



## Market Insights

# The Need for Speed: It's Important, Even for VWAP Strategies

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by Phil Mackintosh

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### The crib sheet

It's not just high-frequency traders that can benefit from rapid trade execution. Long-term investors can benefit too.

We find that if long-term investors use similarly fast technology, they can also improve execution performance—even for a VWAP strategy.

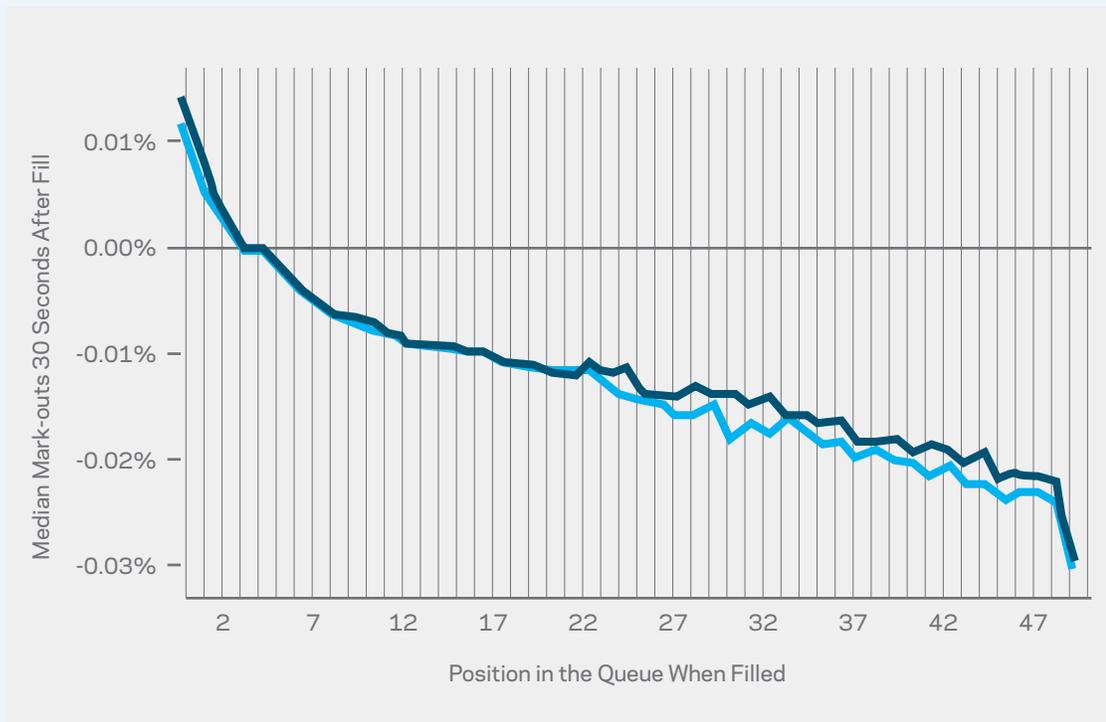
One important reason is that position in the queue affects the time it takes to get a fill. Being nearer to the top of the queue:

- Increases the chance that you capture the spread
- Reduces the chance you are adversely selected
- Reduces the time your order is signaling to the market

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# The Need for Speed: It's Important, Even for VWAP Strategies

**EXHIBIT 1:** Mark-outs are worse for investors who are further back in the queue. In fact, after just five levels, investors are more likely to suffer, on average, some adverse selection.



Source: KCG, ITCH data, Jan - Oct 2014.

**How to read this chart:** Mark-out is the side adjusted change in mid-point prices versus fill prices, measured from the perspective of the liquidity provider. For example, trades at the top of the book capture 1.5bps on average (that's about half the spread on an average stock). However, for anyone more than five steps into the book, on average, the mid is lower than the fill price (for a passive buyer) and higher than the fill price 30 seconds prior (for a passive seller).

## Speed benefits passive investors too

There are a lot of studies that talk about how important speed is to high-frequency trading (HFT) profitability, but there is a perception that speed only helps aggressive and short-term traders.

We show that that's not true. All investors can benefit from using faster trading technology. In this report, we show that speed is even important for a passive VWAP investor.

