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The dynamics of quote adjustments

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ABSTRACT

Liquidity providers on the NYSE make faster quote adjustments towards equilibrium spreads and depths than they do on NASDAQ. Liquidity providers in both markets make faster spread and depth adjustments for stocks with more frequent trading, greater return volatility, higher prices, smaller market capitalizations, and smaller trade sizes. We find that stocks with greater information-based trading and in more competitive trading environments exhibit faster quote adjustments. The speed of quote adjustment is faster after decimalization in both markets. These results are robust and not driven by differences in stock attributes between the two markets or time periods. Overall, our results indicate that stock attributes, market structure, and tick size exert a significant impact on the speed of quote adjustment.

1. Introduction

Traders pay the ask price when they buy shares and receive the bid price when they sell shares. The difference between the bid and ask prices is an important measure of market quality because it represents the cost of trading. The bid–ask spread evolves according to newly placed limit orders as well as new information embedded in order flow, trades, and return volatility. Despite its obvious importance to traders, we know very little about the dynamics of the bid–ask spread. Prior studies offer little evidence as to the speed at which new information is impounded into the bid–ask spread. There is also limited evidence regarding how market structure and trading protocol, such as tick size, affect the speed at which new information is incorporated into the bid–ask spread.

Liquidity providers do not always immediately incorporate the newly arrived information into quotes for a number of reasons. For instance, they may not be able to change quotes because tick size is a binding constraint on spreads or they do not want to change quotes because the minimum feasible quote increment is larger than the desired quote change implied by the new information (see Hasbrouck, 1991a). Furthermore, the speed of quote adjustment is likely to be different across stocks. For example, liquidity providers may make faster quote adjustments to new information (and thereby move more quickly to equilibrium spreads) for stocks with greater adverse-selection risks because the cost of quoting sub-optimal spreads is greater for such stocks.

In this study we address the following questions using a large sample of New York Stock Exchange (NYSE) and NASDAQ stocks: (1) How quickly do specialist/dealer quotes incorporate new information? Do price and depth quotes on the NYSE reflect changes in stock attributes more quickly than those on NASDAQ? (2) How is the speed of quote adjustment related to stock attributes? For example, do stocks with greater information-based trading exhibit faster quote adjustments towards equilibrium spreads and depths? Do stocks that are traded in less competitive markets (e.g., fewer dealers) exhibit slower quote adjustments? (3) Does decimal pricing result in faster quote adjustments to new information? Answers to these questions would be of significant interest to market regulators because they could help design better market structure. Because spreads constitute a part of trading costs, the speed at which liquidity providers adjust their quotes to new information is also of concern to traders.

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Hasbrouck (1988, 1991a,b) examines how marketmakers adjust quote midpoints to signed trades. Hasbrouck and Sofianos (1993) show that the trades in which the specialist participates have a greater immediate impact on quote midpoints than those without specialist participation. Madhavan and Smidt (1993) show that quote revisions are negatively related to specialist trades and positively related to the information conveyed by order imbalances. Dufour and Engle (2000) extend Hasbrouck (1991a) vector autoregression model by incorporating the time interval between trades into empirical estimation. Damodaran (1993) and Brisley and Theobald (1996) estimate the speed of price adjustment using the partial adjustment model of Amihud and Mendelson (1987). Theobald and Yallup (2004) compare the speed of price adjustments between large and small companies. Pascual et al. (2004) estimate the time required for quotes to incorporate all the information content of a particular trade.

While the above studies focus on either how quote midpoints change in response to trades or the speed of price adjustment, our study examines how quickly liquidity providers adjust *quote width* (i.e., the bid–ask spread) and *depth* (i.e., the number of shares at the bid and ask) to their *equilibrium* values in response to new information. Because determinants and information content of spreads and depths are likely different from those of quote midpoints or prices, our study helps better understand the price discovery process. For instance, the quote midpoint reflects the expected value of an asset whereas the spread and depth reflect uncertainty about the value of an asset or adverse-selection risks. The quoted depth is an important metric to traders because it is the guaranteed quantity that can be bought or sold at the quoted price.

