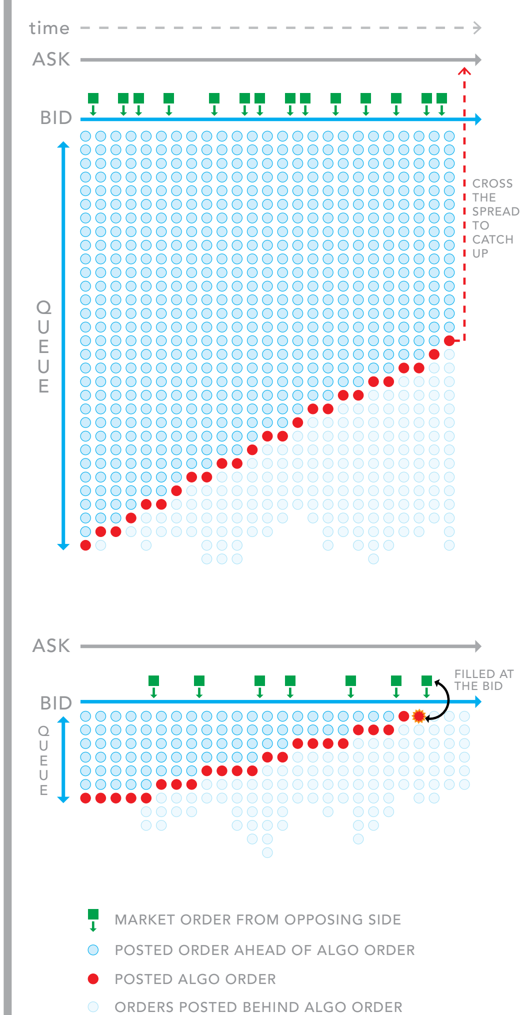
The Difficulty of Trading "Ultra-Liquid" Stocks

The shortfall of an order is affected by several well-known characteristics—the order's participation rate, the stock's volatility and bid-ask spread. But another important factor is how often it is necessary to cross the bid-ask spread. In order to minimize execution costs, many traders use low-participation-rate algorithms allowing them to avoid crossing the spread often, thereby reducing the spread costs associated with taking liquidity.

In general, the lower the participation rate of an order, the easier it is to trade, so it is intuitive that securities with extremely high average daily volumes are particularly easy to trade passively due to the ample supply of aggressive orders to execute against one's passive orders. However, this is not always true. On the contrary, it is often more difficult to trade ultra-high-volume names relative to lower-ADV stocks, and in particular, to provide liquidity. Providing less implies getting a worse price, by crossing the spread or by seeking a midpoint fill in lit or dark venues, which leads to higher shortfalls. In the following study, we demonstrate why the common belief about the ease of trading extremely high-ADV names such as those listed in the Appendix does not match the reality.

This schematic shows a limit order's journey through the time priority queue of a limit order book, and how longer queues can interfere with passive trading.



Volume ≠ Liquidity

How can higher volume not lead to lower trading costs? Consider buying 1% of the ADV of CSCO using a TWAP strategy over a two-hour time frame. CSCO trades 47 million shares per day, which means a TWAP algo must execute about 4,000 shares each minute. To stay reasonably close to its target, the trading algorithm might be configured to cross the spread whenever it falls behind the target quantity by more than 2,000 shares, i.e. the unfilled quantity that results from lagging behind the target quantity by more than half a minute. Suppose, in the hope of not having to cross the spread, the algo posts some fraction of the order quantity on the bid at the end of a long queue of orders already waiting to get executed (84,000 shares based