# The Need for Speed: It's Important, Even for VWAP Strategies

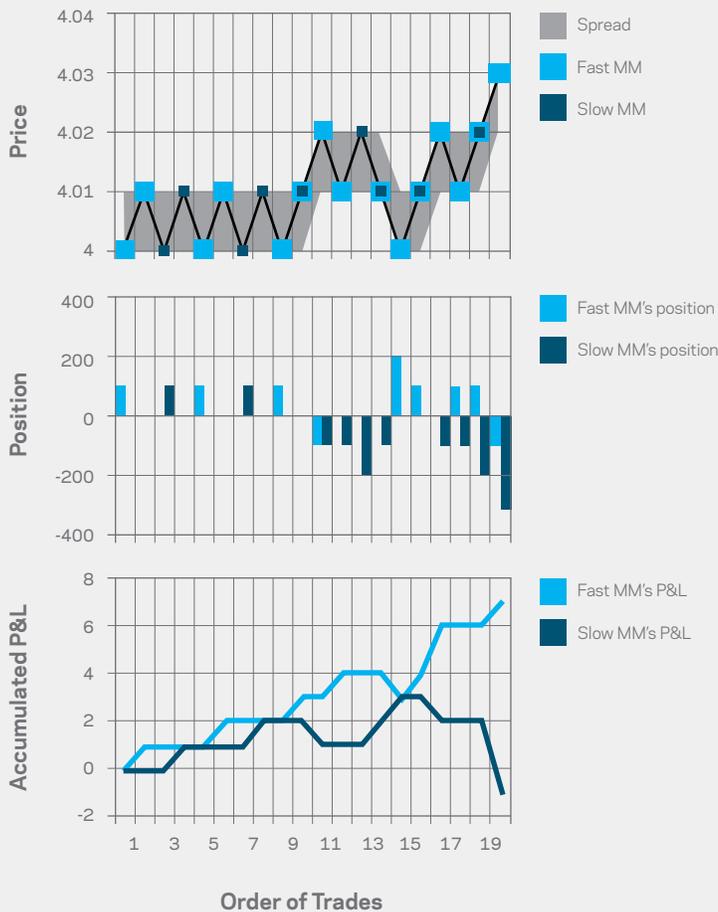
## Speed helps a market maker

We start by looking at the impact of speed on market makers.

In principal, market making is relatively simple. Market makers (MMs) make money when other people cross the spread.

Using a simple model, we put two market makers in competition for the same stock. One is always faster than the other. This example allows us to highlight many concepts relevant to what buy-side traders see in the market (see Exhibit 2).

**EXHIBIT 2:** Our modeling shows that the fast market maker typically has less position risk, less adverse selection, and better P&L.



### How to read these charts

This represents a 20-trade cycle, where the market makers are the only passive traders, always offering 100 shares each, so they refill as their lit bids or offers are taken.

Investors always cross the spread. Investor trades are buys and sells sequentially, and each trade is randomly 100 shares or 300 shares. We call a 300-share trade a "large trade," as it is larger than the NBBO depth provided by market makers.

When a large trade occurs, it will first receive 200-lot fill, sourcing 100 shares from each market maker. Then it will trade 100 at the next price level, filling the fast market maker. Market makers then adapt to the new higher (or lower) spread, and the process continues.

The three charts work together:

**Top chart:** shows the *price movement* (in black), the *spread* (in gray), and the *trades done* by each market maker (light and dark blue boxes). When a larger trade occurs, both market makers trade and a new spread is set in the direction of the larger trade.

**Middle chart:** shows *positions* (by market maker).

**Bottom chart:** shows *accumulated profits* (by market maker).

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- **The first nine trades are ideal for MMs:** While the NBBO is consistently 00/01 and investors are crossing the spread—both market makers are increasing profits (bottom chart), although the fast market maker is always ahead.
- **The first “large” trade causes adverse selection:** On the tenth trade we see a large buy trade from an investor (see model methodology in Exhibit 2). That fills both MMs at 01, which flattens the position for the fast MM but creates a short position for the slow MM, and the residual moves the market higher—also trading at 02 with the fast MM.
- **An even larger investor buy creates MM havoc:** Two 300-lot buys occur at trade 15 and 19. This leaves both market makers short and pushes the slow market maker to losses for the cycle.

