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Three Essays On Short-selling, Margin Trading And Market Efficiency

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THREE ESSAYS ON SHORT-SELLING, MARGIN TRADING AND MARKET EFFICIENCY

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ABSTRACT

My dissertation contains three essays on short-selling, margin trading, and market efficiency. The first essay uses a unique exogenous event, the introduction of short selling in the Chinese stock market, to examine the direct link between idiosyncratic risk and short selling. Based on Shleifer and Vishny (1997), I hypothesize that idiosyncratic risk deters arbitrageurs with negative information from taking short positions in overvalued stocks. Consequently, the stocks with high idiosyncratic risk are more overvalued at the onset of the introduction of short sale and perform worse in the subsequent period. The second essay examines the impact of the introduction of margin trading and short selling in the Chinese stock market on market quality. The third essay examines the relationship between short selling and SEO discount under the SEC's amendment to Rule 105. If the amendment is binding, the short-selling prior to seasoned equity offering (SEO) should correctly reflect negative information and promote price efficiency. Thus the winner's curse problem during SEO process is reduced and the value discount of a SEO should be less.

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INTRODUCTION

Essay I[1]

An asset's idiosyncratic risk is unrelated to the returns of other assets and so it cannot be offset with hedge positions in other assets. To avoid bearing such risk, risk-averse investors may not trade on asset-specific information when idiosyncratic risk is relatively high (Shleifer and Vishny, 1997; Pontiff, 1996 and 2006). High idiosyncratic risk tends to lead to significant and potentially unfavorable price movements and hence may expose investors to margin calls and possible liquidations. While this argument applies to all trading decisions, investors taking short positions should be especially sensitive to idiosyncratic risk. Unlike a long position where upside potential is unlimited and any loss is limited to the original investment, short positions have a limited upside potential and a theoretically unlimited downside risk that increases with the idiosyncratic risk of the asset.

Motivated by the above arguments, this study uses a unique event, the introduction of short-selling in the Chinese stock market, to examine whether idiosyncratic risk deters investors from taking short positions on negative information. The idea that idiosyncratic risk may deter informed investors from trading has received attention in the recent literature, which has examined how idiosyncratic risk interacts with documented market anomalies, including the book-to-market effect (Ali, Hwang, and Trombley, 2003), the low subsequent returns of short interest stocks (Au, Doukas, and Onayev, 2009; Duan, Hu, and McLean, 2010), the post-

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[1] The current version of this essay is under review by the Journal of Banking and Finance

earnings-announcement drift (Mendenhall, 2004), the accrual anomaly (Mashruwala, Rajgopal, and Shevlin, 2006), and the earnings announcement premia (Mendenhall, 2004).

Existing literature notwithstanding, there is no direct evidence on the effect of idiosyncratic risk on short-selling. Lack of direct evidence is partly due to the fact that short-selling has always been part of US financial markets, making it difficult to establish a causal link from idiosyncratic risk to short-selling. For example, if short-sellers are informed (Diamond and Verrecchia 1987; Aitken, Frino, McCorry, and Swan 1998; Chen and Singal 2003; Boehmer, Jones and Zhang 2008) short-sales may incorporate asset-specific information in prices and reduce subsequent idiosyncratic risk. In other words, short-selling itself may affect idiosyncratic risk. Consequently, standard econometric analysis would suffer from a simultaneity bias (see, for example, Roberts and Whited, 2011).

The exogenous change in short-sale practices in the Chinese stock market provides a unique opportunity to examine the effect of idiosyncratic risk on short-selling. On March 31st, 2010, the Chinese exchange authority lifted the ban on short-selling for 90 largest stocks -- the component stocks of the Shanghai50 and the Shenzhen40 indexes. The ban guarantees that, prior to March 31st, the idiosyncratic risk of these stocks was unaffected by short-selling. Idiosyncratic risk measured before the lift of the ban, therefore, can be used to directly examine the effects of idiosyncratic risk on short-selling immediately after the lift of the ban. Even though in the US short-sale ban was once enforced upon a number of financial firms in 2008, the ban is only for three weeks and it is difficult to use such short period to construct idiosyncratic risk variables that is unaffected by short-selling activities.

Before I continue, it is important to note that idiosyncratic risk, as a proxy for uncertainty, may increase the expected overvaluation of a stock when short selling is not allowed (Miller

1977). On the one hand, idiosyncratic risk may increase the expected return of a short position and the level of short-selling activities upon the ban removal. On the other hand it would increase the risk of such positions and deter establishing short positions. Under standard economic arguments, expected returns are proportionate to the standard deviation of returns while risk-associated costs are proportionate to the variance of returns (Pontiff 2006). As a result, the idiosyncratic risk of short positions would outweigh the benefits from increased expected returns. Whether idiosyncratic risk deters short-sellers from trading on their information is ultimately an empirical question.

My results first show a significant price decline for the first three weeks after the introduction of short-sale practice. The decline of prices is consistent with Miller's (1977) theory of overvaluation caused by short-sale ban. In a multivariate framework, the price declines (abnormal returns) are positively (negatively) related to the level of short-selling, indicating that through selling short, investors correct the overvaluation. Moreover, consistent with the main hypothesis, the level of short-selling is negatively associated with idiosyncratic risk variables estimated using pre-event daily returns. Through deterring short-selling, idiosyncratic risk also has a valuation effect on the stocks, that is, the stock prices decline less for stocks with relatively high level of idiosyncratic risk. Specifically, one standard deviation increase in idiosyncratic risk prevents stock price from declining by 3.37%. As stocks remain more overvalued, the stock price decline would occur in the subsequent period when prices converge to true values. Consistent with this hypothesis, I find that the stocks with high level of idiosyncratic risk start to experience lower returns in the subsequent periods (from week 4 to week 7). Furthermore, for shortable stocks idiosyncratic risk does not affect the returns before short-selling is allowed, and for non-shortable stocks the aforementioned valuation effect of idiosyncratic risk does not exist. All my

results are robust to the control of size, transaction cost, liquidity, cross-market listing, and the dispersion of investors' opinions.

<u>Essay II</u>

This study examines how the introduction of margin trading in China affects the informativeness of stock prices and market liquidity. The uniqueness of the margin trading in China is the high minimum margin requirement (roughly 76,000 USD), which excludes 98 % of equity traders from participating in margin trading. If uninformed traders are more capital constrained than informed traders (Maythew, Sarin and Shastri, 1995), it is reasonable to say that a margin trader in China is more likely to be an informed trader and the introduction of margin trading could have an exogenous impact on the information environment of stock trades.

Previous studies on the Fed's margin regulation have largely focused on stock prices (Largay and West 1971; Grube, Joy and Panton 1979; Kofman and Moser 2001) and stock volatilities (Hardouvelis 1988, 1990; Hardouvelis and Peristiani 1992; Hardouvelis and Theodossiou 2002). To the best of my knowledge, there are few studies on the effect of equity margin policy on market quality. My study tries to fill the void in this direction.

The potential contribution of this study could be threefold. First, it raises an issue that strict capital restriction on margin trading would increase the composition of informed trades and thereof the information asymmetry of the overall trading environment. No previous studies show a change in trade informativeness upon margin regulation adjustments, probably because no margin regulations have disproportionally affected informed trader and uninformed traders. Second, I use microstructure data in contrast to previous studies that have limited their analyses on the long-term relation between margin trading and stock prices, mainly due to unavailability

of intraday data. The use of intraday data in this study allows me to examine from a micro perspective the impact of margin trading restrictions on stock information content. Third, due to regulatory and market differences, US evidence may not be indicative of behavior outside of a US market setting. In China, more superior information could be generated without firms (Leland 1992) and the law enforcement against insider trading is essentially weak (World Bank Report on governance indicator 2010). This environment encourages informed trading in a magnitude larger than that of the U.S. or other developed markets. A close investigation on this market could provide more insights to the literature.

My preliminary result shows an increase in quoted bid-ask spread, effective bid-ask spread and price volatility after stocks become eligible for margin trading, suggesting more informative trading occurs in market order flows. The increase of market depth is insignificant after control for price, volume and volatility and there is no evidence of the increase in trading-volume, trade frequency or trade size. Moreover, I find that the adverse selection component of the bid-ask spread increases for the marginable stocks using the method developed by George, Kual, and Nimalendran (1991). I also employ the method developed by Madhavan and Smidt (1991) and find a decrease in the relative weight placed on public information by the investors in the price revision process. This evidence suggests more private information affecting trading decision. Finally, using Hasbrouck (1991)'s approach to measure informativeness of trade, I find the information content of trades increases after the securities become marginable. I interpret all these evidences as supporting the hypothesis that the margin trading increases the relative concentration of informed traders and exacerbates the information asymmetry of stock trades.

<u>Essay III</u>

On October 9, 2007, the SEC effects the amendment to Rule 105 to further regulate short-selling behavior around Seasoned Equity Offerings (SEO). Under the new amendment, a short seller cannot purchase SEO shares if the short-selling occurs within five business days prior to the offering. Before the amendment, SEC only disallowed short sellers to use SEO shares to cover their short-sale positions, leaving the possibility that incompliant investors disguise the covering of short positions by purchasing offered shares through other accounts. The intent of the amendment is to further curb the manipulative short selling which leads to value discount of SEO shares and thereof to further protect the capital raising process of SEO issuers. A number of studies have empirically examined the effect of pre-offering short sale constraints imposed by Rule 105 and its predecessor Rule 10b-21 on the pricing of seasoned offers (Safieddine and Wilhelm, 1996; Corwin, 2003; Kim and Shin, 2004; Henry and Koski, 2010; Autore, 2011). No study so far, however, examines the informativeness role of short sellers and SEO discount under the effect of the recent rule change.

