

Memorandum

To: The File

From: Office of Economic Analysis

Date: April 6, 2005

Subject: Supplemental Trade-through Analysis
(Reserve Size Analysis
Sample Day Activity Analysis
Analysis of Quote Depth)

This memo includes three supplemental OEA analyses relating to reserve size, sample day selection, and quoted depth.

Reserve Size Analysis

To help the Commission assess and respond to comment letters received on the Regulation NMS reproposal, the OEA conducted a supplemental analysis of the effect of reserve size quotes on the estimates of trade-through rates. Some commentators believe trade-throughs identified in the OEA trade-through study resulted from reserve size quotes, and therefore overstated the true trade-through rate.¹ The concern is that a sweep order executing against a quote for its displayed size while also executing a trade at the next price level, may appear as a trade-through if the quote has a reserve size. This would occur if the order failed to access all the reserve size and additional size refreshed the quote following the execution.

This reserve size analysis overstates the effect on trade-through rates to the extent the sweep volume we identify is not from the same order that traded-through. Specifically, we find that the trade-through rate marginally declines from 2.5% to 2.3%, and trade-through share volume marginally declines from 7.9% to 7.7% when adjusted for reserve size quotes.

Method

In the original trade-through analysis, trade-throughs are compared to quote windows that are equal to the lowest bid and highest ask that existed during a three-second window. A sweep order that successfully takes out the displayed size and the reserve size, will not generate a false trade-through since the reserve quote will not appear as a reference quote. However, if the sweep order does not take out all the reserve size, it may appear that a trade-through occurred.

The data does not identify quotes as reserve generated or executions as sweeps. Therefore, in this reserve size analysis, we look for evidence that a sweep order executed on the traded-through market. For each trade-through, we total the share volume executed on the traded-through

¹ Memorandum to File, from Office of Economic Analysis, dated December 15, 2004 (analysis of trade-throughs in Nasdaq and NYSE issues) ("Trade-Through Study").

market, around the time of the trade-through ('sweep volume').² If the sweep volume is large enough to fill the displayed quote size, and meets the price conditions described below, we determine a sweep order may have occurred and the trade-through could have been due to a reserve size quote.

Sweep volume is calculated using the following method. First, volume executed during a three-second interval centered on the trade execution time is considered. Volume is summed for each of the two consecutive seconds in the three-second window at the same price point. In other words, volume is totaled for the second before and the second of the trade, and separately volume is totaled for the second of and the second after the trade. The logic is a sweep order will result in trade prints that are nearly sequential and close in time. Executions that are printed a second or more apart are unlikely to be part of the same sweep order. Each trade-through is evaluated against all sets of sweep volume figures produced by the calculation.³

Next, the sweep volume and sweep price are compared to the size and price of the traded-through quote. The sweep price is considered to better identify those trades that could have executed against the traded-through quote. The trade-through analysis used quote windows, so the sweep order price could have been equal to the benchmark price or to some better price. Limiting the sweep price to the benchmark quote price might be overly restrictive. However, a sweep of the traded-through quote could not have a price that was equal to the counter side quote window price. Therefore, we select the mid-point of the quote window as the bound on the price range.⁴ This means a qualifying sweep order will have a price that is equal to or better than the traded-through quote price but no better than the quote window mid-point.

In summary, if the sweep volume equals or exceeds the traded-through quote depth⁵ and meets the above price condition, the quote is not considered to have been traded-through.

Result

This method of accounting for reserve size quotes will overstate the effect on trade-through rates where the trade-through and sweep volume pairs do not originate from the same order. Specifically, we find that the trade-through rate marginally declines from 2.5% to 2.3%, and trade-through share volume marginally declines from 7.9% to 7.7% when adjusted for potential reserve size quotes.

² If a trade executes through the quotes of more than one market, each market's quotes are subject to the analysis. Trade times are those used in the OEA trade-through analysis and are from the Nastraq data. The Nastraq file contains both trade execution time and trade report time fields. The trade execution time is used where available, and trade report time otherwise.

³ Trades that are included in a sweep volume calculation for a particular trade-through are also available to evaluate other trade-throughs that occurred during that time period or trade-throughs on other markets.

⁴ For the sample day December 18, 2003 the trade-through rate was 2.6%. Adjusted for reserve size, the rate ranged from 2.38% (sweep price restricted to equal the traded-through quote price) to 2.31% (sweep price restricted to the traded-through quote price and no better than the counter side quote price). Restricting price to the traded-through quote price but no better than the quote mid-point yields a trade-through rate of 2.32%. Figures cited in the text are for all four sample days.

⁵ Displayed size is the maximum size displayed during the three-second quote window.

Volume and Volatility of Sample Days in OEA Trade-through Analysis

Some comment letters on the Regulation NMS reproposal suggested that the sample days (September 18, October 16, November 20 and December 18, 2003) used in the OEA trade-through analysis were inappropriate as they represented days of unusual market activity and the release of important economic information. The concern is if sample days are atypical, the trade-through rates may be higher than if more representative days had been used.