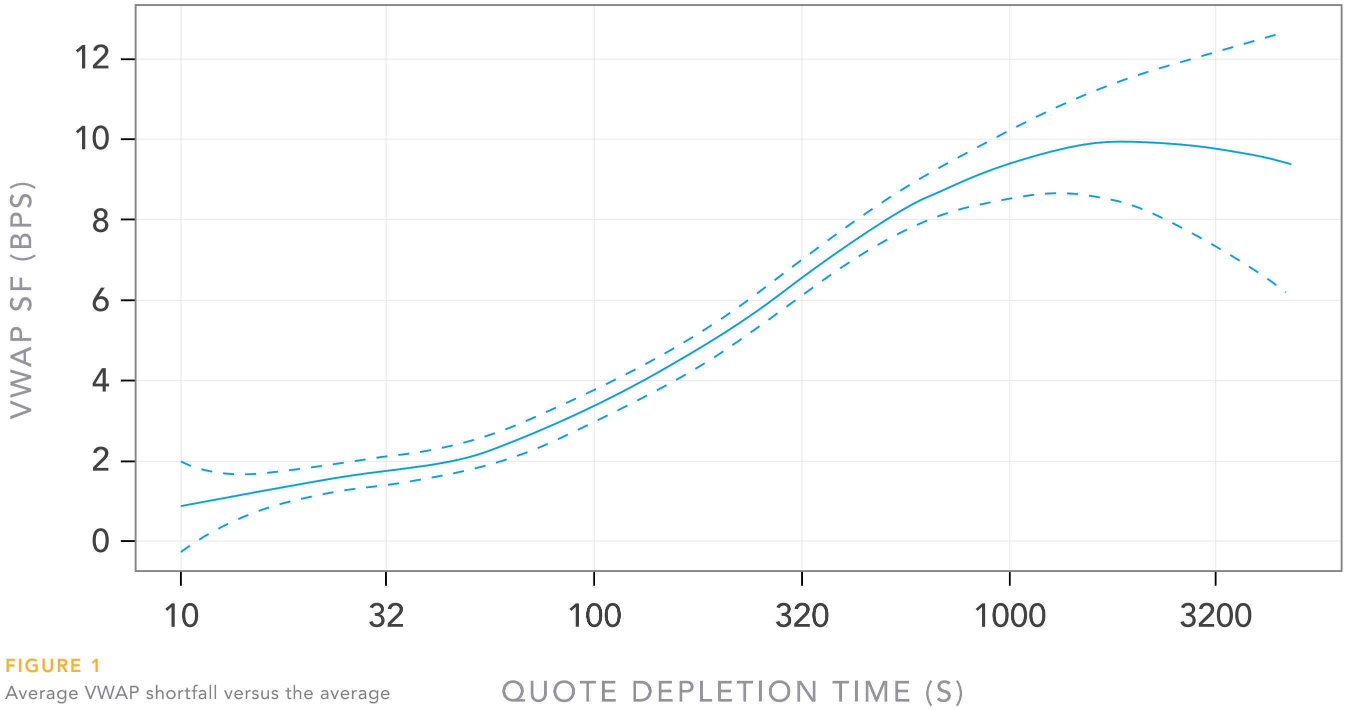


FIGURE 1
Average VWAP shortfall versus the average time it takes to deplete the queue*.

on the average value from the Appendix). During the first 15 seconds of sitting on the queue, 15,000 shares have been taken from the book. The algo's posted order has not yet moved to the front of the queue and remains unfilled, causing the algo to fall behind its target by 1,000 shares. After another 15 seconds, though 30,000 shares of CSCO have traded, the posted order is still not executed, and continues to move along the queue. The algo is now 2,000 shares behind and is forced to cross the spread to catch up. This pattern may be repeated many times over the course of the trade, leading to a poor execution.

In contrast, consider a similar scenario of trading 1% of the ADV of a less liquid stock, EXPD, (ADV of 2.7M shares), again using a two-hour TWAP algo, at a rate of 225 shares per minute. EXPD has an average queue length of only 1,100 shares. After 20 seconds, when the algo's order has worked through the queue and is about to be executed, the algo is behind by only a fraction of a lot (75 shares). The posted shares, in this case, are executed without having to cross the spread, leading to better shortfall. The queue length, therefore, has a strong effect on performance.