In this article, I explore the relation between short selling and SEO discount. According to the literature, there are at least two general motives for short selling during SEO periods: information and manipulation (Henry and Koski 2010). On the one hand, informative short sellers would find it easier and less risky to use fixed, value discounted SEO shares to cover the short positions (Safieddine and Wilhelm 1996), thus they choose SEO period to exercise their negative private information. On the other hand, Gerard and Nanda (1993) propose that traders even with positive information also have an incentive to sell short stocks and use SEO shares to cover the positions. Such manipulative trading generates profit through SEO discount by

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reducing the informativeness of the secondary market order flow. Facing less efficient price, uninformed SEO bidders are exposed to higher risks during the auction process and demand more compensation. In response, issuers have to price lower at a discount to float the market. Henry and Koski (2010) study the manipulative role of short sellers prior to SEO and found positive relationship between short selling activities and SEO discount. They conclude that Rule 105 (before the amendment is imposed) constrains only some but not all manipulative trading.

If the new amendment successfully prohibits the use SEO shares to cover short positions, there is little incentive for a manipulative trader to sell short during the restricted period. In absence of SEO shares, manipulative traders won't necessarily profit through the excessive selling order flow, because the market price responds to the selling pressure (Kyle 1985). The informed traders, on the other hand, would still sell short during the restricted period and profit by using non-SEO shares to cover position. Therefore, the short-selling prior to SEO should be informative and increases price efficiency. According to Gerard and Nanda (1993), SEO discount are smaller when price efficiency is high.

Using a sample of SEOs between September 2009 and December 2011, I test the direct relationship between SEO discount and short selling during Rule 105 restricted period. The preliminary results suggest a strong negative relationship between SEO discounts and the short selling, which is consistent with the intent of SEC to reduce SEO discount by constraining manipulative short selling. These effects are significant only for the non-shelf shelf offerings in my sample, and the evidence of informative trading is much weaker for shelf offerings. Moreover, Henry and Koski (2010) suggests informed short selling before SEO issue dates should have a permanent impact on stock prices. With the method used by Corwin (2003), Kim and Shin (2004), and Henry and Koski (201), I regress post-issue abnormal returns on pre-issue

short selling during restricted period. Consistent with my proposal, I find that the short selling is unrelated to post issue abnormal returns. My results overall suggest a successful implement of SEC amendment to Rule 105, which results in higher informativeness of short-selling and a positive impact of short-selling on price efficiency.

ESSAY I: DOES IDIOSYNCRATIC RISK DETER SHORT-SELLERS? EVIDENCE FROM A FIRST-TIME INTRODUCTION OF SHORT-SELLING

Introduction

An asset's idiosyncratic risk is unrelated to the returns of other assets and so it cannot be offset with hedge positions in other assets. To avoid bearing such risk, risk-averse investors may not trade on asset-specific information when idiosyncratic risk is relatively high (Shleifer and Vishny, 1997; Pontiff, 1996 and 2006). High idiosyncratic risk tends to lead to significant and potentially unfavorable price movements and hence may expose the hedge positions to margin calls and possible liquidations. The idea that idiosyncratic risk may deter informed investors from trading has received attention in the recent literature, which has examined how idiosyncratic risk interacts with documented market anomalies, including the book-to-market effect (Ali, Hwang, and Trombley, 2003), the low subsequent returns of short interest stocks (Au, Doukas, and Onayev, 2009; Duan, Hu, and McLean, 2010), the post-earnings-announcement drift (Mendenhall, 2004), the accrual anomaly (Mashruwala, Rajgopal, and Shevlin, 2006), and the earnings announcement premia (Mendenhall, 2004).

While the argument applies to all trading decisions, investors taking short positions should be especially sensitive to idiosyncratic risk. Unlike a long position where upside potential is unlimited and any loss is limited to the original investment, short positions have a limited upside potential and a theoretically unlimited downside risk that increases with the idiosyncratic risk of the asset.[2] Existing literature notwithstanding, there is no direct evidence on the effect of

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[2] For studies discussing the asymmetric costs between short and long positions, see, among others, Dechow et al. (2001) and Chen and Singal (2003).

idiosyncratic risk on short-selling. Lack of direct evidence is partly due to the fact that short-selling has always been part of US financial markets, making it difficult to establish a causal link from idiosyncratic risk to short-selling. For example, if short-sellers are informed (Diamond and Verrecchia 1987; Aitken, Frino, McCorry, and Swan 1998; Chen and Singal 2003; Boehmer, Jones and Zhang 2008) short-sales may incorporate asset-specific information in prices and reduce subsequent idiosyncratic risk. In other words, short-selling itself may affect idiosyncratic risk. Consequently, standard econometric analysis would suffer from a simultaneity bias (see, for example, Roberts and Whited, 2011).

Motivated by the above arguments, this study uses a unique event, the introduction of short-sale practice in the Chinese stock market, to examine whether idiosyncratic risk deters investors from taking short positions on negative information. On March 31st, 2010, the Chinese exchange authority for the first time lifted the ban on short-selling for 90 large stocks. The exogenous change in short-sale practices provides a unique opportunity to examine the effect of idiosyncratic risk on short-selling. The ban guarantees that, prior to March 31st, the idiosyncratic risk of these stocks was unaffected by short-selling. Idiosyncratic risk measured before the lift of the ban, therefore, can be used to directly examine the effects of idiosyncratic risk on the short-selling. Even though in the US market, a short-sale ban was once enforced and later repealed upon a number of financial firms in 2008, the ban is only for three weeks, making it difficult to construct idiosyncratic risk variables that is completely unaffected by short-selling activities.

The short-sale practices in the Chinese stock market have several additional features that benefit this study. First, in the US the monetary cost of short-selling, reflected in rebate rate and

loan fees, varies with the difficulty of allocating lendable shares.[3] Since 1933 the public cannot

observe loan fees of short-selling in the US market and so the studies on short-selling could not

directly control for this cost variable.[4] In stark contrast to the U.S. setting, every short-sale

transaction in China faces the same loan rate agreed among all brokerage firms. Thus, it saves

the work to control for the monetary cost in the analysis. Second, none of the shortable stock in

the Chinese market is associated with options trading.[5] Since options traders could mimic a short

position by selling a call option or buying a put option of the underlying security, the option

trading could significantly affect short-selling activities (Figlewski and Webb, 1993; Danielsen

and Sorescu, 2001) and the incorporation of negative information (Senchack and Starks 1993;

Aiken et al 1998; Chen and Singal 2003). In absence of options trading, the role and potential

importance of idiosyncratic risk on short-selling is considerably magnified. Third, Boehme,

Jones, and Zhang (2009) document that the short-sale orders from institutional accounts are

information-oriented and strongly predict negative returns. In China, short-sellers are

predominantly institutional investors, because the high assets requirement for selling short

excludes most individual investors.[6] Thus, examining the impact of idiosyncratic risk on short-

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[3] The rebate rate is the interest rate brokers pay to short-sellers for holding the proceeds of a short-sale. The rebate rate decreases if the shortable shares are difficult to allocate and to borrow. A negative rebate rate means that the short-seller pays a fee to the broker. A negative rebate rate is commonly observed in US markets for stocks that are hard to borrow (see Jones and Lamont, 2002).

[4] Institutional ownership could be a good proxy to control short-selling cost, as a number of studies argue that the availability of shares supply determines the loan fee of shorted shares. For example, Saffi and Sigurdsson (2009) say that low supply of lendable shares lead to higher searching costs borne by short-sellers. Nagel (2005) argue that if loan supply is sparse, short sellers have to pay a significant fee. Jones and Lamont (2002) find that a fee paid by short-sellers, which indicates a negative rebate rate, is common among stocks hard to borrow. Nonetheless, institutional ownership could still constrain short-selling beyond affecting loan fees. In an unreported study, I control institutional ownership and my results still holds the same.

[5] Three firms had issued call warrants prior to the introduction of short-sales. However, investors could not write and sell call warrants as a way to synthesize a short position. Therefore, the existence of these three warrants should not affect the short-selling of the underlying stocks.

[6] Each short seller's account is required to have a minimum registered fund of 500,000 RMB (over 76.15 thousand US dollars) and minimum total financial assets of 1,000,000 RMB (over 152 thousand US dollars).

selling in a setting such as China, where short-sellers tend to be highly informative, could provide insight on how idiosyncratic risk affects the price adjustment to negative information.

My results first show a significant price decline for the first three weeks after the introduction of short-sale practice. The decline of prices is consistent with Miller's (1977) theory of overvaluation caused by short-sale ban. In a multivariate framework, the price declines (abnormal returns) are positively (negatively) related to the level of short-selling, indicating that through selling short, investors correct the overvaluation. Moreover, consistent with the main hypothesis, the level of short-selling is negatively associated with idiosyncratic risk variables estimated using pre-event daily returns. Through deterring short-selling, idiosyncratic risk also has a valuation effect on the stocks, that is, the stock prices decline less for stocks with relatively high level of idiosyncratic risk. Specifically, one standard deviation increase in idiosyncratic risk prevents stock price from declining by 3.37%. As stocks remain more overvalued, the stock price decline would occur in the subsequent period when prices converge to true values. Consistent with this hypothesis, I find that the stocks with high level of idiosyncratic risk start to experience lower returns in the subsequent periods (from week 4 to week 7). Furthermore, for shortable stocks idiosyncratic risk does not affect the returns before short-selling is allowed, and for non-shortable stocks the aforementioned valuation effect of idiosyncratic risk does not exist. All my results are robust to the control of size, transaction cost, liquidity, cross-market listing, and the dispersion of investors' opinions.