The speed of quote adjustment on the NYSE is likely to be different from that on NASDAQ for various reasons. For example, NASDAQ dealers may not have strong incentives to make quick quote adjustments in response to information shocks because a significant portion of order flow is either internalized or preferenced. Garfinkel and Nimalendran (2003) find less anonymity on the NYSE specialist system compared to the NASDAQ dealer system. As a result, liquidity providers on the NYSE may respond more quickly to information-based trading than those on NASDAQ. We examine the effect of market structure on quote adjustment process by comparing the speed of quote adjustment between NYSE and NASDAQ stocks.

An important protocol of securities markets is the size of the minimum price variation (i.e., tick size). Although numerous studies examine the effect of tick size on trading costs and return volatility,[1] none of them examine how tick sizes affect the quote adjustment speed. To the extent that the minimum price variation creates frictions in exchange markets, it is likely to affect the speed of quote adjustment. We analyze the effect of tick size on the informational efficiency of spreads and depths by comparing the quote adjustment speed before and after decimal pricing.

We employ a simple model of partial adjustment to analyze how quickly liquidity providers on the NYSE and NASDAQ adjust spread and depth quotes in response to new information. We show that the speed of quote adjustment on the NYSE is faster than the speed of quote adjustment on NASDAQ. In both markets, the quote adjustment speed is faster for stocks with a larger number of trades, higher share prices, greater return volatility, smaller market capitalizations, and smaller trade sizes. Our results also indicate that stocks with greater information-based trading and in more competitive trading environments exhibit faster quote adjustments. The speed of quote adjustment after decimal pricing is significantly faster than the corresponding figure before decimal pricing in both markets, indicating that larger tick sizes slow price discovery. On the whole, our study provides evidence that stock attributes, market structure, and tick size exert a significant impact on the speed of quote adjustment.

2. Statement of hypotheses

This section presents our conjectures on how the speed of quote adjustment is related to market structure and stock attributes.

2.1. Market structure and the speed of quote adjustment

Chung et al. (2004) show that a large portion of order flow on NASDAQ is either internalized or preferenced based on payment for order flow agreements. NASDAQ dealers may have little incentives to compete with quotes because aggressive quotes do not necessarily increase market share when a significant portion of order flow is already internalized or preferenced.[2] As a result, NASDAQ dealers may not have strong incentives to make quick quote adjustments in response to information shocks. Although a part of the NYSE volume is also routed to regional exchanges according to preferencing agreements between brokers and dealers, prior studies (see Bessembinder (2003)) show that NYSE specialists almost always post the most competitive quotes. Consequently, order preferencing between brokers and regional dealers may not significantly compromise quote adjustments on the NYSE. These considerations suggest that the quote adjustment speed on the NYSE is likely to be faster than that on NASDAQ.

Garfinkel and Nimalendran (2003) examine the degree of anonymity – the extent to which a trader is recognized as informed – in alternative market structures and find less anonymity on the NYSE specialist system compared to the NASDAQ dealer system. This result supports the hypothesis advanced by Benveniste et al. (1992) that the unique relationship between specialists and floor brokers on the NYSE results in less anonymity.[3] The lower degree of anonymity on the NYSE constitutes another reason why liquidity providers on the NYSE are likely to respond more quickly to information-based trading than those on NASDAQ. These considerations lead to our first hypothesis.

Hypothesis 1. The speed of quote adjustment on the NYSE is faster than that on NASDAQ.

2.2. Stock attributes and the speed of quote adjustment

Easley and O'Hara (1992) and Harris and Raviv (1993) analyze the role of trades in price formation and show that the number of trades is positively related to absolute price changes (i.e., return volatility). In Easley and O'Hara (1992), the number of trades is informative with respect to price changes because trades and the lack thereof are both informative to marketmakers. In Harris and Raviv (1993), trading occurs if and only if cumulative information for a particular type of trader switches from favorable to unfavorable or vice versa.

Jones et al. (1994) show that the positive relation between return volatility and volume reported in previous studies reflects the positive relation between return volatility and the number of trades. They show that the occurrence of transactions *per se* contains all of the information pertinent to pricing securities. This result is in line with the finding of Dufour and Engle (2000) that the speed of price adjustment in response to trade-related information

[1] See Harris (1994, 1997) for an excellent review of this literature.

[2] See Chung and Chuwonganant (2007) for related evidence.

[3] Benveniste et al. (1992) note that NYSE specialists have continuous face-to-face contact with floor brokers while such contact is not available to NASDAQ dealers because NASDAQ operates on an electronic screen-based system.