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Liquidity and market efficiency: A large sample study

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ABSTRACT

Chordia et al. (2008, hereafter CRS) examine short horizon return predictability from past order flows of large, actively traded NYSE firms across three tick size regimes and conclude that higher liquidity facilitates arbitrage trading which enhances market efficiency. We extend CRS to a comprehensive sample of all NYSE firms and examine the dynamics between liquidity and market efficiency during informational periods. Our results indicate that although all NYSE firms experience an overall improvement in market efficiency across periods of different tick size regimes, this improvement varies significantly across the portfolios of sample companies formed on the basis of trading frequency, market capitalization, and trading volume. After controlling for these factors, we further document a positive association between a continuous measure of liquidity and market efficiency, and show that this effect is amplified during periods that contain new information, as reflected in high adverse selection component of the bid-ask spread.

1. Introduction

How prices are formed is a question that has interested finance researchers for some time. The process of price formation has been described as a "black box" (e.g. Madhavan and Panchapagesan, 2000) and examining this topic is important because it is fundamental to understanding how economies work to allocate goods and services (O'Hara, 1997). Research on market microstructure gives us a basis to explore the price formation process and study how information is incorporated into security prices. O'Hara (1997, p. 1) further suggests that, "as microstructure research is set in the markets for financial assets, this enhances our ability to understand both the returns to financial assets and the process by which markets become efficient."

Theories of price formation and the role of information have been the focus of numerous studies. Garman (1976), in an early model, describes how market prices arise given the nature of the order flow and the temporal imbalances between supply and demand. Kyle (1985) focuses on the informational effect, introduces the strategic consideration, and examines how an informed trader would act strategically to maximize the value of private information. Admati and Pfleiderer (1988), Foster and Viswanathan (1990), and Seppi (1990), building on the work of Kyle (1985), also consider the effects of strategic trading from the perspective of the uninformed traders. The theoretical work in this area suggests that both the informed and uninformed traders may act strategically in choosing the composition or timing of their orders, and the effects of their trading behavior will be reflected in the order flow and stock returns. Recent empirical studies in the market microstructure literature also show increasing interest in the relationship between order flows and stock returns (e.g. Chordia et al., 2002, 2005; Chordia and Subrahmanyam, 2004; Subrahmanyam, 2008). These studies generally analyze the determinants and properties of market-wide order imbalances and confirm the predictive ability of these imbalance measures with respect to future short-horizon returns.

Recent research on order flow and return predictability has expanded its scope and made connections to the concepts of liquidity and market efficiency. Chordia et al. (2008, hereafter referred to as CRS) are among the first to analyze return predictability in connection with liquidity and interpret their findings from a market efficiency perspective. In particular, they examine secular changes in liquidity across three tick size regimes and document a substantial decline in short-horizon return predictability.[1] CRS conclude that the short-horizon predictability of stock returns from past order flows can be interpreted as an inverse indicator of market efficiency. This innovative approach based on market microstructure provides a feasible basis for estimating the degree of informational efficiency in a securities market. Research utilizing this methodology is also beginning to appear in the literature. For instance, Aktas et al.

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[1] CRS analyze a period of three tick size regimes between 1993 and 2002 in which the NYSE changed its minimum tick size from $1/8 to $1/16 on June 24, 1997, and further to $0.01 on January 29, 2001.

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(2008) use the order imbalance and return predictability relationship to examine the effects of insider trading on market efficiency. Others, such as Visaltanachoti and Yang (2010), analyze the speed of convergence to market efficiency for foreign stocks listed on the NYSE. Our study is a continuation of the line of research that relates order flow to return predictability, and adds to the literature the special focus of the liquidity and market efficiency perspectives. With the special focus, this line of research advances the literature and enhances our ability to understand "the process by which markets become efficient", as described by O'Hara (1997, p. 1).

CRS form their sample by selecting from the 500 largest market capitalization firms on the NYSE and including only those that traded every day over the full sample period from 1993 to 2002; their final sample consists of 193 firms. Medium and small companies are excluded because CRS want to minimize the impact of non-trading in a short interval setting. Given the nature of their sample, an interesting question arises as to whether the CRS results extend to the remaining medium-sized and smaller and less frequently traded NYSE firms. Before CRS's results can be generalized across other US firms or applied in various research settings, further analysis needs to be conducted on a more comprehensive sample. Exploring and validating the order imbalance and return predictability relationship as a measure of market efficiency is an important contribution to the capital market literature. In fact, CRS state explicitly that "future investigation should extend the analysis to smaller firms and other years, exchanges, and countries" (p. 252). The first objective of our study is to apply the CRS analysis to a comprehensive sample of NYSE firms and examine in detail the potential confounding effects that trading frequency and firm size have on the relationship between liquidity and market efficiency. Our sample includes all firms listed on the NYSE between January 1, 1993 and June 30, 2004. Compared to CRS's sample of 193 companies, we cover a total of 4222 NYSE firms. We provide empirical evidence on the differences in market efficiency for portfolios of NYSE firms formed on the basis of trading frequency, market capitalization, and trading volume. Although we document a general improvement in market efficiency for market portfolios formed on the basis of these various controls, we also show that the corresponding short-horizon return predictability from past order flows varies significantly across these portfolios. Our results therefore call for a careful selection of control samples in terms of proportional representation when using CRS's market efficiency estimations in cross-sectional research studies. Given these findings, we control for trading frequency, market capitalization, and trading volume in the multiple regression analysis.