According to the 2009 report of China Securities Depository and Clearing Corporation Ltd on all trading accounts in China, 138 million effective individual or institutional investment account are registered for A share trading in Shanghai and Shenzhen exchanges, of which 1.43 million accounts (1.03% of total) have registered assets above 500,000 RMB and 0.59 million accounts (0.42% of the total) above 1,000,000 RMB. The capital requirement does not affect the accreditation for institutional investors, because the registered capital for an investment institution is above 30 million RMB.

Even though margin trading was introduced in parallel with short-selling by the regulators, I do not incorporate the role of margin trading in this study despite its high volume, because the change of margin eligibility may not necessarily lead to an increase in long positions or convey positive information on the assets. When a stock becomes marginable, an investor that already has a long position in the stock could claim its margin eligibility and use it as margin to establish long positions in other securities. Therefore, there is no necessary change in long positions despite an increase in margin trading volume. In contrast, a short-sale transaction involves actual shares borrowed and returned for a particular stock, and is hence more informative than margin trading in terms of establishing positions of the underlying stock. Moreover, the ban on short-sale effectively excludes pessimistic investors from trading on negative news, whereas the ban on margin trading does not directly exclude optimistic traders from trading on positive news.

The remainder of the paper proceeds as follows. Section 2 develops the analytical framework used in examining the effects of idiosyncratic risk on short-selling and derives the empirical hypotheses. Section 3 describes the short-selling practices in China. Section 4 presents the evidence at the introduction of short-selling while Section 5 examines how idiosyncratic risk affects returns in the longer term. Section 6 concludes the paper.

Model and Empirical Hypotheses

Model Setup

Before I continue, it is important to note that idiosyncratic risk, as a proxy for uncertainty, may increase the expected overvaluation of a stock when short-selling is not allowed (Miller 1977). On the one hand, idiosyncratic risk may increase the expected return of a short position and the level of short-selling activities upon the ban removal (Chang, Cheng and Yu 2007). On the other hand, it would increase the risk of such positions and deter establishing short positions. Under standard economic arguments, expected returns are proportionate to the standard deviation of returns while risk-associated costs are proportionate to the variance of returns (Pontiff 2006).

Based on Miller (1977) and on Pontiff (2006), this section develops a model to motivate the relation between idiosyncratic risk, investor trading, and expected returns. Miller (1977) proposes that divergence of opinion and short-sale constraints could lead to overvaluation of securities. As Miller (1977) points out, disagreement implies uncertainty so that stocks with high uncertainty are also stocks with high disagreement. Consistent with previous studies (e.g. Chang et al., 2007 and Gao et al., 2006), I use the idiosyncratic risk of stocks to measure the underlying uncertainty and divergence of opinions.

Suppose that investors' divergent valuations ($\tilde{x}_i$) of stock i follow a normal distribution with a mean of μ_i and a standard deviation of σ_i, where σ_i measures stock-specific uncertainty. As proposed by Miller (1977), if investors cannot sell securities short then the most optimistic investors would buy the stock and market clearing prices would be set by the marginal investor. Let π_i denote the proportion of investors, relative to all investors that know about the stock,

sufficient to buy the whole issue of stock i and let v_i denote the market clearing price of the stock.[7] Then, as proposed by Miller (1977), the proportion of investors buying the stock at the market clearing price would come from the top-end of the valuation distribution so that:

$$\pi_i = \text{Prob}(\tilde{x}_i > v_i) = 1 - F\left(\frac{v_i - \mu_i}{\sigma_i}\right), \tag{1}$$

where $F(x)$ is the cumulative density function of the standard normal distribution. From Equation (1) one can derive the market clearing price of stock i as:

$$v_i = \mu_i + \sigma_i F^{-1}\left(1 - \pi_i\right). \tag{2}$$

In this case $F^{-1}(y)$ is the inverse of the cumulative density function and $F^{-1}(1-\pi_i)$ reflects the overvaluation of the stock per one unit of σ_i.[8] The overall overvaluation of the firm is $\sigma_i F^{-1}(1-\pi_i)$ so that, as proposed by Miller (1977), overvaluation increases with uncertainty σ_i. Because this study examines expected returns rather than valuations, I derive the expected return of firm i as the liquidation value μ_i minus the market clearing price of v_i, or

Lemma 1: *Under the above assumptions, the expected return of stock i is equal to:*

$$E(r_i) = \mu_i - v_i = -\sigma_i F^{-1}\left(1 - \pi_i\right). \tag{3}$$

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[7] To capture differences in π_i across firms, the subsequent analysis takes into account other variables, such as market capitalization, that may be related to firm size and visibility.

[8] Following Miller (1977), I assume that less than half of all investors are sufficient to buy the firm so that overvaluation is positive.

When stock i is overvalued (i.e. $F^{-1}(1-\pi_i) > 0$) then the expected return of the stock is negative. Moreover, as uncertainty increases the expected returns become even more negative.

To derive the position of an informed investor in each stock i, I use Pontiff's (2006) framework, in which expected returns follow a normal distribution and investors have a negative exponential utility with a constant absolute risk aversion coefficient equal to ρ. It is a well-known result that the optimal position in stock i (w_i) of a representative informed investor, would equal to:

$$w_i = \frac{E(r_i)}{\rho \sigma_i^2} \tag{4}$$

Substituting the expected return from Equation (3) in Equation (4) to find the optimal position of the investor gives rise to the first proposition of the paper:

Proposition 1: *In equilibrium the optimal position in stock i of an informed risk-averse investor would equal to:*

$$w_i^* = -\frac{F(1-\pi_i)}{\rho \sigma_i} \tag{5}$$

Clearly, when the stock is overvalued (i.e., when $F(1-\pi_i) > 0$) then the representative informed investor would have a short position in the stock. Furthermore, the short position of an informed investor would be smaller for higher levels of uncertainty σ_i. The proposition suggests that the idiosyncratic risk of short positions would outweigh the benefits from increased expected returns. Whether idiosyncratic risk deters selling short on negative information is ultimately an

empirical question. To the best of my knowledge, this study is the first to provide a cross-section relationship between idiosyncratic risk and short-selling activities.

Empirical Hypotheses

Based on the above framework, this section derives several empirical hypotheses that describe the relations between idiosyncratic risk, investors' short positions, and stock returns. The first hypothesis is based on Lemma 1 and states that, after short-selling is allowed, stocks would experience negative abnormal returns.

Hypothesis 1: *The ban on short-selling leads to stock overvaluation. Upon the introduction of short-selling, stocks allowed for short-selling would experience negative abnormal returns relative to stocks not allowed for short-selling.*

This hypothesis mirrors the proposition of Miller (1977) that in the presence of short-selling constraints stock valuations would be higher than valuations when short-selling is not constrained. The exogenous introduction of short-selling in the Chinese stock market, therefore, permits a direct test of how valuation is affected by short-selling constraints.

The second hypothesis relates idiosyncratic risk, measured before the introduction of short-selling, and the short-selling activity of investors. As can be seen from Proposition 1, informed investors are expected to sell short, on average. More importantly, the investors' short positions should become smaller when idiosyncratic risk increases. This general implication is derived under the assumption of no transaction costs and thus implies that investors would take short positions even if expected returns approach zero. In the Chinese stock market, however,

there are non-trivial direct transaction costs of taking short positions. In the presence of transaction costs, informed investors would take short positions only if the corresponding expected returns are sufficiently high to compensate these investors for the transaction costs. Because expected returns from a short position, on average, decline and approach zero as idiosyncratic risk declines and approaches zero, transaction costs would prevent many informed investors from taking short positions when idiosyncratic risk is relatively low. Only the most pessimistic of the informed investors would sell short in this case. Taking into account the above argument, the second hypothesis relates idiosyncratic risk to short-selling activities.

Hypothesis 2: *Idiosyncratic risk, measured before the introduction of short-selling, would have a negative effect on short-selling activities. This effect should be evident for stocks with relatively high idiosyncratic risk but may not be evident for stocks with relatively low idiosyncratic risk.*

Proposition 1 further shows that, all else equal, high short-selling reflects low expected returns. The idea that trading by short-sellers contains information relevant for stock prices has received wide support in the literature (see, for example, Senchack and Starks, 1993; Aiken et al., 1998; and Boehmer et al., 2008). 9 If market prices incorporate the negative information contained in short-sales, then short-selling should be associated with low contemporaneous stock returns. As mentioned earlier, non-trivial transaction costs could affect the trading decisions of

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[9] Senchack and Starks (1993) find that unexpected increase in short interest generates significant negative abnormal returns around the short-interest announcement date. Aiken et al (1998) also use intra-day Australia trading data to show an execution of a short-sale order, compared to a regular sell order, is immediately followed by a significant price decline. They conclude that short-sale instantaneously convey negative news. Using proprietary NYSE order data, Boehmer et al (2008) also conclude short-sellers are well informed as their trades lead to significantly lower returns in the short period following.

informed investors. For example, when expected returns are low (e.g., due to low uncertainty) relative to transaction costs, then only investors with the most negative information may find it optimal to sell short. Therefore, short-selling observed at low levels of idiosyncratic risk would likely be more informative. This argument is similar to the one made in Diamond and Verrecchia (1987), where high short-selling costs relative to benefits could squeeze out liquidity traders and less informed investors and leave only investors with better information to take short positions. The third hypothesis summarizes the above arguments.

Hypothesis 3: *Short-selling would have a negative effect on contemporaneous stock returns. In addition, the effect of short-selling on prices would be more negative for stocks with relatively low idiosyncratic risk.*

The final empirical hypothesis is again based on Proposition 1 and provides a link between idiosyncratic risk and stock returns following the introduction of short-selling. By reducing informative short-selling, idiosyncratic risk contributes to the persistence of overvaluation at the onset of the introduction of short-sale. Consequently, the prices of stocks with higher idiosyncratic risk should drop by less when short-selling is first introduced. However, if stock prices eventually reflect the sidelined negative information, the returns of stocks with relatively higher idiosyncratic risk would be relatively lower in subsequent periods.

