



# Information, speed vs. cost trade-offs, and order routing decisions in U.S. equity markets

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## ABSTRACT

Prior research indicates that both execution speed and cost are important to traders, but that these two dimensions of execution quality are negatively related across U.S. equity markets. In our paper, we examine how U.S. equity traders, who are (un)informed about future price changes, trade-off between speed and cost in their order-routing decisions. We find that informed traders are more likely to choose trading systems that allow them to trade-off lower cost for faster speed; whereas, uninformed traders are more likely to choose trading systems that allow them to sacrifice speed for lower costs. Our results indicate that traders have varying preferences for the different dimensions of execution quality based on their information levels. These differences subsequently influence order-routing decisions.

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## 1. Introduction

U.S. equities trade in multiple markets and research shows that execution speed and cost are negatively related across markets. For example, market centers that provide faster (slower) execution tend to have higher (lower) trading costs (e.g., [Boehmer, 2005](#)). While all traders presumably have a preference for minimizing their cost of trading, some traders might have an equal (or even greater) preference for minimizing their time to execution. Faster trading, among other things, better enables traders to capitalize on information. Whether or not informed traders prefer faster (slower) execution to higher (lower) trading costs remains an unresolved issue in the financial literature. For example, many theoretical models assume that informed traders prefer to submit market orders (or to execute immediately), but empirical research suggests the opposite, namely that informed traders prefer limit orders (e.g., [Kaniel and Liu, 2006](#)). If execution speed and cost are both important to traders but negatively related across trading systems, then which dimension of execution quality do traders prefer? How does this subsequently influence their order-routing decision?

Our paper provides some insight for answering the above questions. It focuses on speed vs. cost trade-offs, and subsequent order-routing choice, with respect to trader information content. We infer trader information content by analyzing market prices following order execution. If, on average, prices rise (fall) following buy (sell) orders, we conjecture that these orders are more likely to be submitted by informed traders. On the other hand, if prices fall (rise) following buy (sell) orders, we conjecture that these orders are more likely to be submitted by uninformed traders. How (un)informed traders make order routing decisions has important implications for market design, market prices, and transaction dynamics. Using proprietary data about active traders,

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who directly access/provide liquidity in U.S. equity markets, we find that informed traders are more likely to trade-off lower costs for faster speed in their order-routing decisions. Traders who are less/not informed about future price direction are more likely to make the opposite order-routing choice (i.e., to trade speed for lower costs).

Our paper focuses on a trader's order-routing decision in the Nasdaq marketplace. On Nasdaq-listed stocks, competing market makers in the Nasdaq market center provide a significant and stable source of liquidity. Traders can execute against market-maker displayable quotes by using automated execution systems, or, for larger orders, they can negotiate with market makers for trading at different (favorable) prices. An alternative to trading with a market maker is to place a limit order in the marketplace and, effectively, compete with market makers to trade at better prices.<sup>1</sup> Traders can display their limit order in the consolidated quote stream by placing it on the Nasdaq stock market or on any number of competing electronic trading systems.<sup>2</sup> The multiple execution options available to traders routinely force them to make important tradeoff decisions with respect to execution cost and execution speed. While some traders may prefer speed to cost or vice versa, economic theory generally assumes that informed traders have a tendency to execute their orders quickly so they can exploit short-lived information. That is, order-routing options that offer fast execution (whether on Nasdaq or on a competing electronic trading system that is part of the consolidated quote stream) should attract more informed traders.

We find traders are much more likely to experience lower trading costs when they use market-maker trading systems that offer price improvement opportunities (i.e., negotiated trading systems). But, these execution systems result in a much slower execution because human intermediation is involved in the trading process. Traders can execute faster if they use market-maker automated execution systems, but execution over these systems typically results in much higher trading costs because traders are forced to pay the bid–ask spread. We find orders executed over automated market-maker trading systems convey more information than orders executed over negotiated market-maker trading systems. These findings suggest that informed traders are more willing to route their orders over trading systems that trade-off lower costs for faster speed.