Fama (1970) emphasizes a lack of return predictability over a daily horizon as a criterion for market efficiency, yet market microstructure defines informational efficiency as the degree to which market prices correctly and quickly reflect new information over shorter periods. As a result, even semi-strong efficient markets can reflect different amounts of private information in short-horizon returns (Kyle, 1985). In the latter part of their study, CRS further evaluate the microstructure perspective of market efficiency by analyzing return variance ratios and return autocorrelations, and conclude that new information is more effectively incorporated into prices during the more liquid regimes. The second objective of our study is to validate the return predictability as an indicator of market efficiency from a cross-sectional perspective. We are motivated by the liquidity and information effects analyzed by CRS, and our focus is to determine whether and to what extent these effects drive the cross-sectional variations in the short horizon return predictability. We adopt a two-stage regression approach. First, we rely on the CRS methodology (i.e., regressing 5-min returns on lagged order imbalances, and lagged order imbalances interacted with a dummy variable for illiquidity) to extract an estimate for the degree of market efficiency. In the second stage, we deviate from the portfolio approach and analyze the return predictability on a firm-level basis. We relate market efficiency to a continuous measure of liquidity, measured by the effective bid-ask spread, to provide further evidence on how liquidity affects return predictability. We then identify periods of high adverse selection in the market and examine how the liquidity and market efficiency dynamic changes during these informational periods.[2]

Our results corroborate CRS's findings that increased liquidity attracts arbitrage trading, which helps specialists in absorbing investor demand, thus resulting in enhanced market efficiency. Our results are also consistent with the theoretical framework that public information about future returns is contained in past order flows (Subrahmanyam, 2008), and that it may take some time for prices to fully reflect new information (Hillmer and Yu, 1979; Chan et al., 1996; Chordia et al., 2005); we document an increased return predictability (decreased market efficiency) during periods with new information.[3] Most importantly, we show that the effect liquidity has on market efficiency is amplified during such periods. That is, during informational periods, which we identify based on high adverse selection component of the bid-ask spread, increased liquidity has an even stronger and significantly more positive impact on market efficiency. These results suggest that the extent to which prices incorporate information depends on market liquidity: the more liquid the market is, the more efficient it is in incorporating information into prices. Consistent with the theoretical relationship developed by CRS on liquidity and market efficiency, we provide empirical evidence that improved liquidity and information interact, and both contribute to enhance market efficiency. These results extend and strengthen CRS's conclusions, and validate the usefulness of return predictability as an indicator of market efficiency for future research.[4] Our results remain robust after a variety of sensitivity tests and are economically significant.

The rest of this paper is organized as follows: we summarize CRS's study along with the liquidity literature, and propose our empirical predictions in Section 2. We describe the data and methods of analysis in Section 3. We discuss the main empirical results in Section 4. We summarize and conclude the paper in Section 5.

[2] We acknowledge that the new information is a part of the information set which defines market efficiency in the first place. Our analysis of market efficiency relates to the semi-strong form focusing on the set of all publicly available information and deals with the extent to which market prices correctly and quickly reflect new information. Within this information set, we aim to examine the impact of liquidity on return predictability during periods with different levels of information. We adopt the same view as expressed by O'Hara (1997) when she describes the effect of information on securities prices under the sequential trade models such as Glosten and Milgrom (1985) and the strategic trading models such as Kyle (1985). O'Hara (1997) explains that in both types of models, "new information becomes impounded into prices as a result of the trading behavior of informed and uniformed traders. A characteristic of both approaches is that this price adjustment is not instantaneous. Because prices are conditional expected values, the price at each point reflects all publicly available information, but not necessarily all private information. Consequently, until prices adjust to the new-informational value, informed traders earn a return to their information and prices are only semi-strong-form efficient" (p. 153).

[3] This can be due to uninformed traders' reluctance to enter the market when they realize that there is new information and that there are better informed traders out there in the market. Through trading, the new information will eventually be impounded in prices reducing returns predictability. This process, however, may take some time.

[4] Our interpretation is also consistent with the view expressed by Maureen O'Hara in her 2003 AFA presidential address: "So, uninformed traders do learn from prices (having informed traders around is useful) and they also learn from public information. The microstructure of markets matters because it influences the informational content of prices and other market information. Changing a stock's microstructure may thus induce price changes due both to enhanced liquidity and to greater informational efficiency in trading prices" (p. 1342) ... "Traders with superior information will move prices toward full information levels, but continuously attaining full information levels is not credible – new information arrives, old information becomes stale, and even informed traders may face risks that their information is obsolete... Thus, as in microstructure models, the adjustment of prices to full information values can differ widely across markets that are deemed efficient" (p. 1351).