Hypothesis 4: *Idiosyncratic risk would have a positive effect on abnormal returns at the onset of short-selling but would have a negative effect on abnormal returns in subsequent periods.*

The following sections describe the data and provide tests of the above empirical hypotheses.

<u>Institutional Setting, Data and Methodology</u>

<u>Short Sale Practices in China</u>

On March 31st 2010, the Chinese Securities Regulatory Committee (CSRC thereafter), launched a pilot program of short-selling for a group of stocks. The stocks eligible for short-selling are the component stocks of Shanghai50 index and Shenzhen40 index. The stocks included in the two indexes all have large capitalization, high liquidity and high representativeness of industries. At cumulative level, the short-eligible stocks from the two indexes count for over 48% of the capitalization of the whole market.[10]

To sell short a stock, one investor needs to first establish a short-selling account at one of the six security firms accredited for the short-selling brokerage services.[11] Each short seller's account is required to have a minimum registered fund of 500,000 RMB (over 76.15 thousand US dollars) and a minimum total financial asset of 1,000,000 RMB (over 152 thousand US dollars) at the brokerage firm. The capital requirement is overwhelmingly higher than the $2,000 requirement in the US, and excludes most of the individual investors from participating in short-selling. [12]

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[10] As on March 31st, 2010, on average the market capitalization of the shortable stocks is 149.76 billion Yuan and the cumulated market capitalization of all Chinese firms in the data universe equal to approximately 284.1 trillion Yuan.

[11] Six security firms were engaged in the broking services at the very beginning of the short sale in April, 2010. This number increased to 11in June and to 25 in November in the same year.

[12] According to the 2009 year-end report of China Securities Depository and Clearing Corporation Ltd, in China 138 million effective individual or institutional investment account are registered for A share trading in Shanghai and Shenzhen exchanges, of which 1.43 million accounts (1.03% of total) have registered assets above 500,000 RMB and 0.59 million accounts (0.42% of the total)above 1,000,000 RMB. Roughly 99% of investors are excluded from short-selling.

Once confirmed the sufficient assets in the short-seller's account, the brokerage firm will then establish a client-specified "credit trade and collateral fund account" at a commercial bank and uses the account to deposit the proceeds of client's short-sale and the cash for required margin, both of which will serve as the collateral to the client's short position. A short position could be forced to close out when the collateral maintenance ratio is lower than 130% and no additional capital is injected. The collateral maintenance ratio is calculated as the following:

$$\frac{Cash\ for\ margin\ requirement\ +\ Proceeds\ from\ short\ selling}{Shorted\ shares \times current\ market\ price + Accrual\ interest\ payment}$$

Suppose an investor sells short one share at ¥100, she must deposit ¥50 (50% of the proceeds) cash for the margin requirement and then has a total of ¥150 in her account. When the current market price increases to ¥115.4 or above (ignoring accrual interest payment), the collateral maintenance ratio (150/115.4) reaches 130% or below, then a margin call would occur.

If an investor is to use the short-sale proceeds for further investments, the collateral maintenance ratio must reach a level higher than 300%. The threshold could be met only when the current market price drops 50% or more to ¥50 or lower. Since a 50% decline in stock price is extremely unlikely to happen, reinvesting the proceeds of short-sale is almost impossible. Thus some investors with mildly negative belief could stay away and only "those with very unfavorable information will still take short position" (Figlewski 1981).

Besides the unavailability of short-sale proceeds, another short-sale constraint faced by investors is the uptick rule. Under the uptick rule, the short-sale order will not be executed unless the price is higher than the last traded price or previous day's closing price. Chang et al (2007) actually show that the short-selling of stocks subject to uptick rule is more difficult than that of other pricing rules. In addition, naked short-selling is strictly forbidden on all shortable stocks.

Brokerage firms have to own the shares in order to lend them, which imposes further constraints to short sellers (Boehme, Jones and Zhang 2009; Boulton and Braga-Alves 2010).

Sample Data

The short-selling information is hand-collected from the public websites of Shanghai Stock Exchange and Shenzhen Stock Exchange under the category of "Margin Trading and Short Selling Information". For each stock, the exchange reports the number of shares sold short, the number of shares repurchased and the uncovered shares that have been sold short at daily level. The information comes from the report of all brokerage firms on their clients' short-selling activities. The exchange authority requires the brokerage firms to submit the report by 10:00 PM of each trading day, so the market could observe the short-selling information in a timely manner.

Since only the index component stocks are eligible for short-selling, the adjustments to index could affect the construction of my sample pool. After the introduction of short-selling, 6 new stocks have been added to the index with 6 old stocks being replaced. In total, 96 stocks have been or once had been eligible for short-selling, and my sample originally contains all of these stocks. The daily trading data is purchased from GTA Company, which is the supplier of Chinese Securities Market and Accounting Research (CSMAR) database by Wharton Research Data Services (WRDS). Since one stock does not have long enough daily data during the event period, my sample size is reduced to 95. From GTA, I also obtain the analyst forecast reports on the earnings per share and price/earnings ratio of year 2010 to measure the divergence of investors' opinions on stock valuation. The analyst forecasts are carried out within one year prior to the event.

Table 1 provides a summary report for the sample firms on firm characteristics, level of short-selling activities and level of idiosyncratic risk. In Panel A, the market capitalization is 149.7 billion Yuan or roughly above 20 billion US dollars on average, indicating considerably large size of the sample firms. The average market-to-book ratio is 2.957, indicating that a shortable stock is more likely to be a growth stock. Analyst coverage is the number of analysts that produces forecast report on companies' earnings per share in the year of 2010. The mean of analyst coverage reaches 27. The dispersion of opinions has an average value of 0.247. It is measured following Diether et al's (2002) method as the standard deviation of forecasted earnings per share over the mean of it.

Panel B reports the short-selling activities during the first 16-day window (including the event day plus the trading days within the first three-weeks). The total amount of shares sold short during this period is a bit over 10,000 on average. The median level of short-selling is 0, indicating that no short-selling occurs to the majority of shortable stocks. In addition, one variable that proxies for the level of short-selling activities is the proportion of shares sold short to total shares traded in the same period. The magnitude of this variable is 0.0023%. Compared with the prevalent short-sale practice in the US reported in Boehme et al.'s (2008) and Diether et al. (2009)13, the level of short-selling activities in the Chinese market is very low at the initial stage of the introduction. The low amount is primarily due to high monetary costs and severe institutional constraints. Even though the level of short-selling is very low, the short-selling activities could nevertheless cause price to change. In fact, Diamond and Verrecchia (1987) argue that short-sale tends to be more informative when high constraints squeeze out uninformed

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[13] Boehme et al (2008) reports 12.9% of the trading activities involved US SuperDot shares are short-selling. Diether et al (2009) reports short-sale takes a total of 24% in NYSE and 31% in Nasdaq.

short-sellers to trade (Diamond and Verrecchia 1987). Therefore, it is clear that the price effect does not come from the selling pressure of short-sellers, but rather from the negative information incorporated through the trades.

<div align="center">Idiosyncratic Risk as a Deterrent to Arbitrage</div>

To estimate idiosyncratic risk, Wurgler and Zhuravskaya's (2002) use two models: the CAPM model and a three-substitute-stock model. The CAPM model method implies a strategy of longing the index fund and simultaneously selling short an eligible stock. The residual variance of this model is the proxy for idiosyncratic risk. The three-substitute-stock measurement is based on a strategy of selling short one stock and simultaneously hedging the position by buying long three substitute stocks that are matched in market size, book to market ratio and industry. The variable for idiosyncratic risk is the residual variance of the regression of the shortable stock returns on the returns of the three substitute stocks. The assets allocation of the substitute stocks in the long position is determined by the coefficients of the independent variables in the regression. Take PetroChina for example, the regression yield estimates as follows:

$$R_{PetroChina,t} = 0.0133 * R_{Yanzhou,t} + 0.478 * R_{Oilfield,t} + 0.097 * R_{Tianan,t} \qquad (6)$$

$R_{PetroChina,t}$ is the return of PetroChina and $R_{Yanzhou,t}$, $R_{Oilfield,t}$, and $R_{Tianan,t}$ are defined analogously for the three stocks matched in size, book-to-market and industry. All returns are returns in excess of the risk-free central bank note rate. Based on the coefficients shown in the equation, the estimation result implies a diversification strategy that for every ￥100 short position in PetroChina, an investor needs to buy￥1.3 in Yangzhou Mining, buy ￥47.8 ChinaOilfield, buy ￥9.7 Tianan Mining and buy ￥41.1 (100-1.3-47.8-9.7) of risk-free

asset. In the estimation, all the coefficients of matched stocks are restricted to be positive because short-selling is still not applicable for these matched stocks.

The idiosyncratic risk variables are estimated using the daily data within a window of [-365,-20], where day 0 is denoted as the event day. By using pre-event data, the estimation ensures a pure causal effect from idiosyncratic risk to short-selling. Panel C in Table 1 shows the descriptive statistics of the variables. *Idiosyncratic risk (CAPM)* has an average level of 0.046% (2.14% for the standard deviation) and *Idiosyncratic risk (match)* has an average level of 0.040% (2.00% for the standard deviation). The idiosyncratic risk measured by three-stock model is lower than that measured by CAPM model, suggesting that a slightly better hedging position could be achieved through buying three matched stocks. The measurement R^2 indicates the level of systematic risk as a proportion of total risk. The R^2 of my sample is 0.46 for the CAPM estimation and 0.52 for the matched stock estimation. In a study of S&P500 index addition, Wurgler and Zhuravskaya (2002) find the variables of idiosyncratic risk at the similar level, however, they find that R^2 s are in much lower magnitude (0.18 for CAPM and 0.109 for matched). The comparison of R^2 suggest quite different risk structures between the two markets.