An alternative to trading with a Nasdaq market maker is to route a limit order to an electronic order book. While traders can avoid the bid–ask spread by posting a limit order in the marketplace, this opens them to adverse selection costs when (if) execution occurs. Both informed and uninformed traders choose this option. We find that the information content behind a limit order is highly dependent upon how the order is priced in relation to the national best bid and offer (NBBO) at the time of submission. Execution time declines and the information content of an order rises as traders submit more aggressively priced limit orders. For example, marketable limit orders execute the fastest and convey the most information.

Our study contributes to three streams of literature which examine issues related to trading speed (costs) and informed trader behavior in securities markets. Theoretical models generally classify traders as either informed or uninformed (i.e., liquidity traders) based on their information content. Informed traders play a significant role in the price discovery process and understanding the motives and actions of this trader group has long been an important focus of microstructure studies.

First, our study contributes to literature which examines multiple dimensions of execution quality and trader preferences for the different dimensions. A growing academic literature has begun to use new data sources to examine execution quality along more than one dimension.<sup>3</sup> Studies indicate that traders are concerned about both execution speed and execution costs (e.g., [Boehmer et al., 2007](#)), but these two dimensions of execution quality are negatively related (e.g., [Battalio et al., 2003](#); [Boehmer, 2005](#)). Because the data (e.g., market center execution quality reports) used in these studies do not identify individual traders, as noted by [Boehmer \(2005\)](#), it is difficult to assess trader preferences for the different execution quality dimensions or how traders trade-off between speed and costs.<sup>4</sup> For example, execution speed and cost cannot be measured from trader original order, which is presumably how traders assess execution quality. Furthermore, trader order submission strategies are not observable (e.g., original order size, order routing choice, order type choice, etc.). This complicates inferences about whether traders prefer faster (slower) trading to lower (higher) costs. While prior studies document differences in execution quality across markets using anonymous trade-level data, our study differs in that we aim at gaining a better understanding of which execution quality dimension (un)informed traders prefer. We analyze trader-defined order-level data, which allow us to link trader (ex ante) order submission decisions to subsequent (ex post) measures of execution speed and costs.

Second, our study contributes to that literature which examines trader choice of order type. Theoretical models have traditionally assumed that informed traders submit market orders and uninformed traders submit limit orders (see, for example, [Glosten, 1994](#); [Kyle, 1985](#); [Rock, 1990](#)). In competitive securities markets informational advantages erode rapidly and traders must act quickly (or submit a market order) in order to profit from their short-lived information. In spite of the fact that the commonly held belief among many that informed traders prefer to use market orders, recent empirical research seems to indicate the opposite, or that informed traders prefer limit orders. For example, [Kaniel and Liu \(2006\)](#) find that limit orders are more informative than market orders, although they admittedly use an information horizon for informed traders that is, on average,

<sup>1</sup> This came about with the 1997 Order Handling Rules. Several researchers have examined the effect of this important rule change. See, for example, [Bessembinder \(2000\)](#), [Barclay et al. \(1999\)](#) and [Chung and Chuwonganant \(2004\)](#).

<sup>2</sup> Alternative trading systems typically display their orders in the consolidated quote stream through exchanges. Some market centers do not publicly display their orders (i.e., dark pools). However, market centers that display their orders have traditionally attracted a majority of Nasdaq's order flow.

<sup>3</sup> A multi-dimensional analysis of execution quality is not possible with commonly used transaction-level data which only allow researchers to compute a uni-dimensional measure of execution costs. However, execution costs can only be evaluated in terms of the parts (i.e., trades) rather than the sum of the parts (i.e., the order). This is problematic because traders assess execution costs from their originating order. See [Bessembinder \(2003\)](#) for some of the other issues involved assessing trade execution costs from transaction level data.

<sup>4</sup> [Battalio et al. \(2003\)](#) use dealer audit trail data to examine execution quality dimensions; whereas, [Boehmer \(2005\)](#) and [Boehmer et al. \(2007\)](#) use market center execution quality (Dash 5) reports. Dash 5 reports are published monthly by market centers for each stock in four aggregate order size categories: 100–499, 500–1999, 2000–4999, and 5000–9999 shares.

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