Short Selling and the Price Discovery Process

Ekkehart Boehmer
EDHEC Business School

Juan (Julie) Wu
University of Georgia

We show that stock prices are more accurate when short sellers are more active. First, in a large panel of NYSE-listed stocks, intraday informational efficiency of prices improves with greater shorting flow. Second, at monthly and annual horizons, more shorting flow accelerates the incorporation of public information into prices. Third, greater shorting flow reduces post-earnings-announcement drift for negative earnings surprises. Fourth, short sellers change their trading around extreme return events in a way that aids price discovery and reduces divergence from fundamental values. These results are robust to various econometric specifications, and their magnitude is economically meaningful. (*JEL* G14)

The consequences of short selling for share prices, market quality, and information flow are still fervently debated by academics, securities market regulators, and politicians. The informational efficiency of prices, a public good, is a key attribute of capital markets that can have significant implications for the real economy.[1] Short sellers account for more than 20% of trading volume and are generally regarded as traders with access to value-relevant information (Boehmer, Jones, and Zhang 2008). This suggests that they play an important role in the price discovery process. However, being informed does not necessarily imply that their trading instantaneously impounds this

We thank Kerry Back, David Bessler, George Jiang, Sorin Sorescu, Matt Spiegel (the editor), Heather Tookes, an anonymous referee, and seminar participants at the All-Georgia Finance Conference, EDHEC, First Annual Academic Forum for Securities Lending Research, HEC Lausanne, HEC Paris, Indiana University, Rice University, Texas A&M University, University of Georgia, University of Houston, University of Oregon, University of South Carolina, and the 2007 FMA Doctoral Consortium for helpful comments. Juan (Julie) is grateful for financial support through the Mays Business School Postdoctoral Fellowship program. This article was previously circulated under the title "Short Selling and the Informational Efficiency of Prices." Send correspondence to Ekkehart Boehmer, EDHEC Business School, 393 Promenade des Anglais, 06202 Nice, France; telephone: + 33 644 27 88 71. E-mail: ekkehart.boehmer@edhec.edu. Juan (Julie) Wu, Department of Finance, Terry College of Business, University of Georgia, Athens, GA 30602; telephone: (706) 542-0934. E-mail: juliewu@terry.uga.edu.

[1] More efficient stock prices more accurately reflect a firm's fundamentals and can guide firms in making better-informed investment and financing decisions. Related theoretical work focusing on the link between the informativeness of market prices and corporate decisions includes, among others, Tobin (1969), Dow and Gorton (1997), Subrahmanyam and Titman (2001), and Goldstein and Guembel (2008). Also related are recent empirical studies on seasoned equity offerings (Giammarino et al. 2004), mergers and acquisitions (Luo 2005), and investments in general (Chen, Goldstein, and Jiang 2007).

doi:10.1093/rfs/hhs097 Advance Access publication September 3, 2012

information into prices—in fact, informed traders often have incentives to trade in a way that minimizes information leakage. In this article, we use daily data on short-selling flow and various dimensions of informational efficiency to systematically quantify the effect of daily short-selling flow on the price discovery process.

Financial theory takes different views on short sellers and the consequences of their trading decisions on price discovery and, more generally, on market quality. In some models, short sellers are rational informed traders who promote efficiency by moving mispriced securities closer to their fundamentals (see, e.g., Diamond and Verrecchia 1987). In other models, short sellers follow manipulative and predatory trading strategies that result in less informative prices (Goldstein and Guembel 2008) or cause overshooting of prices (Brunnermeier and Pedersen 2005). Most empirical studies suggest that short sellers are informed traders. Using either monthly short interest data (see, e.g., Asquith and Meulbroek 1995; Dechow et al. 2001; Desai et al. 2002; Asquith, Pathak, and Ritter 2005) or shorting flow data (see, e.g., Christophe, Ferri, and Angel 2004; Boehmer, Jones, and Zhang 2008; Diether, Lee, and Werner 2008), these authors document that short sellers have value-relevant information and suggest that their trading helps correct overvaluation.