Abnormal Return and Significance Test

To measure abnormal returns (AR) and cumulative abnormal returns (CAR), I use the market–adjusted measures:

$$AR_i\ (t) = R_{it} - R_{Mt} \tag{7}$$

And
$$CAR_i\ (t_1, t_2) = \sum_{t=t_1}^{t_2}(R_{it} - R_{Mt}) \tag{8}$$

R_{it} is stock i's return on the day t while day 0 denoted as the event day when the introduction of short-selling takes effect. R_{Mt} is the value-weighted average return of all the

stocks traded in the Chinese stock markets on day t. AR_i (t) is the actual return on security i and the return less the market index return on day t, and CAR_i (t_1, t_2) is the cumulated abnormal return during the event window (t_1, t_2).

To test the statistical significance, I perform bootstrap tests assuming non-parametric distribution of stock abnormal returns. The bootstrap test is in the spirit of Kothari and Warner (1997), Barber and Lyon (1997) and Chang, Cheng and Yu (2007). For each shortable stock, I form a pool of matched stocks with respect to market-capitalization, market-to-book ratio and event days. I then randomly select one matched stocks from the matching pool for each stock sold short, so for the group of 95 shortable stocks, there is one corresponding portfolio composed of 95 matched stocks. I then compare the mean abnormal return of the shortable portfolio and the matched portfolio to see whether the shortable portfolio has a relatively lower abnormal return as hypothesized. Because the matched sample should preserve the cross-sectional correlation as it exists in the event firms' pool, the event firms' returns in excess of the matched stocks' returns would yield less mis-specified test statistics. The comparison process repeats 1000 times and the proportion of the times when the shortable has higher returns than the matched portfolio is recorded as the empirical p-value. A low p-value indicates that the shortable stock portfolio is more likely to have lower abnormal returns than its matched counterparts.

<u>Empirical tests upon the introduction event</u>

Abnormal Returns After Short-sale Introduction

Figure 1 shows the abnormal returns at both daily level and cumulative level from day 0 till day 35. The curve of cumulative abnormal return shows a declining pattern of stock prices since the introduction of short-sale. The overall price decline is consistent with Hypothesis 1 that

the ban on short-selling leads to stock overvaluation. Upon the introduction of short-selling, stocks allowed for short-selling would experience negative abnormal returns relative to stocks not allowed for short-selling. Moreover, the price decline that occurs in the early stage is not recouped in the later period. The permanent price decline suggests that short-sellers incorporate negative information into stock prices, rather than exert selling pressure to dampen the prices.

Panel A of table 2 reports the cross-sectional means of abnormal returns for different event days surrounding the introduction event. The average abnormal return of all shortable stocks on the effective dates (day 0) is -0.274%. The statistical significance indicated by the empirical p-value is below 5%, meaning that less than 50 out of 1000 simulated samples have the abnormal returns higher than the shortable stocks. The significant lower abnormal returns indicate that stock prices are previously overvalued due to the short-sale ban. Panel A also reports that for the days following the event, 5 out of 10 abnormal returns are negative with a significant level below 5%. I then equally divide the sample based on the level of idiosyncratic risk. 14 As shown in Panel A, for low idiosyncratic risk stock, 9 out of 11 abnormal returns since day 0 are negative, whereas for high idiosyncratic risk stocks only 5 out of 11 abnormal returns are negative. The return differences (high minus low) between the two groups are shown in the last columns. The difference is 0.590% for day 1 and 0.735% for day 2 and they both are significant at 5% level as the p-value from the group t-test suggests.

Panel B reports the cumulative abnormal returns (CAR) in the days surrounding the introduction of short-sale. The pre-event CAR is not economic or statistical significant for neither group of stocks. For all samples, the CAR from day -10 through day -1 is negative

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[14] Using the level of either measure of idiosyncratic risk to divide stocks would yield the similar results. In this table and later tests, I use the level of matched-stock measure of idiosyncratic risk to divide the stocks.

0.518%, which is not significantly different from zero at 10% level (p-value=0.36) either. The insignificant pre-event CAR indicates no firm-related events occur to the shortable stocks around the event period. In contrast, after the introduction of short-sale, the returns become significantly negative For example, the CAR from day 0 through day 15 is − 3.239% on average with an empirical p-value below 1%. Chang, Cheng and Yu (2007) study the lift of the ban on short-sale practice in the Hong Kong Stock Market and find the similar magnitude of price decline (−4.523%) for a similar length of event window. After day 15, the declined prices do not bounce back. For example, the CAR is between day 16 and day 20 is − 1.118% and the CAR between day 16 and day 30 is − 0.370%.

Panel B also presents the CARs difference for the two groups. The low idiosyncratic risk stocks have more price decline from day 0 to day 15 than the high idiosyncratic risk stocks. For example, the difference in CAR [0, 15] reaches 5.713% with 1% significance level. This evidence supports the first statement in Hypothesis 4 that among stocks with low idiosyncratic risk, short-selling is relatively easier so prices decline more. Whereas for stocks with high idiosyncratic risk, short-selling is deterred more and so less overvaluation is corrected. In the subsequent periods after day 15 the valuation difference between the two groups reverses. Consistent with the second statement of hypothesis 4, the high idiosyncratic risk stocks starts to underperform the low idiosyncratic risk stocks. The underperformance of high idiosyncratic risk stocks reaches 4.65% for the period between day 16 and day 30. When high idiosyncratic risk stocks are more overvalued in the previous period, price would decline more once prices converge to the fundamental values.

Figure 2 provides more supportive evidence for Hypothesis 4, by showing the cumulative abnormal returns for the two groups. The figure indicates that the prices of stocks with low

idiosyncratic risk decline sharply for the first three weeks (from day 0 to day 15) and stay relatively stable for the subsequent weeks, whereas the prices for stocks with high idiosyncratic risk stay stable at the beginning but decline in the subsequent weeks.

<center>Idiosyncratic Risk Constraining Short-selling Activities</center>

A unique feature of this study is the cross-sectional examination on the direct relation between idiosyncratic risk and the level of short-selling. In the multivariate framework, the dependent variable is the short-selling level measured as total shares sold short divided by total traded shares for the first 10, 15, 20 days after the introduction of short-selling. Since the number of shares sold short cannot be negative, it is reasonable to apply the Tobit regression with zero lower-bound of short-selling activities. Following the literature, I control a number of trading characteristics that could determine short-selling activities. For example, I add in past returns as a control variable since Diether et al (2009) find that short-sellers are largely contrarian traders. The other control variables include effective bid-ask spread, illiquidity and divergence of opinions. The effective bid-ask spread is estimated through Roll's (1984) equation of $2\sqrt{-Cov}$, where Cov is the auto-covariance of daily returns obtained from series of closing prices. The illiquidity of stocks is measured as the natural logarithm of the average daily absolute return divided by the dollar volume of pre-event period (Amihud 2002). The dispersion of opinions is measured following Diether et al's (2002) method. Moreover, some of the shortable stocks are cross-listed on NYSE or Hong Kong. Since short-selling is allowed in these two markets, the negative information traded through NYSE short-selling might dissipate to the underlying stock in the Chinese market where short-selling is banned. Therefore, it is reasonable to control the cross-listing effect on short-selling.

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Table 3 shows the regression results for the group of high-idiosyncratic risk stocks, the group of low-idiosyncratic risk stocks and all stocks. For the group of high idiosyncratic risk stocks in Panel A, the idiosyncratic risk variables are negatively and significantly associated with the level of short-selling across different specifications. For low idiosyncratic risk in Panel B and all stocks in Panel C, although the coefficients of idiosyncratic risk variables are negative in most specifications, the result is not statistically significant. The insignificant relation for low idiosyncratic risk stocks indicate that for this group of stocks, the economic benefit from idiosyncratic risk is not sufficient to compensate the high monetary costs. The lack of statistical significance for the sample as whole is mostly due to small sample problem and lack of testing power. In addition to the cross-section testing, in later section of 5.1, I apply monthly panel data with longer period to test the negative relation between idiosyncratic risk and short-selling. With more observations and more powerful tests, the negative relation is robust for both high idiosyncratic risk stocks and for all stocks. In a study on the short-sale practice in the UK, Au et al (2009) also find that the deterrent effect of idiosyncratic risk is mainly driven by the stocks with high idiosyncratic risk. Overall, my result is consistent with Hypothesis 2 that idiosyncratic risk deters short-selling and the deterrent effect is more pronounced when idiosyncratic risk is high.

<center>Valuation Effect of Short-selling and Idiosyncratic Risk</center>

Hypothesis 3 predicts a negative relation between the level of short-selling and abnormal returns. To test this hypothesis, I run cross-section regressions of cumulative abnormal returns on the level of short-selling. Panel C of Table 4 reports the relation between short-selling and stock return for all samples across different testing periods. For example, in Model 5 the dependent

variable is the cumulative abnormal return from day 0 to day 15 and the level of short-selling activities is measured as reports the coefficient of the level of short-selling as 1000 times shares sold short in proportion to total shares traded for the same period. The coefficient of short-selling in Model 5 is –4.99, indicating that a 0.1% increase in this variable would result in a price decline of negative 4.99%. Panel A and Panel B of table 4 report the results for the two groups of sub-samples conditional on idiosyncratic risk and the short-selling appears to be a significant determinant across all specifications. The results suggest that the short-selling activities in the market bring strong signals that embody the negative news of the underlying firms.