## What next? A short cover looks like a predatory trade

The cycle leaves both market makers short in a market that is trending higher and driven by an informed buyer. Good traders know to cut losses and let profits run. So it's possible that second 21 would see the slow MM cover his position with his own aggressive buy.

Ironically, this would look like a “predatory trader” getting in front of a “long-term investor” after their order began trading. In fact, it would just be prudent risk management.

It's also possible that the fast market maker will quickly move his offer higher—so he doesn't also end up with a larger short in a rising market. Again, an informed active investor would see the book fading and complain that liquidity providers had “sniffed” their trade.

What this shows is that not all trading is as it seems. Fade and predatory flow may be symptomatic of a lack of natural sellers.

Our example also shows that market making is not as simple as people think—especially when large informed investors are aggressively trading in the market.

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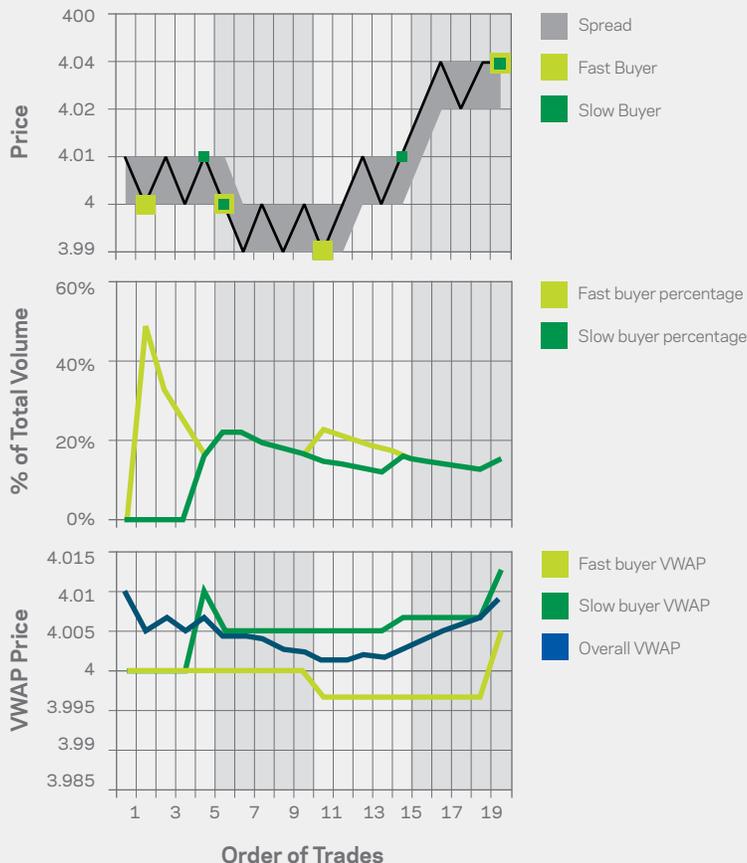
## Speed improves cost for investors too

We can apply the same logic to two long-term buyers trying to achieve VWAP (or any shortfall based strategy with a participation target). We see that queue priority, and therefore speed, is just as important.

In principal, VWAP strategies are relatively simple. To match the market VWAP, you need to have participation consistent with the volume in the market. To minimize signaling, however, you ideally pause between order submissions.

To achieve this, we model four separate slices (shown by the gray columns in Exhibit 3). Each slice first tries to capture the spread, but we do not peg orders. If the investor has not received a fill by the fifth trade, he crosses the final spread to ensure he doesn't fall behind on his volume target.

**EXHIBIT 3:** Our modeling shows that a passive strategy with better queue priority is more likely to beat VWAP for the same reasons: less position risk and less adverse selection.



### How to read these charts

This represents a 20-trade cycle, where the two investors are simultaneously working identical VWAP buy orders in the same stock. In addition, a market maker is joining his bids with a moderate queue entry speed (between the fast and slow buyer).

