The effect of algorithmic trading on market liquidity: Evidence around earnings announcements on Borsa Italiana

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\section*{A B S T R A C T}

This paper examines the impact of algorithmic trading (AT) on market liquidity around periods of high information asymmetry when available liquidity is more valuable. We identify the implementation of proximity hosting services by Borsa Italiana, that are expected to increase AT, in order to examine the behaviour of liquidity around earnings announcements in pre- and post-AT periods. Consistent with previous research, we find that bid-ask spreads widen and market depth falls following earnings announcements in the pre-AT period. However, in the post-AT period, while we find a similar pattern in bid-ask spreads, we find no evidence of a significant fall in market depth. We also find firms that experience the largest increase in AT from pre- to post-AT periods, exhibit lower bid-ask spreads and greater depth following earnings announcements. We conclude that AT improves market liquidity by increasing the resiliency of markets around periods of high information asymmetry, specifically around earnings announcements.

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\section*{1. Introduction}

A small but growing body of literature examines the impact of algorithmic trading on liquidity. The seminal work of Hendershott et al. (2011) provides an empirical assessment of the effect of algorithmic trading (herein AT) on market liquidity. Using message traffic as a proxy for the quantity of AT, the authors provide evidence that the presence of AT in markets enhances liquidity. Brogaard (2010) extends the work of Hendershott et al. (2011) by examining a proprietary dataset that identifies the trading behaviour of twenty-six high-frequency traders on NASDAQ. Brogaard (2010) examines the cross-sectional determinants of the provision of liquidity by high-frequency traders and finds that high-frequency traders are more likely to set the inside quotes (i.e., provide liquidity) in larger stocks. More recently, Jarnecic and Snape (2014) examine the order submission strategies of traders and find that high-frequency traders provide liquidity at multiple prices in the order book and temper liquidity imbalances. This literature, therefore suggests that AT generally improves market liquidity.

In this paper, we extend previous literature examining the impact of AT on liquidity by examining liquidity provision during periods of high information asymmetry - specifically, around earnings releases. A considerable body of literature has examined the impact of earnings releases on liquidity including Morse and Ushman (1983); Lee et al. (1993) and Krinsky and Lee (1996). This literature generally finds that liquidity declines following earnings announcements. This decline in liquidity can be attributed to

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the greater adverse selection costs faced by liquidity providers around earnings announcements, who subsequently widen bid-ask spreads to compensate themselves for greater risk exposure and reduce depth in order to limit the amount of risk they face. We conjecture that because ATs can rapidly change quote or limit order prices as market conditions change, they are better able to manage the risks and reduce costs of adverse selection around earnings releases. Consequently, we hypothesize that liquidity around earnings announcements will improve in the presence of AT.

In order to test our hypothesis, we exploit a natural experiment that is likely to increase the amount of AT in markets. In 2009, Borsa Italiana introduced proximity hosting that enabled brokers to place their servers in the same room (i.e. in close proximity) as the exchange’s trading server. This proximity hosting service reduced latency for ATs and was associated with a significant increase in message traffic through time, indicative of an increase in AT activity. We identify periods around the introduction in proximity hosting that clearly represent pre- and post-AT environments. We then examine liquidity around earnings announcements in the two periods to test the effect of AT on liquidity around earnings announcements.

Consistent with previous literature, we document a widening in bid-ask spreads and a decrease in depth at the time of, and following, earnings announcements in the pre-AT trading environment. We also find no evidence of a significant change in the behaviour of bid-ask spreads in the post-AT period. However, in the post-AT period, we provide strong evidence that depth is higher, following earnings announcements. We also provide evidence that bid-ask spreads are lower and depth higher following earnings announcements in the post-AT period for firms which experience the greatest increase in AT. This is consistent with the proposition that AT improves market liquidity around periods of high information asymmetry.

The remainder of this paper is structured as follows. The following section provides institutional detail including proximity hosting services for Borsa Italiana. Section 3 describes the data and method. Section 4 reports empirical results and Section 5 provides various robustness tests. The final section provides a conclusion.

2. Institutional Details

Since its integration into London Stock Exchange (LSE) Group, many services have been updated at Borsa Italiana to improve its electronic trading systems for market participants. On 10 November 2008, Borsa Italiana’s equity market successfully migrated to TradElect: the LSE’s trading system. Access sites were located in Milan and Turin, and hosted both the MDF/DDM Plus central system (the market data distribution system of Borsa Italiana) and CCG clearing system (the Clearing House system of Borsa Italiana). All data centers were connected via high-capacity fiber-optic links (10 Gbps) providing a unique operating system.

Borsa Italiana offered different connectivity options depending on customer needs: (1) virtual private network (VPN) connection via internet, (2) direct connection through dedicated lines installed at the firms or third-party locations (Bit Network) and (3) connection through an accredited service provider (Cervi, 2008).

In August 2009, the LSE Group launched its Exchange Hosting Service. Physically located at the LSE, the facility reduced latency and allowed participants to co-locate their servers as close as possible to the exchange’s matching engine (Bailey, 2009; Harold, 2008). Hosting and co-location services in Borsa Italiana’s main market (MTA) were available via data centers in Milan and London. However, due to their proximity to the LSE, London-based traders were provided a latency advantage over the Italian-based traders (The Trade, 20 October 2011). Subsequently, on 25 June 2012, the LSE Group shifted the trading system used to trade Italian equities back to Milan (see Financial Times, 18 January 2012), coinciding with Borsa Italiana’s adoption of the Millennium Exchange trading platform and the launch of its latest co-location service.

3. Data and Method

3.1. AT Activity on Borsa Italiana

Our analysis considers component securities of the FTSE MIB index as of April 2012 sourced from the Thomson Reuters Tick History (TRTH) database. The TRTH database managed and distributed by the Securities Industry Research Centre of Asia Pacific (SIRCA) also provides intraday trade and quote information time stamped to the nearest millisecond and order book information (price and volume) for up to ten price levels.

To investigate the effect of AT on liquidity around earnings announcements, we determine the change in AT via several proxies which are common in the literature to categorize our sample period into pre- and post-AT trading periods. Specifically, we examine: (1) message traffic, (2) the order-to-trade ratio (OTR) and (3) Algo Trade (Hendershott et al., 2011). Consistent with Boehmer et al. (2014) and Hendershott et al. (2011), we define message traffic as the sum of trades, new order submissions, modifications and order cancelations in the order book for each stock in the FTSE MIB on a given trading day. In addition, for each stock in the

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2. 24 ms latency advantages were sufficient to give the London traders a competitive advantage over long-term investors based in Italy; see The Trade, October 20, 2011.
3. The FTSE MIB index consists of the most active, liquid and capitalized stocks of the Italian Equity Market (Frino et al., 2013).
4. Messages are reflected in the TRTH database via new records at each timestamp.

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