Note that the details of this stylized example are not essential—regardless of whether a trader uses an algorithm or trades manually, qualitatively all directional traders have a limited patience to provide liquidity before crossing the spread. Other things being equal, a longer queue makes it more likely that patience will be exhausted and the spread will be crossed. Also note that there are good reasons to have limited patience—routinely waiting too long before crossing the spread can lead to an adverse selection effect, where stocks are allowed to run far away before a trade is completed. The effect discussed in this paper is not just an artifact of unreasonably impatient traders but rather is characteristic of sensible trading approaches.

Figure 1 illustrates the effect at a statistical level, using performance data from actual orders. As predicted, the average VWAP shortfall is an increasing function of the time it takes to deplete the queue. Queue depletion time is proportional to the average quote size for the stock divided by the average daily volume of the stock.

* The blue dotted lines represent a 95% confidence interval

Volume, Queue Length and Shortfall

A longer queue depletion time leads to a lower provide rate, and thereby to paying the full or half the spread more often, which results in worse execution shortfall. At first this seems consistent with the common intuition that higher volume means cheaper trading, but in fact this intuition is accurate only if queue length is held equal. Figure 2 shows the queue depletion time does not simply drop as volume increases. The queue depletion time does initially fall as volume grows, but at a certain point—around 5 million shares/day—average queue length starts growing even faster than volume, as shown by the higher queue depletion time.

Correspondingly, Figure 3 shows an initial decline in the shortfall of individual child orders from first placement to eventual execution. This is at least consistent with the common intuition that higher volume stocks are easier to trade than low-volume names. However at still higher volumes, as the queue depletion times grow, it becomes increasingly hard to provide liquidity while staying within a discretionary range of some target (set by POV, TWAP, VWAP, etc.) and shortfalls increase accordingly. While not shown here, there is also a clear relation between the time to deplete the queue and the percentage of the orders executed via aggressive orders. Putting together all these results shows that, counter-intuitively, on average higher-volume stocks have disproportionately long queues and are costlier to trade.

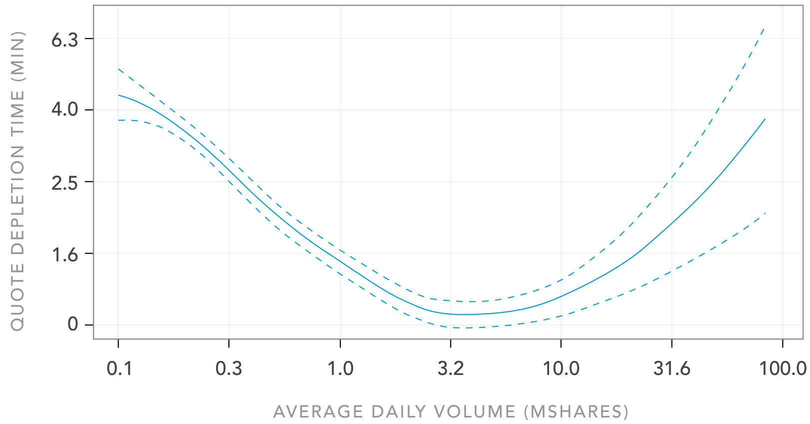


FIGURE 2
Average queue depletion time versus ADV*.

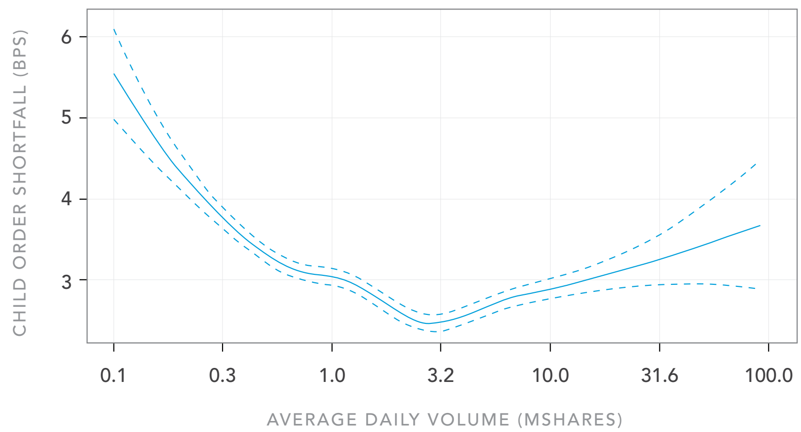


FIGURE 3
Average child order shortfall versus ADV*.