Our article connects to this point. In line with previous work, we agree that short sellers' information will eventually be incorporated into prices; going beyond previous work, we use higher-frequency daily data on short-selling flow to characterize more precisely how and when short sellers impact price discovery. Most prior work uses monthly short interest reports to examine whether short sellers anticipate future returns or changes in firm fundamentals (see, e.g., Dechow et al. 2001; Karpoff and Lou 2010; Henry, Kisgen, and Wu 2011). We take a different approach by directly focusing on short sellers' daily trading activity and its impact on price discovery at different horizons. This allows us to systematically examine whether short sellers' information is incorporated into prices and how quickly this takes place. Our daily flow data are more appropriate for this analysis than are monthly snapshots of short interest data when short sellers adopt short-term trading strategies.Indeed, recent empirical evidence suggests that many short sellers are active short-term traders. Between November 1998 and October 1999, Reed (2007) finds that the median duration of a position in the equity lending market is three days, and the mode is only one day. Diether, Lee, and Werner (2008) estimate an average days-to-cover ratio of four to five days for a shorted stock in 2005. These findings indicate that a large portion of recent short-selling activity is short-term and indeed often limited to intraday horizons. Daily shorting flow data allow us to capture the effect of these shorting activities on prices and facilitate a more detailed analysis than monthly short interest data.

We use four distinct approaches when analyzing the effect of shorting on informational efficiency. First, following Boehmer and Kelley (2009), we construct transaction-based high-frequency measures of efficiency. Second,

[11:21 28/12/2012 OEP-hhs097.tex] Page: 288 287–322

we adopt Hou and Moskowitz's (2005) lower-frequency price-delay measure, an estimate of how quickly prices incorporate public information. Third, we use the well-established post-earnings-announcement drift anomaly (see Ball and Brown 1968) as a measure of inefficiency and test whether short sellers influence its magnitude. Fourth, we examine short selling around large price movements and price reversals. By design, these four approaches are complementary in their assumptions and allow us to examine the effects of short selling on efficiency from different perspectives. Together, analyzing the influence of short selling along those four distinct dimensions of informational efficiency provides a detailed and integrated view on the role short sellers play in equity markets.

Each of the four approaches suggests that short sellers improve the informational efficiency of prices. First, more shorting flow reduces the deviation of intraday transaction prices from a random walk, so more shorting makes prices more efficient. Second, more shorting flow is associated with shorter Hou-Moskowitz price delays, suggesting that prices incorporate public information faster when short sellers are more active. Third, for the most negative quartile of earnings surprises, an above-median increase in shorting immediately after the earnings announcement eliminates the drift. Fourth, we find no evidence that short sellers exacerbate large negative price shocks. Conversely, their trading patterns seem to facilitate more accurate pricing even on extreme return days. All these results are robust to different econometric methods and specifications, and as we discuss in Section 7, they are difficult to explain by reverse causality. Further analysis reveals that the efficiency-enhancing effect of short selling is economically meaningful. Overall, these findings suggest that short sellers play a critical role in facilitating rational price discovery, a major function of capital markets, along several dimensions.

Our article is related to several earlier studies on short selling. We complement earlier work by Dechow et al. (2001), Desai et al. (2002), Hirshleifer, Teoh, and Yu (2011), and others that examines the relation between monthly short interest and variables related to firm fundamentals. These studies typically benefit from long monthly time series. Our shorting flow data cover only three years, but we can zoom in on the daily horizon and directly evaluate the impact that shorting has on prices. As Richardson (2003) points out, higher data frequency is important in identifying the impact of short selling on firm fundamentals. We also complement earlier work by Boehmer, Jones, and Zhang (2008) and Diether, Lee, and Werner (2008), who find that daily shorting flows predict returns over horizons up to several months. Both of these sets of studies suggest that the presence of short sellers is linked to some correction of overvaluation. However, neither focuses on the questions of when exactly short selling affects prices or how quickly their information is incorporated into prices. Our first contribution is to complement these studies by focusing directly on the link between daily shorting flows and four different measures

[11:21 28/12/2012 OEP-hhs097.tex] Page: 289 287–322

of informational efficiency. We show that shorting flow indeed makes prices more efficient and that this process begins at intraday horizons.

Our study is also related to prior work on short-selling constraints. Proxies for shorting constraints include indicators for the practice and prohibition of short selling across equity markets (Bris, Goetzmann, and Zhu 2007), addition/removal of short-sale restrictions in certain stocks in Hong Kong (Chang, Cheng, and Yu 2007), loan rates from a large U.S. security lender in the late 1990s (Reed 2007), and data on share lending supply and borrowing fees from U.S. and other equity markets (Saffi and Sigurdsson 2011). Focusing on variation in shorting constraints and directly linking short sellers' actual trading decisions to price efficiency are complementary approaches, and the latter allows us to examine the consequences of short sellers' decisions more directly.