According to Hypothesis 4, if idiosyncratic risk deters short-selling, then stocks should be more overvalued when idiosyncratic risk is high. Table 4 also reports the cross-section relation between idiosyncratic risk and abnormal returns. Across all the specifications for high idiosyncratic risk in Panel A, the coefficients of idiosyncratic risk are significantly positive. Take model 2 for example, the coefficient of idiosyncratic risk is 112.3, meaning that one standard deviation (0.03% shown in Table 1) increase in the idiosyncratic risk prevents the overvaluation from being corrected by a positive 3.37% (0.03%*112.3%). Since idiosyncratic risk does not quite deter short-selling activities when idiosyncratic risk is low (see Panel B of Table 3), the valuation effects of idiosyncratic risk through deterring short-selling may not exists when idiosyncratic risk is low. Consistent with this argument, the results for low idiosyncratic risk stocks in Panel B show no significant relation between idiosyncratic risk and short-selling. The overall results in Panel C suggest strong negative relation between idiosyncratic risk and short-selling. The overall results support the main proposition that idiosyncratic risk prevents short-sellers from trading on negative information. Based on the results in Panel A and Panel B, the valuation effect of idiosyncratic risk is mainly driven by the stocks with high idiosyncratic risk.

In order to distinguish my idiosyncratic risk variables from the dispersion of opinions, I retain the residual variance of idiosyncratic risk regressed on the dispersion of opinions, measured following Diether et al (2002). The new idiosyncratic risk variables are isolated from the effect of dispersion of opinions and these variables are still positive and significant at 5% level, as shown in Panel C of Table 4. In addition, the incorporation of market size, liquidity, turnover and bid-ask spread does not affect the robustness of the results.

Placebo Tests

To ensure that the effect of idiosyncratic risk on returns only exists among stocks that are allowed for short-selling, I apply the same tests to (a) stocks allowed for short-selling in the non-event period and (b) stocks not allowed for short-selling during the event period. Table 8 shows that idiosyncratic risk does not affect abnormal return for the period before the introduction of short-sale, as the coefficients of idiosyncratic risk appear to be not statistically or economically significant. Table 9 shows that for non-event firms during the introduction of short-selling, idiosyncratic risk does not affect stock returns either. The test results indicate the positive relation between idiosyncratic risk and return at the onset of short-sale introduction is due to the constraining effects on short-selling activities instead of a market-wide effect.

Subsequent Returns

Hypothesis 4 also predicts that if the stocks with high idiosyncratic risk are more overvalued at the beginning of short-sale introduction, in the subsequent period, their performance should be lower than that of the stocks with low idiosyncratic risk. The univariate results in table 2 have supported this hypothesis. In addition, Table 5 shows the multivariate results for further evidence. The dependent variable in the regression is the cumulative excess

return from day 16 to day 35 or from week 4 to week 7, during which period price decline patterns reversed for the two groups of stocks. In Table 5, the sign of the coefficients of the idiosyncratic risk variables become negative instead of positive in the previous table. Specifically, the idiosyncratic risk estimated through three-matched-stock model is negatively associated with cumulative excess return with a significance level of at least 10%. The magnitude of my results stay the same when using (16, 20), (16, 30) or (16, 35) as the testing period. Overall, the negative relationship between the returns and idiosyncratic risks shows the stocks with higher idiosyncratic risk are more overvalued at the introduction of short-sale.

<u>Empirical tests at the monthly level</u>

Empirical Tests for Longer Horizon

In this section, I test Hypothesis 2 and Hypothesis 4 using the monthly data beginning on March, 2010 till January, 2011. Since the monthly data covers a longer period and contains more observations, such empirical setting could yield more powerful tests than the previous cross-section setting. Table 6 shows the regression of short-selling activities on monthly idiosyncratic risk. The monthly idiosyncratic risk variable is estimated using daily returns within each month, and the estimation method for the variables still follows Wurgler and Zhuravskaya (2002). In addition to the ordinary least square (OLS) model, I also apply the fixed-effects model and the random-effects model to control for the group dependence of the observations for individual stocks. Table 6 report the regression results for all samples in Panel A and the results for the sub-samples conditional on idiosyncratic risk in Panel B. The first two columns of Panel A show the results from the OLS estimation. The coefficients of both idiosyncratic risk variables appear to be negative and statistically significant at 1 % level. With more testing power, the negative

relation between idiosyncratic risk and short-selling for all stocks becomes significant than the previous cross-section test result. In the random-effects model and the fixed-effects model, the statistical significance idiosyncratic risk is slightly reduced, indicating group dependence among the observations. Nonetheless, the coefficients of idiosyncratic risk are negative and mostly statistical significant. The NYSE control variables also appear to be negative and statistically significant at 10% level. The negative information traded through NYSE short-sales may already affect the underlying stock prices in the Chinese market, thus there is less need for selling short these stocks. In addition, the Shanghai listing dummy variable is also a significant determinant of short-selling. This variable is mainly used to control for the trading volume difference between the Shanghai Exchange and the Shenzhen Exchange. Panel B of table 6 shows the same specification for the sub-groups. Consistent with Hypothesis 2, for stocks with higher idiosyncratic risk the negative impact of idiosyncratic risk on short-selling is relatively strong. For example, the negative coefficients are significant at the 1% level for the OLS models, 5% for the fixed-effects models and 10% for the random-effect models.

To test Hypothesis 4, I apply the Fama-Macbeth fixed-effect regression of monthly stock return on the level of current month idiosyncratic risk, denoted as IdioRisk t, as well as the level of previous month idiosyncratic risk, denoted as IdioRisk t-1. Based on Hypothesis 4, the stock return should be positively related to the risk of current month and negatively related to the risk of previous month. The regression results are reported in Table 7. The coefficients of idiosyncratic risk variables of both current month and previous month have the expected signs and the coefficients are statistically significant at 1% level. Moreover, the economic significance of idiosyncratic risk of current month is at the similar magnitude with the result from Table 4.

Ang et al's (2006, 2009) also find that the negative relation between stock return and idiosyncratic risk of previous month in the US market and worldwide. Doran et al (2011)'s argue that the negative relation is due to the deterrent effect of idiosyncratic risk on short-selling. Our results provide evidence towards their argument. Following this notion, the negative relation between idiosyncratic risk and return may not exist in a market setting where short-sale practices do not exist. In a group of unreported tests, I do not find that such relation exists for the period before the introduction of short-selling.

Conclusion

This study sets out to explore the role of idiosyncratic risk as a deterrent to short-selling activities by using a unique market setting where short-sale is exogenously introduced. My result shows that the prices of the shortable stocks significantly decline for the first one to three weeks after short-selling starts, which is consistent with Miller (1977)'s proposal that stocks are overvalued when short-selling is prohibited. The stock prices are negatively associated with the level of short-selling activities, indicating investors start to arbitrage away the overvaluations through short-selling. Consistent with Shleifer and Vishny (1997), short-selling is negatively related to idiosyncratic risk and overvaluation remains more prevalent among stocks with high idiosyncratic risk. Specifically, a one standard deviation increase in idiosyncratic risk prevents stock price from declining by 3.37% during the first three weeks of short-selling. In addition, the overvaluation due to idiosyncratic risk leads to lower stock performance afterwards, as idiosyncratic risk is negatively associated with stock returns in the subsequent period from week four to week seven (day 16 to day 35).

Most importantly, my study is the first that provides a direct link between idiosyncratic risk and short-selling activities. The theoretical proposition of this relationship is built on the models developed by Miller (1977) and Pontiff (2006). On the one hand, Miller suggests that higher uncertainty, often proxied by idiosyncratic risk, leads to higher overvaluation and higher expected profit of short-sellers. On the other hand, Pontiff argues that high idiosyncratic risk leads to less weight on arbitrage positions of overvalued securities. My study contributes the literature by proposing that in the scenario of establishing short positions, economic cost from idiosyncratic risk out-weight the economic profits. Therefore, the net effect of idiosyncratic risk on short-selling should be negative. My empirical evidence well supports this proportion. Moreover, the negative relation between idiosyncratic risk and short-selling activities is more pronounced among stocks with high idiosyncratic risk, and the result is robust after controlling for illiquidity, transaction cost, market size and investors' opinion dispersion.

Even though the short-selling activities in China at the initial stage are not as prevalent as in the US, the level of short-selling activities is significantly associated with stock price decline, indicating that short sellers are highly information-oriented. Since short-sale orders are reported to public in a timely manner, the market could immediately extract the negative information and develop more efficient prices. As a deterrent to short-selling, idiosyncratic risk deserves attention from investors for developing sound strategy based on the short-selling information.

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ESSAY II: MARGIN REGULATION AND INFORMED TRADING: EVIDENCE FROM CHINA

Introduction

This study examines how the introduction of margin trading in China affects the informativeness of stock prices and market liquidity. The uniqueness of the margin trading in China is the high minimum margin requirement (roughly 76,000 USD), which excludes 98 % of equity traders from participating in margin trading. If uninformed traders have less capital and more financial constraint than informed traders (Maythew, Sarin and Shastri, 1995), it is reasonable to believe that most uninformed traders are excluded from margin trading, and margin trading is more likely to be involved with informed traders. The motivation of this paper is to investigate how margin trading in a market setting that is highly exclusive to retail investors could affect the informative trading environment of the marginable stocks. In particular, I investigate the change in the information content of stock prices and the adverse selection problem through the introduction of margin trading.

The introduction of margin trading could affect the overall informativeness of stock trades in the following ways: (1) by taking leverage, investors are exposed to higher earning perspectives as well as higher risks. It provides a motivation for margin traders to collect more insider information to ensure earnings and reduce risks. In developing countries, more superior private information could be generated outside the firm (Leland 1992). Within the time between the announcement on February 12, 2010 and the implementation on March 31, 2010, potential margin traders could have gathered private information and then trade on the information when

margin trading is allowed. Therefore, the introduction of margin trading is associated with an exogenous information inflow. (2) With more information, traders would enlarge the size of their trades through margin trading. Other things equal, the margin trading creates an additional order flow upon existing orders. If margin traders are more likely to be informative traders, it is reasonable to believe that the additional order flow by margin trading would affect the information environment of stock trades.

