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Price formation, market quality and the effects of reduced latency in the very short run

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ABSTRACT

Applying an innovative event study methodology to ultra short return horizons, this paper resolves market adjustment in the aftermath of corporate news events with unprecedented precision. It uncovers the ramifications of the reduction in latency of the German stock market on April 23rd 2007 and shows that it has had positive consequences for market quality. Analyzing second by second time windows the paper demonstrates that price determination, market efficiency as well as quoted spreads and order flow have significantly improved not only in broad average terms, but in particular during informative events.

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1. Introduction

Over the past decade, the ever-increasing power of modern IT systems has led to a tremendous increase in trade frequency, creating a market setting in which nowadays even the speed of connection is an influential profit determinant. Recent years have shown a similar trend to transfer trading decisions to computers, using complex algorithms that dig through vast piles of information in very short time windows, exploiting even the tiniest arbitrage opportunities. In a number of markets, computers already account for a substantial part, if not the majority of trading activities as pointed out by [Hendershott et al. \(2011\)](#) and [Easley et al. \(2012\)](#) for the equity market and [Chaboud et al. \(2014\)](#) for the ForEx market. Likewise, stock exchanges lowered the latency¹ of their trading systems, allowing for faster order execution and price determination. As a result of both trends, the periods relevant in drawing inferences on market behavior have substantially shortened and market micro structure has changed fundamentally.² Attempting to explore those ultra short periods leads to several inherent challenges, the enormous increase of the amount of data being only one of them. This may be one reason why studies targeting market response in the very short run are still relatively rare.

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¹ For electronic systems, time is not continuous but discrete. Latency is defined as the minimum time, i.e. the granularity of time, for which the electronic exchange system is idle.

² See [O'Hara \(2014\)](#) for a discussion.

To shed more light on the market behavior during shortest periods, the paper at hand does not study mere intraday return data. Rather, it analyzes market reactions triggered by corporate news events in ultra short periods. While the usual definition of short run stock returns corresponds to interday returns, the ultra short run focuses on intraday intervals. The paper's definition of the ultra short run period is return seconds, resulting in a time series of 1,485,000 consecutive intraday stock returns for each event in the sample, which consists of German stocks listed on Deutsche Boerse's XETRA system.³ We propose a simple yet powerful event study approach building on (i) the unique features of returns in very short periods and (ii) a very precise knowledge when the event occurred. The informational events used in this study, providing this high degree of precision, consist of an intraday sample of German Ad Hoc Disclosures.⁴ The analysis differentiates between seconds, minutes and hours and delivers substantial insights into the price formation process as well as into the reaction of market micro structure parameters.

The main contributions of the paper are as follows: First, it proposes a neat event study approach for ultra short run horizons, relying only on precise knowledge of the underlying event but not requiring any assumption with respect to return direction or expectation. Second, we demonstrate that the reduction of market latency from 50 ms to 10 ms on April 23rd, 2007, has not only reduced quoted spreads as found by [Riordan and Storkenmaier \(2012\)](#), but also substantially improved price discovery and information processing. Third, by disentangling the underlying forces of bid-ask quote movements, the analysis is able to make for direct evidence supporting the notion that the decline in latency has led to a significant increase in order flow shortly after information arrival. Finally, the paper yields evidence for two aspects: (i) market participants with access to professional data providers tend to react several seconds (ca. 05–10 s) ahead of those not relying on these services, having significant and directly observable advantages that speak for the viability of these news services. (ii) Aside from those benefits, the Ad Hoc Channel is found to be free from any systematic (illegal) insider patterns.

The remainder of the paper is structured as follows: The following part provides a review of the extant literature. Section 3 delivers detailed information on the data that form the basis of the analysis, while Section 4 outlines the study's methodological approaches. Section 5 presents the empirical results and Section 6 concludes.

2. The literature

Two streams of literature are important for the course of the paper. The first consists of studies targeting intraday market adjustment, the second is composed of research scrutinizing market properties within short time windows. The former includes [Patell and Wolfson \(1982, 1984\)](#), [Jennings and Starks \(1985, 1986\)](#) and [Woodruff and Senchack \(1988\)](#) and was above all concerned with the particular effects of certain news events. These studies analyze the informational content of corporate announcements on the US market and focus on critical aspects of their informational contents and report a rapid price adjustment lying at least within hours after announcement publication. Intraday reactions to earnings announcements are further studied by [Lee \(1992\)](#), who finds that most price effects occur within 30 min while volume effects are persistent up to 90 min. Inferences about short run price adjustments and market quality are made by [Ederington and Lee \(1993, 1995\)](#). Applying trade by trade data and analyzing US interest and ForEx markets in response to certain scheduled events, they are able to report very fast market adjustment within only a few minutes, in some cases only 40 s after information arrival. [Gosnell et al. \(1996\)](#)'s intraday assessment of US equity markets based on 15 min returns delivers evidence for substantially longer price adjustment processes, lasting up to 75 min after the announcement. Evidence for faster price convergence of interday news events is generated by [Greene and Watts \(1996\)](#). Overnight information is essentially impounded by the first trade on the next day while information during trading hours needs longer to get impounded in market prices. However, calculating 15 min trade intervals yields that the large majority of the intraday price adjustment happens within the first 15 min after news arrival. Volumes and volatility in the aftermath of takeover announcements on the Canadian market is scrutinized by [Smith et al. \(1997\)](#), also using quarter of an hour return data. They further report persistent abnormal volume and absolute abnormal returns up to 5 h after the takeover announcement.

Equity markets have been subject to significant changes since the turn of the century. The first study we know which accounts for those changes and scrutinizes price changes in the very short run is that of [Busse and Green \(2002\)](#). Their analysis of trade by trade data and minute returns shows that equity markets react very shortly after the broadcast of stock analyst opinions, even within a 15 s time window. Though being significant in the intraday period, abnormal returns tend to reverse and cancel out when longer periods are targeted. While [Busse and Green \(2002\)](#)'s results indicate that the market adjustment is completed within a 15 min window, those obtained by [Brooks et al. \(2003\)](#) suggest that the adjustment process takes substantially longer, even up to 90 min. Despite its reluctance, the market reaction has the tendency to reverse after certain amounts of time. [Adams et al. \(2004\)](#) find no evidence for price overshoots and an again faster price adjustment within 10–20 min in the aftermath of unanticipated inflation news. A recent paper by [Drienko and Sault \(2013\)](#) builds upon a particular Australian disclosure regime and reports rapid market price adjustment toward issued announcements. Using 5 min returns, the study indicates that share prices react immediately after the news announcements, yet again with a tendency to reverse going forward.

³ XETRA is the name of the electronic limit order book of Deutsche Boerse Group.

⁴ German Ad Hoc Disclosures are similar to the SEC Form 8K report, however requiring immediate publication.

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