Journal of Empirical Finance 19 (2012) 702–720

Contents lists available at SciVerse ScienceDirect

Journal of Empirical Finance

journal homepage: www.elsevier.com/locate/jempfin

# Speed of convergence to market efficiency: The role of ECNs

Dennis Y. Chung, Karel Hrazdil *

*Beedie School of Business, Simon Fraser University, 8888 University Drive, Burnaby, Canada*

ARTICLE INFO

*Article history:*
Received 15 February 2012
Received in revised form 2 July 2012
Accepted 20 August 2012
Available online 29 August 2012

*JEL classification:*
G1

*Keywords:*
ECN
Speed
Market efficiency
NYSE
Arca

ABSTRACT

Chordia, Roll and Subrahmanyam (2005, CRS) estimate the speed of convergence to market efficiency based on short-horizon return predictability of the 150 largest NYSE firms. We extend CRS to a broad panel of NYSE stocks and are the first to examine the relation between electronic communication networks (ECNs) and the corresponding informational efficiency of prices. Overall, we confirm CRS's result that price adjustments to new information occur on average within 5–15 min for large NYSE stocks. We further show that it takes about 20 min longer for smaller firms to incorporate information into prices. Most importantly, we demonstrate that the speed of convergence to market efficiency is significantly related to the type of trading platform where orders are executed, even after controlling for relative order flows, trading costs, volatility, informational effects, trading conditions, market quality, institutional trading activity, and other firm-specific characteristics. Our findings provide direct answers and insights to issues raised in a recent SEC concept release document.



## 1. Introduction

Modern trading technology increasingly affects the way how orders are entered, routed, and executed. Competition from alternative electronic markets (i.e. electronic communication networks, hereafter ECNs), regional exchanges, and regulatory pressures are forcing traditional exchanges to react and adapt. As ECNs began competing for order flows from major U.S. exchanges, NASDAQ and NYSE acquired some of the emerging ECNs in order to remain competitive.[1] NYSE Euronext, the world's largest cash equities market, now trades more than one-third of the world's cash equity volume and offers its clients alternate trading platforms with trading models from what NYSE Euronext describes as a "high tech/high touch" trading floor system to a fully electronic system. One of the most successful ECNs is Euronext's NYSE Arca (hereafter Arca), an all-electronic trading platform with distinct market structure and certain advantages over the traditional NYSE floor trading (e.g. deeper liquidity, after hours trading, increased transparency, and efficient electronic execution in multiple U.S. market centers through its smart order routing algorithm). As of March 2007, Arca accounted for approximately one sixth of all the shares traded on the U.S. financial markets. For NYSE-listed securities, Arca accounted for over 10% of the shares traded, a rapid increase from less about 3% in 2004 (Stoll, 2006). Given the increasing importance of ECNs as alternate trading platforms, our main objective is to study the informational efficiency of prices of NYSE stocks whose orders are also routed and executed through the ECN Arca platform, and to determine whether Arca trading affects the speed off convergence to market efficiency.[2]

* Corresponding author. Tel.: +1 778 782 6790; fax: +1 778 782 4920.
*E-mail addresses:* dychung@sfu.ca (D.Y. Chung), karel_hrazdil@sfu.ca (K. Hrazdil).

[1] For example, NASDAQ acquired Inet ENC (formerly Island) in 2005 and Instinet ECN in 2006. In early 2006, NYSE merged with Archipelago (now NYSE Arca), and later merged with Euronext (forming NYSE Euronext on April 4, 2007).

[2] We focus on the NYSE and Arca stocks because there are more distinctive differences between NYSE and ECNs (i.e. exchange characteristics, trading rules, treatment of limit orders etc.) than differences between NASDAQ and ECNs (see Harris, 2003 for further details). For a thorough analysis of various institutional features, see Masulis and Shivakumar (2002). Furthermore, Stoll (2006) provides a comprehensive review of the electronic trading in stock markets; Chung and Hrazdil (2010b) provide details on how market efficiency differs between NYSE and NASDAQ stocks.

0927-5398/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jempfin.2012.08.006

Prior literature provides mixed theoretical predictions on the informational efficiency of prices on ECNs compared to traditional exchanges.[3] On one hand, some researchers propose that all-electronic trading should improve the efficiency of stock prices. Stoll (2006) argues that ECNs not only reduce the cost of providing liquidity, but also increase the accuracy of price signals. Lower trading costs and higher volume improve liquidity, which allows rational traders (arbitrageurs) to keep stock prices closer to their equilibrium values. On the other hand, other researchers find that trading on ECNs has a greater permanent price impact, and therefore is more likely to carry informed trades than the traditional markets (Barclay et al., 2003; Huang, 2002). There is also evidence in the literature that periods with more information asymmetry are associated with higher short-horizon return predictability and that trading volume is most strongly associated with market efficiency (Chung and Hrazdil, 2010a). Further, those who believe that markets are dominated by uninformed or noise traders argue that the low cost of trading and high turnover on ECNs will lead to excessive uninformed trading driving stock prices away from their fundamental values (Shleifer and Summers, 1990). A third possibility also exists (the null hypothesis), that the efficiency of information processing will be the same between orders executed through an ECN and orders executed through a traditional trading platform. If NYSE provides sufficient liquidity (as is most likely the case for large, actively traded stocks) and enhances arbitrageurs' ability to take advantage of any mispricing, then the additional liquidity obtained through the ECN should not have incremental effect on increasing market efficiency.[4] Therefore, whether and to what extent ECNs impact the informational efficiency of prices is an empirical issue, which is a main focus of this study.