To help the Commission assess and respond to those comment letters, OEA prepared statistics on the volume and volatility for the sample days compared to average values for the year 2003. Those statistics are presented in the table below. Also included are NYSE and Nasdaq trade-through rates for each of the sample days to help determine if the trade-through rates were affected by any days of unusual market activity.

A review of the data in the below table show that the sample day volume and price range changes (volatility) are within the normal range of daily volume and volatility values for the year. Furthermore, the daily trade-through rates fall within a narrow range and are not driven by outlier values that might have been associated with days of extreme market conditions.

Sample Day (2003)	Nasdaq Trade-through Rates	NYSE Trade-through Rates	S&P 500 Index Volatility (High-Low)/Close Price	Share Volume in S&P 500 Stocks (billions)
September 18	2.3%	2.8%	0.014	1.3
October 16	2.5%	2.8%	0.009	1.2
November 20	2.6%	2.2%	0.013	1.1
December 18	2.6%	2.3%	0.012	1.3
Sample Average	2.5%	2.5%	0.012	1.2
Year 2003 Daily Average			0.014	1.3
Median Value			0.013	1.3
25 th Percentile			0.009	1.1
75 th Percentile			0.017	1.4

Daily volatility is calculated for each day in 2003 for the S&P 500 Index. We measure volatility as the difference of the daily high and the daily low as a fraction of the daily closing price for S&P 500 Index values. As shown in the table, the mean and median daily values for the year 2003 were 0.014 and 0.013, respectively. The 25th and 75th percentiles were 0.009 and 0.017, respectively. The volatility values for the four sample days were 0.014, 0.009, 0.013, and 0.012, and the four day average is 0.012. Each of the sample day volatility values are equal to or less than the average value for the year and all are within the inter-quartile range. ⁶

⁶ Volume and volatility statistics were also computed for the Nasdaq Composite, an appropriate comparison for the Nasdaq sample only. Average daily volatility for the Nasdaq Composite (measured as described

The average daily volume for the S&P 500 stocks for year 2003 was 1.3 billion shares per day. Daily trading volumes in the S&P 500 stocks for the four sample days in the OEA trade-through analysis were: 1.3 billion shares, 1.1 billion shares, 1.2 billion shares and 1.3 billion shares. The four day sample average is 1.2 billion shares which compares to the annual average of 1.3 billion shares per day.

Finally, the NYSE and Nasdaq sample day trade-through rates fall within a fairly narrow range - 2.3% to 2.6% for Nasdaq and 2.2% to 2.8% for NYSE - and are not driven by an outlier value in the sample day rates. Taken with the volume and volatility statistics, the evidence supports the conclusion that sample days are not days of extreme values and are reasonable days for evaluating trade-throughs.

above) was 0.017 for the year 2003. Volatility values for the sample days were 0.017, 0.019, 0.011, and 0.019, and average to 0.016. All daily values are within the inter-quartile range of 0.012 to 0.021. Average daily share volume for the year in Nasdaq Composite Index issues was 1.7 billion shares. Average daily share volume for the four sample days was 1.8 billion shares, and on individual sample days share volume was 2.0 billion, 1.7 billion, 1.8 billion, and 1.7 billion shares.

Quote Size and Depth Statistics

To help the Commission assess and respond to comments on the Regulation NMS reproposal, OEA prepared an analysis of quoted depth in Nasdaq stocks. The attached table contains quoted depth statistics for the sample stocks used in the OEA trade-through analysis, including the mean and median, and values for the 25th and 75th percentiles. Three measures of depth were calculated and are based on top-of-book quotes from the Nasdaq, ArcaEx, CSE, and the ADF, for the four sample days in 2003.

We define total depth as the sum of displayed quoted size (top-of-book) across all four markets, at any price. Inside depth is defined as the sum of quoted size across all four markets when the quote price is equal to the best bid or the best offer. Two tick depth is equal to the sum of quoted size across markets, when the quote price is at the NBBO or no more than two cents away from the bid (or ask).

For each stock, the bid depth or offer depth is weighted by the length of time the quote size was quoted. Depth numbers are the average of the time-weighted bid and ask shares offered. The sample average represents an equal weighted average across stocks.

Stock Depth Statistics

The sample includes 3,429 Nasdaq Stocks. Total depth includes all top of book displayed depth on Nasdaq, ArcaEx, CSE, and ADF. Depth at the inside includes depth only when quote is at the best bid (or offer) price. Depth two ticks away includes displayed depth up to two cents away from the inside quote.					
(Average of Bid Depth and Offer Depth)					
		Average	Median	25 th Percentile	75 th Percentile
Total Displayed Depth		3,176	1,637	1,095	2,445
Total Displayed Depth At Inside		1,833	581	384	987
Total Displayed Depth Up to 2 ticks from Quote		2,804	1,178	724	2,056

The statistics show, for example, that one-half of the stocks have 1,637 shares (median) or less displayed for purchase or sale. The median number of shares available for purchase or sale at the inside quote is 581 shares. Looking at depth up to 2 cents away from the NBBO, the data show that one-half of the stocks have displayed depth of 1,178 shares or less.