Our finding that short sellers enhance efficiency around earnings announcements informs the growing body of literature on post-earnings-announcement drift (initially documented in Ball and Brown 1968). Although there is mounting evidence that post-earnings-announcement drift (PEAD) is one of the more persistent anomalies in financial markets, empirical work on shorting behavior in this context is quite limited. Using monthly short interest data, Cao et al. (2007) find relatively weak evidence that short sellers reduce drift, but Lasser, Wang, and Zhang (2010) argue that short interest is not related to PEAD in the expected manner. Even with intraday shorting flows, Zheng (2009) finds no evidence that short sellers affect PEAD. Berkman and McKenzie (2012) find that short selling (proxied by loaned shares in the equity lending market) increases after negative earnings shocks but conclude that it does not remove long-term PEAD measured over the quarter following the earnings announcement. We contribute detailed daily evidence to this debate. Consistent with Berkman and McKenzie (2012), we find that shorting increases after negative earnings surprises. Boehmer, Jones, and Zhang (2008) show that the ability of daily short selling to predict future returns dissipates roughly one month after portfolio formation. Thus, short sellers' ability to exploit PEAD should be strongest during the month after the earnings announcement. We find that short selling eliminates PEAD over this horizon in the stocks with negative surprises where short sellers are most active. Overall, these tests also benefit from the daily nature of our data on shorting flows, which allows us to create more powerful tests than would be possible based on monthly short interest reports. Different from the above studies, our new result in this respect is that the activity of short sellers eliminates PEAD at least in some stocks, and this happens fairly quickly, further supporting the positive role of short sellers in promoting efficient pricing.

Finally, our analysis provides important guidance for current worldwide debates regarding the optimal regulation of short selling.[2] Our article

[2] Anecdotal evidence indeed goes both ways. Jim Chanos, president of Kynikos Associates (the largest fund specializing in short selling), is best known for being one of the first to spot problems with Enron. However,

contributes to these debates by systematically highlighting how short sellers help increase market quality and illustrating specific ways in which this occurs.

The remainder of the article is organized as follows. Section 1 describes the data and our sample. Section 2 introduces our measures of relative informational efficiency. Section 3 analyzes the relation between short selling and high-frequency measures of efficiency, whereas Section 4 looks at the relation between shorting and low-frequency measures of efficiency. In Section 5, we describe our event-based analysis that relates post-earnings-announcements drift to shorting activity, and in Section 6, we examine short selling around extreme return events. In Section 7, we describe several robustness tests and provide some evidence on causality. Section 8 concludes the article.

1. Data and Sample

The shorting flow data used in this article are published by the NYSE under the Regulation SHO pilot program and are available from January 2005 through June 2007.[3] We augment the shorting data by identical, proprietary data obtained from the NYSE that cover the remaining six months of 2007. For each trade, our data include the size of the portion transacted by short sellers, if any. We aggregate the intraday shorting flow that is executed during normal trading hours into daily observations. This sample is limited to a three-year period, but the daily frequency of these flow data allows for more powerful and more accurate tests than those constructed from the monthly short interest data that are used in many of the earlier studies.

We match the daily shorting flow data with the Center for Research in Security Prices (CRSP) database to obtain daily returns, consolidated trading volume, closing prices, and shares outstanding. We include only domestic common stocks (share codes 10 and 11) in the analysis but exclude Berkshire Hathaway Class A and B shares, which are priced around $3,000 and near $100,000, respectively, during the sample period. We compute daily liquidity and price efficiency measures from the NYSE's Trades and Quotes (TAQ) data. On an average day, our final sample covers 1,361 stocks.

2. Measuring Price Discovery

We employ four different approaches to measure how efficiently prices incorporate information. First, our most powerful tests focus on high-frequency

some high-profile lawsuits, including Biovail, a Canadian pharmaceutical company suing hedge fund SAC, and Overstock.com, suing Rocker Partners, accuse short sellers of manipulating their stock prices.

[3] Regulation SHO initiated by the SEC aims to "study the effects of relatively unrestricted short selling on market volatility, price efficiency, and liquidity" (see Regulation SHO-Pilot Program, April 19, 2005, at www.sec.gov/spotlight/shopilot.htm).

[11:21 28/12/2012 OEP-hhs097.tex] Page: 291 287–322

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.