Several studies investigate the Federal Reserve's adjustment of required margin and the consequent market behaviors and stock prices (Largay and West 1971; Grube, Joy and Panton 1979). Several other studies focus on the margin requirement on equity-option to investigate the flow of information between stock market and option market (Mayhew, Sarin and Shastri 1995; Chakravarty, Gulen and Maythew 2004). Among these studies, no consensus has been reached on the role of margin restrictions affecting market prices, and several questions still remain unaddressed: how would margin trading affect the informativeness of trades? Whether strict restrictions on margin trading could necessarily control information asymmetry and adverse selection? Is the informativeness of margin trading different for the securities associated with derivatives compared to those without? To the best of my knowledge, previous research has done little to investigate the informativeness of equity trading caused by margin regulations, partially due to data availability at the microstructure level.[15] While a few studies analyze the impact of margin trading on market stability using international data (Gikas A. Hardouvelis and Stavros Peristiani 1992; Lee and Yoo 1993), they do not address the informativeness aspect of margin trading. My work tries to fill the void in this direction.

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[15] With the last Fed adjustment to margin requirement in 1974, it is unlikely to find an analogous event of margin trading with the data available at microstructure level.

The study on the Chinese equity market could also benefit this study. Due to regulatory and market differences, the US evidence may not be indicative of behavior outside of the US market setting, the Chinese equity market (Shanghai and Shenzhen together but excluding Hong Kong) exceeds Japan and the UK to become the second largest capital market following the US judged by trading volume and market capitalization, as reported by J.P Morgan. However, its market volatility is over 350%[16] of the US and the law enforcement against insider trading is essentially weak, as the World Bank reports on governance indicator of 2010. This indicates a prevalence of informed trading in a magnitude much larger than the U.S. or other developed markets. Thus, any trading mechanism that affects informed trades could have useful policy implications. The stocks in the Chinese equity market are not associated with any option listing or other derivatives, so there is no migration of informed traders from the derivative market to the underlying stock market as suggested by Kumar et al (1998). It is also worth mentioning that China employs an electronic limit order system for trading platform, in which the involvement of market dealers is limited (Glosten 1994). It would be interesting to study informative trading under this exchange setting.

I conduct my analysis by using a pool of 90 Chinese stocks that were simultaneously allowed for margin trading for the period of three months before and three months after the event. The external shock of margin trading, especially the short-selling part, is expected to be associated with a dissemination of information that was previously locked up by regulatory prohibition. Therefore, the magnitude of the change in the information content is larger than the change in a market setting where margin trading is previously allowed. In addition, the introduction event essentially lowers the margin requirement from 100% to 70% by 30%,

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[16] See Du and Wei (2004)

whereas the greatest change in margin level in the U.S is 25%[17]. Furthermore, the marginable stocks are the constituent stocks of Shanghai 50 Index and Shenzhen 40 Index, and these two indices are designated to include the largest, most liquid stocks in the market. It is reasonable to believe that the prices of these firms are associated with higher market efficiency and the information is fully reflected in the price compared to other stocks. Hence, the observed information effect from external event would be less disturbed by noises.

My results show that after the margin trading is introduced, quoted spread, effective bid-ask spread and price volatility increase for the marginable stocks, suggesting more private information is being disseminated through margin trading. The market depth increases weakly, but the increase diminishes when controlled for price, volume and volatility. Also, there is no evidence of the increase in trading-volume, trade frequency or trade size. The ambiguous effect on total trading volume and market depth suggest that uninformed investors trade in smaller volumes to avoid being hit by informed trades, in spite of the increase of trading volume caused by margin trading. Moreover, I find that the adverse selection component of the bid-ask spread increases for the marginable stocks using the method developed by George, Kual, and Nimalendran (1991). I also employ the method developed by Madhavan and Smidt (1991) and find a decrease in the relative weight placed on public information by the investors in the price revision process. This evidence suggests more private information affecting trading decision upon margin-eligibility. Finally, using Hasbrouck's (1991) approach to measure informativeness of trade, I find the information content of trades increases after the securities become marginable. I interpret all these pieces of evidence as supporting the hypothesis that high restriction on margin trading increases the relative concentration of informed traders in the stock market and

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[17] See Alexander, Ors, Peterson and Seguin (2004)

the information asymmetry of stock trades. To check the robustness of the link between margin trading and informed traders, I divide my samples into two portfolios based on the margin trading volumes and repeat previous testing. I find that the stocks with higher margin trading activities are associated with higher adverse selection component of bid-ask spread, higher level of information content, and less weight on the public information in the trading decision, compared to the stocks with lower levels of margin trading.

The organization of this paper is the following: Section I reviews the literature. Section II describes data and states the hypotheses. Section III documents the impact of margin trading on the microstructure of the stock markets, and Section IV concludes the article.

<center>Literature Review</center>

In response to the October 1929 stock market crash, the Federal Reserve enacted the Security Exchange Act of 1934 as the first regulation designated to manage market-wide margin trading behavior. The purpose of this act is to curb speculative activity, cut excess credit and hence reduce stock price volatility. Specifically, it fixes the proportion of initial margin financed with investors' own funds (margin requirement) at certain market-wide level. Historically the Fed has adjusted the margin requirement 23 times since the enforcement of the act, whereas the current margin requirement has been maintained at 50% since 1974. After the stock market crash in 1987, a stream of research emerges to investigate the relation between margin trading regulations and stock market volatility. Notably, Hardouvelis (1988, 1990) suggest that the decrease in margin level lead to greater market volatility afterwards. In support, Hardouvelis and Theodossiou (2002) document an inverse relation between margin levels and volatility during bull and normal market. Kofman and Moser (2001) indirectly support Hardouvelis and

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Theodossiou by presenting a significant negative relation between price reversals and margin levels. In the case of Japan, Lee and Yoo (1993) find that margin decrease has a significant relation with volatility increase. Also Hardouvelis and Peristiani (1992) find that an increase in margin requirements in Japan leads to a decline in the conditional volatility of daily returns. On the other hand, however, there are several studies holding different point of views: Ferris and Chance (1988) and Hsieh and Miller (1990) apply a different methodology and find that margin requirement is unrelated with stock volatility. The relation between margin requirement and stock volatility is also found weak and non-significant in the case of Korea and Taiwan by Lee and Yoo (1993). Seguin (1990) examines the effects of margin eligibility at over-the-counter markets and find that stock volatility decreases when stocks become margin-eligible whereas the flow of information and market depth increases. Moreover, Seguin and Jarrell (1993) suggest margin trading is helpful to stabilizing the market. They use NASDAQ securities to show the returns for margin eligible-securities decrease less than the ineligible securities over the crash of '87. Alexander et al (2004) document that the introduction of margin trading is not associated with significant change in market volatility or market liquidity. But they find the information environment of the marginable stocks improves upon the introduction of margin trading. Their sample consists of NASDAQ small-cap firms with margin-eligibility event.

In the option market, the regulation on margin requirement is imposed by individual exchange authorities instead of the Fed. Several studies show that the shift of option margin requirement or the introduction of option could cause information to flow between option market and the underlying stock market. For example, Mayhew, Sarin and Shastri (1995) assume that the uninformed traders are most likely to be capital-constrained and sensitive to margin requirement, so a decrease of margin requirement in option market is associated with an

additional inflow of uninformed traders migrating from the underlying stock market. The option market consequently experiences a decrease in spread whereas the underlying stocks experience an increase in spread and trade informativeness. Kumar, Sarin and Shastri (1998) argue that the introduction of option could cause the flows of informed traders, instead of uninformed traders, from the underlying stock market to the option markets in contrast. They show that the information asymmetry and adverse selection reduce in the underlying stock markets upon the introduction of option. Also in Chakravarty, Gulen and Mayhew (2004)'s work, informed investors trade in both stock market and option market, so the trades in option market contribute to the price discovery of the underlying stocks. John, Koticha, Subrahmanyam and Narayanan (2003) develop a model and argue that option introduction *without* binding margin requirements could cause informed traders' bias toward the stocks because of its greater information sensitivity. This argument provides an alternative explanation of the wider stock bid-ask spread documented in Mayhew et al (1995)'s work. John et al (2003) also theorize that when margin requirement is imposed to the options, the informed trader's bias could shift toward option trading and will potentially lead to narrower bid-ask spread of the stocks.

In China, trade on margin is legally banned until March 31, 2010 when China Securities Regulatory Commission (CSRC) carried out a trial program of margin trading and short selling (also a form of margin trading) for a limited batch of 90 stocks. CSRC target the largest and most liquid stocks for margin-eligibility in an attitude consistent with the Fed. The Fed states that marginability in deep and liquid markets would not be likely to increase volatility (SEC Release 34-21583, p. 65). The introduction of margin trading is designated to inject credit to the stock market and encourage more information being reflected through margin trading so the market could be more complete with information and market efficiency can be improved. On the other

hand, to protect small investors from taking excess leverage, CSRC takes a conservative step and impose high institutional constraints on margin trading, namely high capital requirement to register a margin-trading account. Specifically, to participate in margin trading, an investor is requested to register a trading account with a minimum deposit of 500,000 RMB (over 76.15 thousand US dollars) and a minimum total financial assets of 1,000,000 RMB (over 152 thousand US dollars), which are overwhelmingly higher than the $2,000 requirement in the US, the 300,000 yen in Japan or the 100,000 Won in Korea. According to the 2009 year-end report of China Securities Depository and Clearing Corporation Ltd, among the 138 million individual or institutional account registered for A-share trading in Shanghai and Shenzhen exchange markets[18], 1.43 million accounts (1.03% of the total) have registered assets above 500,000 RMB and 0.59 million accounts (0.42% of the total) above 1,000,000 RMB. In sum, the high asset requirement excludes roughly 99% of the total investors from participate in short-selling. Moreover, the margin requirement in China is 70%, higher than the 50% in Japan and the US, 40% in Sweden and 20% in France (Roll 1989). The loan rate for borrowing on margin is 7.89% on a half year base, which is also higher compared to other markets.

