



Bullish/bearish/neutral strategies under short sale restrictions



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ABSTRACT

This study investigates the effects of short sale restrictions by extending the model of [Dridi and Germain \(2004\)](#) and infers informed traders' strategies and the relation between order imbalance and price thereunder. The results are generally in line with the empirical evidence documented in the literature and are summarized as follows: First, seller-initiated trading incurs a greater price reaction. Second, short sale restrictions shift the skewness of asset returns. Third, the restrictions can stimulate investors to acquire information or increase each individual trader's order flow under the bullish and neutral signals as well as the bearish signal, which is yet to be explored empirically.

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1. Introduction

During the global financial crisis of 2008–2009, more than 30 countries, including the United States, restricted short sales, which were regarded as a source of stock price decline ([Beber and Pagano, 2013](#)). However, in the finance literature, there is much debate about whether short sales restrictions can boost stock prices. For example, [Miller \(1977\)](#) insists that short sale restrictions may increase stock prices. He assumes that investors have different views on stock prices. Under this assumption, pessimistic investors pursue a selling strategy (including the short sale strategy), while optimistic investors adopt a buying strategy. Thus, short sale restrictions increase the portion of optimistic investors pursuing a buying strategy, which will increase stock prices and even generate upward biases in stock prices. On the other hand, there are studies that show short sale restrictions may induce downward biases in stock prices. For example, [Bai et al. \(2006\)](#) show that short sale restrictions may induce downward biases in stock prices under a rational expectation equilibrium framework owing to traders' hedging needs. [Gallmeyer and Hollifield \(2008\)](#) also show that short sale restrictions may decrease stock prices if the optimist's intertemporal elasticity of substitution is less than one. Additionally, according to [Nezafat et al. \(2015\)](#), short sale restrictions reduce investors' incentive to acquire information and the demand

on assets, which can reduce stock prices. In summary, these studies about the effects of short sale restrictions show two conflicting results for stock prices.

In this study, unlike previous studies, we focus on microstructural relations between trading behavior and stock price under short sale restrictions. Although [Diamond and Verrecchia \(1987\)](#) also investigate market microstructural issues that short sale restrictions may cause by adopting [Glosten and Milgrom \(1985\)](#), their main focus is on the bid-ask spread and the speed of convergence. Our paper focuses more on properties related to the size of order flows.

Our model setting is based on the approach of [Dridi and Germain \(2004\)](#), which is an extension of [Kyle \(1985\)](#). Under Kyle's model, an informed investor and a market maker strategically decide the order flow and the price. Therefore, this model enables us to investigate the trading behavior of informed traders, as well as the relation between the order imbalance and the price of an asset. [Dridi and Germain \(2004\)](#) inherit the basic properties and assumptions in Kyle's model, but unlike Kyle, they assume that informed investors know only whether the price of a security will increase or decrease in the future, not the security's true value. In other words, informed investors obtain a bullish or bearish signal. Under this additional assumption, they show that stock price is nonlinearly related to order imbalance, consistent with the

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empirical results of Kempf and Korn (1999) and Gabaix et al. (2003).¹ In this paper, we investigate short sale restrictions in a model setting similar to that of Dridi and Germain. The details of our model setting regarding the information informed investors have and short sale restrictions are as follows. We assume that informed investors have a directional signal about the future stock return. First, we assume that informed investors get a bullish/bearish signal, as Dridi and Germain (2004) do. However, the signals seem to be too simple to reflect reality; therefore, we extend the setting and assume that informed investors may get a neutral signal as well as a bullish/bearish signal. A neutral signal means information that is not useful for directional trading or information that the stock price will not change. This assumption is closer to what we can observe in reality. Frequently, individual stock prices do not change much, and the information investors gather is not always valuable in directional trading. Accordingly, most financial analysts express their opinions with a buy, sell, or hold recommendation, and sentiment indices are categorized as bullish, bearish, or neutral.²

Regarding short sale restrictions, we assume that only some of informed investors are prohibited from short selling. It differs from the assumption of Bai et al. (2006) or Nezafat et al. (2015) that all informed investors are prohibited from making short sales. We believe that our setting is more general in the sense that it reflects the reality that the severity of short sale restrictions is not the same among investors. For example, some classes of investors like mutual funds and pension funds either face explicit or implicit short-selling constraints through their fund agreements as Almazan et al. (2004) and Nezafat et al. (2015) state. On the other hand, other classes of investors like hedge funds may not impose any short sale restrictions at all. Our model embraces this different degree of short-sale constraints among investors. Furthermore, for some periods, due to the short-sale ban, no investors may engage in short sales. Our model can handle this change in the degree of short-sale restrictions and look at the implications of the change. In addition, our model includes the no short-selling case and no restriction case as special cases.