Conclusion

Although volume and liquidity are often thought of as synonymous, the large number of shares typically posted on the book of very high volume stocks makes it difficult to gain priority and get executed with limit orders. In the race to stay close to a benchmark and avoid adverse selection, traders must get more aggressive to escape the crowded book of competing quotes, and suffer the consequences in worse shortfall.

For questions or comments, please email Dr. Eran Fishler, Chief Operating Officer (technotes@pragmatrading.com).

APPENDIX

50 Largest ADV Stocks as of June 2012

TICKER	ADV (MSHARES)	QUEUE LENGTH (SHARES)	SPREAD (CENTS)	15-MIN VOLATILITY (%)	QUEUE DEPLETION TIME (S)
BAC	190.3	558,925	1.0	0.41	138
SPY	161.1	30,237	1.0	0.12	9
XLF	89.6	2,574,847	1.0	0.19	1345
FB	74.5	22,296	1.3	0.91	14
EEM	60.9	82,727	1.0	0.16	64
JPM	56.8	13,250	1.0	0.30	11
VXX	56.4	11,852	1.0	0.57	10
SIRI	53.8	1,021,571	1.0	0.45	920
QQQ	50.2	63,295	1.0	0.15	59
IWM	48.7	15,158	1.0	0.19	15
CSCO	47.3	84,527	1.0	0.23	85
MSFT	45.6	40,857	1.0	0.20	42
F	43.8	132,213	1.0	0.31	141
GE	43.8	89,467	1.0	0.20	96
S	43.5	422,473	1.0	0.58	456
C	41.9	14,347	1.0	0.37	16
CHK	38.6	10,778	1.0	0.52	13
INTC	36.9	35,485	1.0	0.22	45
NOK	32.2	430,861	1.0	0.37	627
PFE	30.9	58,008	1.0	0.19	88
MS	29.7	24,323	1.0	0.43	38
WFC	29.4	14,728	1.0	0.26	23
ORCL	29.3	22,414	1.0	0.26	36
MU	27.9	94,524	1.0	0.52	159
ZNGA	25.7	16,315	1.0	0.82	30
T	25.4	33,937	1.0	0.14	63
DELL	23.6	53,863	1.0	0.26	107
VWO	22.8	43,736	1.0	0.15	90
VALE	21.9	23,396	1.0	0.31	50
TZA	21.8	11,200	1.1	0.56	24
EFA	21.8	34,171	1.0	0.14	73
EMC	21.7	23,829	1.0	0.25	52
SDS	21.0	316,091	1.0	0.24	706
AA	21.0	100,122	1.0	0.32	224
HPQ	20.7	20,302	1.0	0.27	46
GDX	20.3	4,984	1.1	0.32	11
EWZ	20.3	5,748	1.0	0.22	13
RF	20.2	134,203	1.0	0.45	311
LOW	20.0	11,869	1.0	0.26	28
FAZ	19.3	7,236	1.1	0.50	18
FXI	19.2	22,049	1.0	0.17	54
YHOO	18.9	36,246	1.0	0.29	90
XLI	17.7	169,464	1.0	0.16	447
NWSA	17.5	26,692	1.0	0.24	71
AAPL	17.5	416	14.3	0.25	1
ARNA	17.0	24,373	1.0	0.98	68
XLE	16.6	8,623	1.0	0.19	24
TVIX	16.2	5,162	1.2	1.04	15
PBR	16.2	16,496	1.0	0.33	48
RIMM	16.0	19,069	1.0	0.53	56