Both VWAPs target 20% volume, but initially try to capture the spread (without pegging to the bid). Consequently, incomplete child orders must cross the spread on the fifth trade and then the VWAP will send a new child order. The child slice windows are shown by the gray background shading.

The three charts work together:

**Top chart:** shows the *price* movement (in black), the spread (in gray), and the *trades* done by each investor (light and dark green boxes).

**Middle chart:** shows cumulative *POV* (by investor), which stays near to the 20% target for both.

**Bottom chart:** shows *performance*, measured by the accumulated average price (by investor).

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This example allows us to highlight why speed is also important to buy-side traders trying to capture spread:

- **The first slice (five trades):** Shows how important queue priority is when you have a “need to complete.” Even in sideways markets, this results in crossing more spreads, which adds to transaction cost. The first down-tick hits the fast buyer, the second hits a market maker. At the end of the fourth trade, the second buyer is still not done—and needs to increase the offer to maintain his 20% ADV target.
- **The second slice shows adverse selection:** Both passive traders are filled in the first trade as the market ticks down. Neither reload, as they are both above their 20% ADV target (middle chart).
- **Fast trader VWAP is better:** The bottom chart shows how each trade instance affects the rolling average price for each buyer. The buyer using the fastest routing always has a better VWAP.

## Queue priority in the real world

The NASDAQ ITCH feed is an order book feed that provides full depth of book detail attributed with order IDs that helps us infer what queue position an order had prior to the occurrence of a trade.

### Lower queue priority sees a higher mark-out

Using data for all stocks traded YTD in NASDAQ and NASDAQ BX, we see that orders that were deeper in the book when they were filled suffer from worse mark-out, measured as the movement in the mid after the fill (Exhibit 1).

Just as our model predicts (Exhibit 2), the chance that you capture some of the spreads is reduced, and adverse selection is higher.

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*If you're tenth in the queue and you get a fill, it's most likely you were hit by an informed buyer (or seller) with large size and urgency.*

*Consequently, it's most likely you will see adverse selection (a price move against you after the fill).*

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# The Need for Speed: It's Important, Even for VWAP Strategies

## There are other ways to jump the queue

Market complexity actually helps slower traders get priority. For a start, with around 50 venues, there are 50 queues you can join.

### Dark or inverted venues can help you get ahead

Maker-taker venues pay rebates to attract market makers, offering a higher margin on each trade. Consequently, rebate venues typically have the longest queues (although also the most liquidity).

In contrast, more expensive venues, like inverted exchanges, typically have less competition for queue priority. Their take rebates also attract the first trade when liquidity is being taken. So although resting an order on an inverted venue costs a lot more than a maker-taker venue (typically around half a spread for a stock trading 1-tick wide), you're also likely to get a faster fill.

Dark pools are also cheaper to trade in as they sometimes offer price improvement and also have a [lower cost of signaling](#). Orders posted in the dark can get filled before those posted on maker-taker exchanges as the fee to remove liquidity is typically lower.

### Fragmentation, routing, and maker-taker interaction

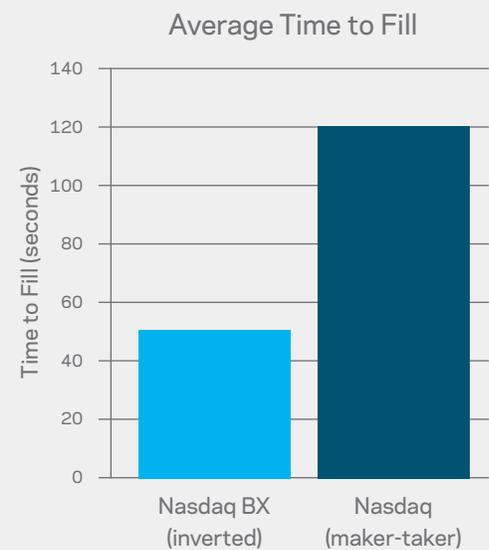
Optimal execution strategy isn't just about being fast—it's about being smart too. It's also a complex problem to solve, as you need to:

- Understand the current depth of book at each venue and where the stock is likely to trade
- Weigh the trade-off between venue cost and spread capture
- Consider order types
- Understand how routing strategy can affect queue position

These are all topics for other reports. What we find here is that, all other things equal, speed is important. Slower trading technology is likely to make your trades cost more than they need to.

