



Clustering of intraday order-sizes by uninformed versus informed traders



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ABSTRACT

We examine quantity choice patterns by equity traders across trading hours in the U.S. Controlling for intraday variations in trading activity, we find that traders submit more non-rounded order sizes and more order sizes overall leading up to a day's market close. Traders who submit more distinct order sizes pay a higher cost to trade, and they are also less informed about future prices. Our results suggest that the goal to satisfy specific quantity demands rises across the day. This differs from total trading demand, which resembles a U-shape pattern intraday, but is consistent with less trade-size clustering at the ends of fiscal quarters.

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1. Introduction

Trades in financial markets tend to cluster in varying sizes. Researchers have studied trade-size clustering in various securities markets and uncovered systematic variation in clustering across calendar time.² For example, evidence of less trade-size clustering at quarter-ends has been documented in foreign exchange markets (Moulton, 2005), equity markets (Alexander and Peterson, 2007), and futures markets (ap Gwilym and Meng, 2010). Moulton (2005) conjectures that the phenomenon is driven by an increasing desire to have portfolios aligned with stated objectives at a time of greater internal and external scrutiny. When traders care more about trading precise quantities, less trade-size clustering occurs in the marketplace. Conversely, when traders care less about trading precise quantities, more trade-size clustering occurs. The primary motivation for our study is to examine whether or not the desire to satisfy specific quantity demands varies on an intraday basis rather than on a calendar day basis and, if so, *who* tends to drive the result. We obtain a unique dataset about individual traders which allows us to investigate the issue.

A stronger demand to trade in precise quantities at particular times of day is important because the heightened demand can have

direct implications for market quality dynamics. For example, Moulton (2005) finds that trading costs are higher at times when trade-size clustering is less prevalent. She attributes this to a quantity-price trade-off relationship in markets. That is, when traders exhibit a stronger desire to trade precise quantities, they must sacrifice on the price dimension of liquidity. Intraday variation in quantity choice patterns may also have significance for the efficiency of market prices, particularly if it impacts the manner in which informed traders trade. For example, Alexander and Peterson (2007) find that rounded trades – particularly those of a medium size – are more informative about future prices than unrounded trades. They conjecture that informed traders engage in size clustering strategies in order to disguise their trading. If trade-size clustering is less pronounced at certain times of day than others, then this may make it more challenging for informed traders to conceal their trading. And changes in informed trader behavior can have direct implications for the efficiency of market prices.

As is the case at the end of a fiscal quarter, the end of a trading day can also bring about greater internal and external scrutiny which may result in a stronger desire to satisfy specific quantity demands. For example, risk management practices are more heightened around the market close (see D'Antona, 2013). Consider market participants who execute large multi-trade orders. They often have a strong desire to “finish the ticket” before the market closes in order to avoid being exposed to excess risk overnight. Short-term traders, such as those engaging in intraday high-frequency trading strategies, often have a strong desire to unwind

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² A related literature stream examines price clustering in financial markets (see, for example, Harris, 1991; Christie and Shultz, 1994; Ohta, 2006).

their remaining position sizes at the end of the day in order to ensure they “go home flat” or risk-free. These and other factors may contribute to less size clustering around the market close than at other times of day because traders have a stronger desire to transact in precise quantities.³

In order to explain trade-size (and price) clustering patterns in securities markets, researchers have used the “negotiations hypothesis” and “behavioral hypothesis” (e.g., Alexander and Peterson, 2007; Blau et al., 2012; Meng et al., 2013). The behavioral hypothesis indicates that traders think in round numbers and that they choose round sizes in order to minimize cognitive processing costs (Wyckoff, 1963; Niederhoffer and Osbourne, 1966). The negotiations hypothesis indicates that traders choose round sizes to minimize the costs of continuing negotiations (Ball et al., 1985; Harris, 1991). While the behavioral and negotiations hypotheses may be useful in explaining why trade-size clustering occurs around the morning hours of trading, these two theories may be less applicable around the market close.

To see why, consider a trader who has been working a 10,000-share sell order across the day. The trader has 637 shares remaining to sell and the market closes in 15 min. In this scenario, the trader may be less likely to think in round numbers and more likely to think in a non-rounded size (637) so that he can “finish the ticket” before the market closes. In addition, the trader is less likely to settle on a rounded size to minimize the cost of continuing negotiations because the upcoming market closure indicates that no subsequent negotiations will occur. In the morning hours of trading, risk management practices and other factors are less likely to interfere with trader tendency to think in terms of round numbers. Also, in the morning period costs can still arise from continuing negotiations across the trading day because the market close is not imminent. From this example, one can see how intraday variation in size clustering might occur and why size clustering may be higher around the opening hours of trading and lower around the closing hours.