We first consider equilibria under which the total number of informed investors is given exogenously to make our research simple. Next, we endogenize the number of informed investors. Investors collect private information only when the cost does not exceed its expected return. Thus, the number of informed investors is determined endogenously via decisions about information acquisition.

On the basis of the settings described above, we derive the optimal strategy for informed investors and the equilibrium price function, and provide some empirical implications as follows. First, when informed investors get a bullish/bearish signal and the number of informed investors is fixed, the effect of short sale restrictions can be similar to that of a reduction in the number of informed traders in a restriction-free economy. Accordingly, the profit of informed investors increases and the expected price variance increases. These implications are consistent with the empirical results documented by Beber and Pagano (2013), Boehmer et al. (2013), and Boehmer and Wu (2013) in that short sale restrictions make the market inefficient. Though the inefficiency under

the restrictions is widely known from both empirical and theoretical studies, our study contributes to the literature by showing the increased inefficiency based on the link between trading behavior and price.

Second, the presence of restriction-bound investors causes the net order flow of the total market to be positive, which means buyers initiate more than sellers do, on average, consistent with empirical results of Choe and Lee (2012) and Sifat and Mohamad (2015). Consequently, a sell order becomes more informative than a buy order, and the absolute return of sell orders is larger than that of buy orders, consistent with the empirical findings of Chordia et al. (2002).

Third, when informed investors can obtain a neutral signal rather than only a bullish or bearish signal, the aforementioned results are still valid, but there are two additional implications. One is that informed investors can make profits with buy orders even when they have neutral signals. The other is that restrictions increase the skewness of returns, which is consistent with Bris et al. (2007), Chang et al. (2007), and Saffi and Sigurdsson (2011). Diamond and Verrecchia (1987) briefly mention this phenomenon without any formal derivation, but we prove that the restrictions change the skewness of returns and show that they increase the skewness of returns numerically.

Fourth, when we allow the number of informed investors to be determined endogenously, investors' decisions on information acquisition become dependent on the severity of short sale restrictions. When short sale restrictions are limited to a small number of investors, investors do not acquire information. However, when many investors are restricted—in other words, when the restrictions become severe—more investors acquire information to profit from the market inefficiency caused by short sale restrictions. This result is in contrast with the result of Nezafat et al. (2015), which shows that short sale constraints reduce information acquisition because restrictions hinder the taking advantage of bearish signals.

The paper is organized as follows. Section 2 presents the baseline model setting and assumptions. Section 3 provides propositions and their implications. Section 4 extends the baseline model to a bullish/bearish/neutral economy. Section 5 describes the equilibrium with information acquisition. Section 6 concludes this study.

2. Baseline model

The basic structure of our model is identical to that of Dridi and Germain (2004). We briefly review their assumptions. The true value of a stock is \tilde{v} , with distribution $N(0, \sigma_v^2)$. There are three types of market participants: uninformed traders, risk-neutral informed traders, and competitive risk-neutral market makers. Uninformed traders place orders on the basis of liquidity needs. The total order flow of uninformed traders is \tilde{u} , with distribution $N(0, \sigma_u^2)$. There are N different informed traders. Although Kyle (1985) assumes informed traders forecast the realization of \tilde{v} perfectly, it is generally hard to believe that they know the exact future value. Hence, Dridi and Germain (2004) assume that informed traders know only the sign of \tilde{v} . Each informed trader $i = 1, \dots, N$ places an order of \tilde{x}_i shares based on the signal, the sign of \tilde{v} . The total order flow of informed and uninformed traders is represented as \tilde{w} :

$$\tilde{w} = \tilde{u} + \sum_{i=1}^N \tilde{x}_i \quad (1)$$

Market makers observe \tilde{w} and determine the price, \tilde{p} . Equilibrium is obtained if

$$\tilde{p} = E[\tilde{v}|\tilde{w}] \quad (2)$$

and

$$\tilde{x}_i = \arg \max_x E[(\tilde{v} - \tilde{p})x | \text{sign}(\tilde{v})] \quad (3)$$

¹ This is in contrast to Kyle's linear relation between stock price and order imbalance.

² For example, the *AAll Investor Sentiment Survey* measures the percentages of investors' views by classifying them as bullish, bearish, or neutral on the stock market, and the *Investors Intelligence* index is a sentiment measure based on market newsletters and is bullish, bearish, or neutral. These measures are used for measuring investors' market sentiments in the literature (e.g., Brown and Cliff, 2004, 2005; Han, 2008).

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