemingly small operational differences – fee/rebate schedules, order types, and speed bumps – appear to diversify when and what type of liquidity they attract. Understanding the characteristics unique to a venue, or its “fingerprint,” provides important inputs for trading algorithms when making routing decisions.

In this article, we explored venues' liquidity characteristics by breaking down trading volume by trade position vs the NBBO, as well as by measuring displayed liquidity at the NBBO. We saw significant diversity across exchanges in these properties and also how they shift during trading hours. Our analyses show that the fill speed ranking and quote information score depend on the stock's characteristics and vary across time of day, suggesting that the appropriate venue choice depends considerably on these factors.

For more information on this subject, or for questions about Instinet's electronic trading capabilities, please contact your regional Instinet representative or Informed.Trading@Instinet.com.



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