Previous research on ECNs concentrates primarily on the trading of NASDAQ stocks and provides evidence on the efficiency of ECNs in terms of competition for order flow, volume growth, liquidity, market quality, and information asymmetry (i.e. Barclay et al., 2003; Fink et al., 2006; Huang, 2002; Rakowski and Beardsley, 2008; Simaan et al., 2003; Tse and Hackard, 2004; Weston, 2002 among others). The general consensus among these studies is that ECNs are efficient in competing for order flow (most studies find that ECNs get at least 20% of the order flow of NASDAQ-listed securities) and are not detrimental to market quality.

To the best of our knowledge, only two studies examine the effect of ECN activity on NYSE-listed stocks. First, Lipson (2004) analyzes competition between various market centers for NYSE stocks and reports that marketable limit orders routed to Archipelago (now NYSE Arca) are typically more informed than those routed through the NYSE. Second, Nguyen et al. (2005) examine the Archipelago's change to becoming a stand-alone exchange and the impact of this change on the execution quality and the exchange's ability to compete for order flow in NYSE and NASDAQ stocks. Nguyen et al. (2005) find that while the effect of the change is positive on the execution quality of NYSE stocks, the effect for NASDAQ stocks is negative.

In our study, we take an exploratory approach; we concentrate on the NYSE stocks and focus our attention on the impact that the ECN Arca trading platform has on the price efficiency of these stocks. We directly measure whether and to what extent order execution through different trading venues results in different speeds of convergence to market efficiency between the Arca and the NYSE trades.

Recent developments in market microstructure give us a basis to explore the price formation process and study how fast information is incorporated into security prices. We rely on seminal approach developed by Chordia et al. (2005, hereafter CRS) who estimate the speed of convergence to market efficiency based on the short-horizon return predictability from past order flows of 150 largest, actively traded NYSE firms. CRS estimate the amount of time it takes for market participants to observe and extract information from order flows, ascertain whether there is new relevant information about values, take advantage of any predictable price movements, and in the process eliminate any serial return dependence remaining after prices adjust to their new equilibrium levels. CRS measure the speed of convergence as the time that the market requires to achieve weak-form market efficiency and on the basis of the time interval over which historical returns and order imbalances are no longer significant in explaining short-horizon return predictability.[5] In their subsequent work, Chordia et al. (2008) confirm that the short-horizon predictability of stock returns from past order flows alone is sufficient for and can be used as an inverse indicator of market efficiency. Chordia et al. (2008) further encourage additional research and that "future investigation should extend the analysis to smaller firms and other years, exchanges, and countries" (p. 252). In our study, we utilize the speed of convergence to market efficiency measure developed by CRS to evaluate the informational efficiency of prices across the Arca and the traditional NYSE platforms.[6]

Our study makes three specific contributions to the literature. First, we complement CRS by using more recent data and extend CRS to a broad sample of NYSE stocks. Compared to CRS's sample of 150 companies, we cover a total of 2041 firms with shares that were traded simultaneously on Arca and NYSE during the first six months of 2008. Second, unlike Boehmer and Kelley (2009) and Chung and Hrazdil (2011) who utilize levels of market efficiency (based on deviations from random walk and short-horizon return predictability, respectively), we focus on the actual length of time that it takes for the trading of a stock to achieve market efficiency. With this focus, we extend CRS (2005) and Visaltanachoti and Yang (2010) by using finer and higher frequency time

[3] We use the concept of efficiency as developed by Fama (1970) and relate the form of trading venue to the extent to which prices fully reflect available information.

[4] In fact, the NYSE features both a physical auction convened by designated market makers (DDMs) and a completely automated auction that includes algorithmic quotes from DMMs and other participants. First, trading floor brokers leverage their physical point-of sale-presence with information technologies and algorithmic tools to offer customers the benefits of flexibility, judgment, automation and anonymity with minimal market impact. Second, supplemental liquidity providers are electronic, high-volume members off the trading floor, who add liquidity on the NYSE, complementing that of other quote providers (source: http://www.nyse.com/equities).

[5] This innovative approach spurred a large body of research that examines the determinants and consequences of market efficiency in a variety of research settings (i.e. Aktas et al., 2008 in the context of insider trading; Visaltanachoti and Yang, 2010 who analyze foreign stocks listed on the NYSE; Su et al., 2010 in the context of daily top gainers; Chung and Hrazdil, 2010a in context of determinants of cross-sectional short horizon return predictability).

[6] We examine the speed of convergence measure separately for each platform and only for these two platforms. We do not consider the effects of other major U.S. platforms and their possible interaction with order flows; we leave the detail analysis of the possible cross-platform effects for future research. In Section 4.2, we do however consider and discuss the potential order flow collinearity between the NYSE and Arca.