Source: KCG Data, June 2014

**EXHIBIT 4:** Comparing NASDAQ's inverted order data (BX) to the primary NASDAQ (ITCH), we see that order duration is much shorter for orders placed in the inverted venue.



Source: KCG Data

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## Appendix

### What a market maker wants

Market makers typically make two-sided markets in the stocks they are trading. Their intention is to try to capture spread.

As our model above shows, it's really important that they also avoid large positions and losses. When an "informed trader" buys through the book, market makers are left short in a rising market—and their losses are (in theory) unlimited unless they close out their trade.

Consequently, making markets—sitting on the bid and the offer simultaneously—is similar to selling very short-term strangles (see chart). The market maker is hoping to earn the spread, but if the stock gaps through the bid or offer, they must cover, at new prevailing market prices.

Recall from our recent [report on tick sizes](#), that we found market makers actually seem to price spreads fairly rationally.

The Profit-and-Loss Profile of a Market Maker



# The Need for Speed: It's Important, Even for VWAP Strategies

## Appendix continued

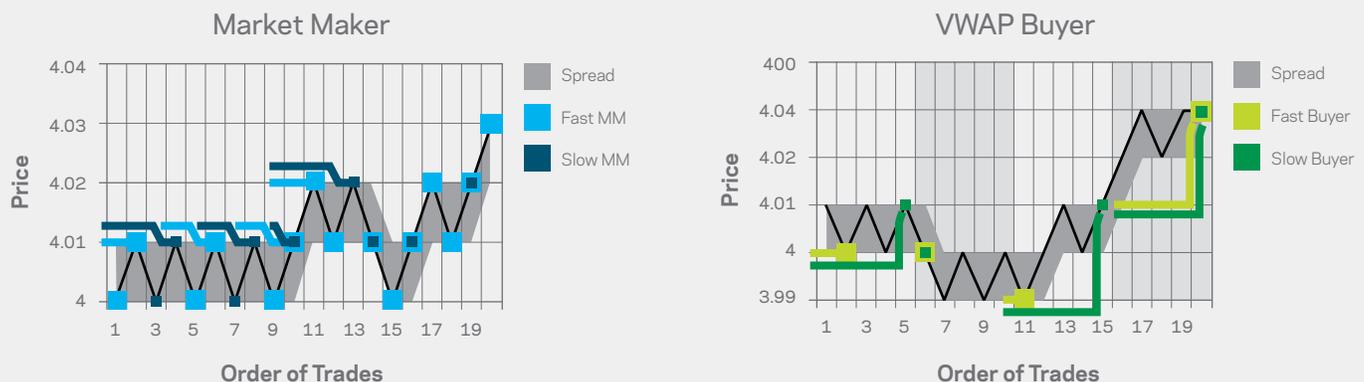
### How our queue priority model works

The charts in Exhibits 2 and 3 show how queue priority affects the order of trade execution, but they don't show the actual queue and replenishment.

Using the top charts from Exhibits 2 and 3, recall that we show the price movement (in black), the spread (in gray), and the trades done by each investor (blue or green boxes). In the charts below, we have added some lines to show how resting orders are positioned before the trades. This shows the queue placement and order refresh strategies of the model.

For example:

- In the market maker chart, we show how the offer side of the book is structured to always have just 100 shares from each market maker, but the fast market maker is always first in the initial queue—as you see when the new (higher) price level at 2 is set.
- In the first VWAP phase, the fast buyer has priority and gets done on the first down-tick. However, the second buyer is behind the market maker and misses a fill on the second down-tick and then needs to cross the spread.
- In the second VWAP phase, the market down-ticks straight through the bids of both buyers in the first trade. So they don't breach their participation target, neither reload until trade 11.
- In the final VWAP phase, the market trades up from the bid at the start of the phase. Both buyers need to aggress 2-ticks to trade at the offer on the fifth trade.



Source: KCG

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