If size clustering of orders is less prevalent at the end of the day, then this may be related to other observed variables in trading patterns. For example, Hodrick and Moulton (2009) argue that quantity and price are interrelated. They develop a theoretical model wherein traders sacrifice (i.e., trade off) on order size and price when financial markets are not perfectly liquid.⁴ Moulton (2005) finds empirical evidence consistent with this on a calendar day basis. Specifically, she finds that foreign exchange traders experience higher price impacts at the end of the quarter when they trade in more distinct quantities, where more distinct quantities refers to more variation in the quantities (sizes) traded. During the intraday, order execution costs are known to be higher at the end of the day, and our main focus is on examining quantity choice patterns around this time. In addition, we examine whether a relationship exists between quantity choice and price at both the order-level and individual trader-level. For example, do traders who submit more distinct order sizes pay a higher cost to trade? Are trading costs higher for distinct order sizes? We provide some insight for answering these questions.

If traders are more concerned about executing in precise order sizes, then their desire to trade is likely driven by liquidity reasons rather than by private information. A rational informed trader is more likely to submit common rather than distinct order sizes in order to hide effectively among the main trade sizes in the marketplace (see, for example, Alexander and Peterson, 2007). Therefore,

we expect informed (liquidity) traders to submit common (distinct) order sizes more often, and we investigate whether or not patterns exist between choice of order size and whether traders are well-informed or ill-informed at both the order level and trader level.

To conduct our study, we obtained proprietary order-level data from a U.S. broker–dealer. From these data, we study more than six million order executions on Nasdaq-listed stocks, which are submitted by more than three thousand traders, over an approximately six and one-half year sample period. The brokerage-level data are advantageous for conducting a study on trader quantity choice. For one, these data allow us to analyze quantity choice based on the original order size submitted by a trader. By contrast, other studies that examine size clustering (and infer trader quantity choice) in financial markets tend to focus on trade executions at the market center level.

Controlling for variations in trading activity (i.e., total trading demand) across the day and other factors, we find that size clustering is less prevalent around the market close and more prevalent around the market open. On the other hand, the results not only extend the financial literature on trade-size clustering at quarter-ends, but also on intraday trading patterns. Researchers have found that various trading variables exhibit distinct time-varying patterns across trading hours. For example, trading volume, price volatility, bid/ask spreads, and order execution costs have all been shown to be higher around the opening and closing hours of trading.⁵ We conjecture that the submission of more distinct order sizes, or the submission of more non-rounded order sizes and/or more order sizes overall, leading up to the end of the trading day is driven by an increasing desire to trade in specific quantities before the market closes.

We find that distinct order size submissions are associated with higher trading costs and that they are less informative about future prices. Similar results exist at the trader-level. For example, traders who submit more distinct order sizes pay a higher out-of-pocket (i.e., effective spread) cost to trade which is in line with quantity-price trade-off theory (Hodrick and Moulton, 2009). These traders also appear less informed about future prices. For example, traders who submit a wider range of order sizes experience smaller price impacts, and their trading behavior is less representative of information-based trading. We find that traders who are less prone to size clustering execute orders more slowly, trade in larger sizes, and are less likely to trade across multiple trading venues. In electronic multi-market settings (e.g., our setting), Boehmer (2005) conjectures that informed traders prefer to execute quickly, in smaller trade sizes, and across multiple trading venues so as to not reveal their information to the marketplace.

The remainder of our paper proceeds as follows. In Section 2, we describe data used in the study. In Section 3, we describe the methods used to identify whether or not traders care more about trading their exact quantity demands as the market close approaches. In Sections 4 and 5, we report empirical results for the two methods. In Section 6, we examine which traders appear to have a stronger desire to satisfy their exact quantity demands. Section 7 provides concluding remarks.

2. Data

There are three data sources used in this paper, the principal one being a proprietary order-level database obtained from a U.S. broker/dealer firm. Thomson Reuters Tick History database and the Center for Research and Security Price (CRSP) database are also used in conjunction with the proprietary data. The securities firm was randomly selected, and they agreed to provide the data. The

³ Credit Suisse and Bank of America representatives noted that, in part, heightened risk management practices brought on by the financial crises and the rise in high frequency trading is resulting in more trading activity around the close.

⁴ Hodrick and Moulton (2009) define liquidity along three dimensions: price, time, and quantity. In a perfectly liquid market, a trader can execute a desired quantity immediately without affecting the market price. However, when the market is not perfectly liquid, a trader is forced to sacrifice (i.e., trade off) on one or more of the three dimensions.

⁵ See, for example, Brock and Kleidon (1992), McInish and Wood (1992), Chung et al. (1999) and Garvey and Wu (2009). Admati and Pfleiderer (1988) provide a theoretical explanation for why some of the patterns occur.

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