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Throttling hyperactive robots – Order-to-trade ratios at the Oslo Stock Exchange ☆

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ABSTRACT

We investigate the effects of introducing a fee on excessive order-to-trade ratios (OTRs) on market quality at the Oslo Stock Exchange (OSE). We find that traders reacted to the regulation as measured OTRs fell. However, market quality, measured with depth, spreads, and realized volatility, remain largely unaffected. This result differs sharply from the experience in other markets, such as Italy and Canada, where similar regulatory changes have been accompanied by a worsening of liquidity. The unchanged market quality at the OSE is likely due to the different design of the regulation, which is tailored to encourage liquidity supply.

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1. Introduction

Stock exchanges are currently facing interesting times. In particular, the issue of designing the exchange's *trading rules* has become increasingly complex. When exchanges were mutual organizations, owned by its member stock brokers, they designed trading rules that would suit their members. Most of the world's exchanges have now demutualized into for-profit corporations. This has changed the exchanges main objective into maximizing profit for the exchange. To maximize revenues, exchanges now *compete* to attract order flow, where the design of trading rules has become a key tool.

This competition has also been enhanced by regulatory incentives such as Regulation National Market System (Reg NMS) in the United States, and MiFID in Europe, which explicitly enforce exchange competition. The new regulations have also introduced numerous competitors to the traditional exchanges through various forms of electronic OTC trading (dark pools) where the trading rules are much more opaque than the traditional exchanges that enforce pre-trade transparency.

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The increased competition among exchanges has escalated the sophistication and diversity among the traders. The most important changes have come through the rise of electronic "algorithmic" traders (high-frequency traders–HFTs). The advent of HFTs has been met with scepticism by both regulators and the general public, in particular after the publication of *Flash Boys* by Lewis (2014).

This has led to experimentation with the market design and trading rules, such as altering the calculation of trading costs (make/take fees),[1] changing tick sizes,[2] payment for order flow,[3] co-location,[4] etc. In designing these trading rules, exchanges are balancing different profit components. As part of their efforts to attract order flow, their main source of revenue, exchanges want to make it easy for HFTs to access their limit order books. However, having HFTs actively placing orders in the order book might come with costs, both for the exchange, and for other traders accessing the same book. One is the IT costs, the need to deal with high-speed communications, and fast processing of the continuously updated limit order book. Another potential cost is reputational loss. Given the generally unfavorable view of HFTs, being too positive on HFTs may lead other traders to abandon an exchange. There is also the potential that regulators may introduce regulation not suited to an exchange's business model.

As a consequence, exchanges have tried to find ways to affect the incentives of HFTs that limit some of their message traffic, but that do not seriously inhibit their incentives to send order flow to the exchange. From the point of view of the exchange, and all other traders than the HFTs, the IT costs necessary to cater to the HFTs are economic externalities forced on them by the presence of HFTs. The economic problem for an exchange is similar to, for example, road congestion. According to economic theories of optimal taxation, the way to deal with such externalities is to design a tax that incentivizes behavior to avoid paying the tax. In the case of road congestion, the main goal of a tax is to encourage drivers to spread their driving away from rush hour, not primarily to generate revenues. The problem from an exchange's point of view is similar. The exchange's goal is to change the HFTs behavior by having them internalize the cost of excessive communications in their decision problems.

In this paper we look at a case where the Oslo Stock Exchange (OSE) in 2012 introduced a fee payable by traders with "excessive" order activity (order placements, order modifications, order withdrawals) relative to the number of trades in which the trader participates. The threshold that defined excessive order activity was set to an order-to-trade ratio (OTR) of 70:1 per month. That is, traders that post orders in excess of 70 per trade they participate in must pay a fee. However, the exchange realized that many of these orders are beneficial, as they provide liquidity for the market as whole, not merely to the fastest HFT.

To create incentives to leave an order in the book for some time, the exchange decided not to include orders staying in the book for more than one second when calculating the OTR. In addition, the OTR calculation excludes price-improving orders. The design of OSE's OTR fee thus has some of the same goals as a make-take fee structure; to encourage liquidity provision.

We investigate the consequences of the introduction of this fee on market quality at the OSE. We look at the impact on liquidity and trading volume on the exchange. We also compare the OSE to its closest competitors. The latter is relevant since although the fee was introduced at the OSE only, the OSE has a number of competing trading venues like NASDAQ-OMX (Stockholm), Chi-X, and BATS, where OSE-listed stocks are also traded. Traders may react in ways that the OSE desires, such as cutting down unnecessary message traffic while maintaining trading at the exchange. However, traders may also choose to move some or all of their trading activity away from OSE if they expect the OTR threshold to become binding, such that the cost of trading OSE-listed stocks is lower at other venues.

Our focus in this paper is changes in equity market structure and trader behavior, with a particular focus on the consequences of high-frequency trading on market quality. There is a large literature on this area, and we use the recent survey of Menkveld (2016) to summarize the main points.

The debate has centered around the contribution of HFTs to trading quality. Detractors argue that HFTs prey on all other traders in the market, and the playing field should be leveled.[5] Others argue that much of what HFTs do is market making, the classical function of providing liquidity and being paid by earning the spread. This dichotomy led (Menkveld and Zoican, 2016) to classify HFTs into two types: "HFT bandits" and "HFT market makers". Much of the discussion around HFTs boils down to identifying the relative proportions of these two types.

Most of the theoretical literature on high-frequency trading is concerned with ways in which the HFTs can use their speed to get a competitive advantage,[6] and is mainly suggesting that these activities have a negative impact on market quality. The findings in the empirical literature are more positive. First, there is a part of the literature that documents a

[1] See U.S. Securities and Exchange Commision (2015). For a summary of the arguments around make/take fees, see Angel et al. (2011). For some empirical evidence on make/take fees, see Malinova and Park (2015) and Battalio et al. (2016).

[2] For an overview of the literature on tick sizes, see the survey by the U.S. Securities and Exchange Commision (2012). For an analysis of tick sizes on the OSE see Meling and Ødegaard (2017).

[3] See U.S. Securities and Exchange Commision (2016).

[4] See Brogaard et al. (2015) for an example study of co-location.

[5] A common suggestion is a change of trading protocols towards auctions (Budish et al., 2015). We also see market participants attempting to change protocols and trying to attract order flow. A well-known example is the IEX exchange, which has built in a delay in communications to and from the exchange in an attempt to deter certain kinds of HFT.

[6] See e.g. Biais et al. (2015) and Foucault et al. (2016).

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