<div align="center">Hypotheses and Data</div>

The informational impact of margin eligibility depends on whether the capital restriction disproportionately affects informed traders and uninformed traders of the marginable securities. Diamond and Verrecchia (1987) model that high restriction on short selling increases the market perception of informed trading, because only the investors with more precise information and strong negative beliefs to stay and sell short. As I previously argue, the restriction excludes

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[18] A-share trading in China is exclusively for domestic investors.

capital-constrained uninformed traders and leaves informed institutional investors to trade, it is reasonable to believe that an event such as margin trading introduction is associated with more information-motivated trading. Based on the above arguments, I develop the following hypotheses:

H1. Bid-ask spread increases when margin trading becomes eligible

H2. The adverse selection component of bid-ask spread increases and the order-processing component of the bid-ask spread decreases when margin trading becomes eligible

Shanghai Stock Exchange and Shenzhen Stock Exchange operate as a pure order-driven market, in which brokers accept and consolidate the limit orders and then feed orders to an automatic trading platform known as automatic order matching and execution system. In a market setting with specialist, Glosten and Milgrim (1985) and Lee, Mucklow, and Ready (1993) suggest that specialists actively manage adverse selection risk by adjusting the bid-ask spread. Even though the electronic limit-order auction trading systems in China does not invite competition from the third market dealers, Glosten (1994) still show that the bid-ask spread is also driven by the information-motivated trade in an equilibrium model. Therefore, I expect an increase in adverse selection in the trades and an increase in the bid-ask spread following the event of margin trading introduction.

H3. Volatility increases when margin trading becomes eligible

Kyle (1985) and Admati and Pfleiderer (1988) model that private information revealed through trading causes variance to increases. A number of studies also show that volatility is largely due to private information revealed through trading, rather than to public information releases (French and Roll 1986; Barclay, Litzenberger, and Warner 1990; Barclay and Warner

1993). Therefore, I expect the increase in informed trading could lead to an increase in intra-day volatility.

H4-null. Market depth increases when margin trading becomes eligible

H4-alter. Market depth decreases when margin trading becomes eligible

Kyle (1985) define concept of depth as the order flow required to move prices by one unit. The null hypothesis proposes a reduction in market depth as the increase of informed trading associated with margin-eligibility. Because of higher concentration of informed traders, the market makers want to trade in smaller amount for each quote to void being hit by information-motivated orders. As an alternative hypothesis, margin trading could increase the depth because the investors' wealth constraint is reduced (Conrad 1989; Seguin 1990) and more trades could occur on credit. Additionally, margin eligibility stimulates the sensitivity of informed traders on mispricing. Since more informed order flows will occur in response to a slight amount of mispricing (Madhavan and Smidt 1993), the market depth could increase by the informed order flows.

H5. The weight on public information decreases and the weight on current trading information increases.

Since trading becomes more informative, the expected stock value is more likely to be driven by the revision and less likely to be driven by a combination of the previous public prices., as a result that the current order flow reflects a noise signal based on private information.

H6. The informativeness of trades is enhanced upon the introduction of margin trading

The stock price is decomposed into a random walk component that reflects market efficiency and a stationary component that embodies microstructure imperfections (Hasbrouck 1991, 1993). The more informative trading increases the price component of private information and reduces the component of public information. Thus the random walk pattern of the stock price is expected to decrease.

H7. The higher level of margin trading, the more information asymmetry is reflected in the stock price.

The hypothesis is essentially based on the argument that margin trading is associated with informed trading in this particular set. To test this hypothesis, I divide my samples into two groups based on the level of margin trading. I then test H2, H5 and H6 separately for the group with high level of margin trading and the group with low level of margin trading.

<u>Data Description</u>

The proprietary microstructure dataset is offered by a Chinese private security-data company. The dataset covers the period of 3 months before and 3 months after the stocks become effectively marginable. This analyzing period is consistent with the microstructure event studies of Diether et al (2009) and Chen et al (2010) on price informativeness. Since margin-eligibility is granted only to the constituent stocks of Shanghai 50 Index and Shenzhen 40 Index, there are 90 marginable stocks in the market. Since one stock is missing pre-event data, my sample contains 89 stocks in total. For each transacted trade, there are five ask limit-orders and five bid limit-orders. The bid-ask spread is calculated using the most inside bid-quote and ask-quote. The depth is defined following Kyle as the number of shares transacted at current bid-ask spread; it measures the investors' willingness to trade.

Results

The Impact of Margin Eligibility on Trading Costs

If margin eligibility encourages informed trading, I should observe a detrimental impact on the liquidity of the marginal stocks. Most previous studies measure liquidity by examining the bid-ask spread and the market depth at the quote. I use all quoted bid-ask spreads and depths, and the amount of time each quote is valid for each sample stock. Then, for each day, I estimate daily relative bid-ask spread as the weighted average of all relative spreads in a day, where the weight is the amount of time during which the quote is hold valid from the previous transaction to the current transaction. The bid-ask spread is the difference between the ask price and the bid price divided by the average of bid and ask prices. In the spirit of Skinner (1989) and Kumar et al (1998), the bid-ask spread ratio for a particular stock is defined as the ratio of the median daily relative bid-ask spread in the post period divided by the median daily relative bid-ask spread in the pre-period. A depth ratio is defined analogously. A ratio that is greater than one implies an increase in the r measure. I also construct the volatility ratio using the median of post-period daily variance of the mid-point of bid-asks spread divided by the median daily variance.

Table 10 reports the bid-ask spread ratio, the depth ratio and the volatility ratio for the marginable stocks around the introduction of margin trading. I calculate the mean and median of these ratios, as well as the proportion of the stocks that has the ratio greater than one. In Table 10, the bid-ask spread increases by a median value of 20% and the variance increases by a median value of 56%. Moreover, the proportion of stocks with increased spread is 94.38% and the proportion of stocks with increased volatility is 100%. The p-values of Wilcoxon signed rank test

of bid-ask spread and stock volatility are both under 1%. These results together support the hypothesis of information-motivated trading induced by margin eligibility.

Change in Market Depth

In Table 10 the relative depth increases by a median value of 16.2% at 1% significance level. This result is contrary to the informed trading hypothesis that uninformed investors would trade less to avoid being hit by information-motivated orders. As I previously argue, the increase in depth could be explained by two reasons: (1) margin trading reduces traders' wealth constraint so investors can trade in larger orders by taking leverage (Conrad 1989). In this sense, the margin eligibility also provides liquidity to the market by enabling investors to trade on credit. (2) The sensitivity of informed orders to mispricing increases through margin eligibility. Upon a series theoretical works, Madhavan and Smidt (1991) defines the depth as: $\frac{1}{\lambda} = \frac{\alpha \, \pi(\sigma_x^2)}{1 - \pi(\sigma_x^2)}$, where $1/\lambda$ is the market depth following Kyle's (1985) definition. Madhavan and Smidt (1991) refer $\pi(\sigma_x^2)$ as the market quality and information in respect to uninformed trading, σ_x^2 and α as the relative sensitivity of informed trader's order flows in response to perceived mispricing. A comparative statics is therefore developed: $\frac{\partial(1/\lambda)}{\partial(\alpha)} > 0$. When α is large, a slight difference between the current price and the beliefs of informed traders could lead to large amount of informed trading flows. An increase in α implies more informative trading flows in response to a perceived mispricing and the price would adjust faster to its fundamental value and therefore an increase in market depth, ceteris paribus.

Order Follow Change

Table 11 presents three variables of order flows: the trading volume, trading frequency, and the average transaction size. I apply the same methodology to calculate the ratio to compare the pre-event level and post-event level for the trading volume ratio and trading frequency ratio. The transaction size ratio is similar with depth ratio but it takes equal-weighted average of the transacted volumes whereas the other two ratios take the time-weighted average. Table 11 shows that all three variables of order flows are not improved upon the introduction of margin trading. None of these variables are economically significant, as it is reflected by the proportion of increased stocks and the one-tailed signed test. This evidence suggests that there is no substantive impact on order flows and trading activities. A possible explanation to the ambiguous change in order flows could be the following: informed traders are able to submit larger orders because of the margin positions they are taking, whereas uninformed investors are trading in smaller orders in afraid of being hit by the informed orders. Therefore, the net effect to order flows could be balanced out and the direction of the change would be hard to determine.

Overall Market Liquidity Change

The preliminary result showed in Table 10 is a mixed evidence of market liquidity affected by the introduction of margin trading. Specifically, it shows a high transaction cost indicated by high bid-ask spread but a higher depth that would allow traders to trade in larger volumes. Therefore, the impact on the trading activities and order flows needs to be further investigated. Following Mayhew et al (1995) Kumar et al (1998) and Alexander et al (2004), I estimate the cross-sectional regressions of the change in the measures of market liquidity presented in table 10- bid-ask spread and depth—on changes in three control variables: price,

volume and volatility. This set of regression equation is based on Benston and Hagerman (1974) and Stoll (1978), who show that spreads are negatively related to price and volume and positively related to risk. Because Easley and O'Hara (1987) show that trade size is related to the adverse-component of the spread, I include average trade size as well. My regression takes the form of the following:

$$SpreadRat_j = \beta_0 + \beta_1 VolumeRat_j + \beta_2 PriceRat_j + \beta_3 VarianceRat_j + \varepsilon_j \qquad (9)$$

$$DepthRat_j = \gamma_0 + \gamma_1 VolumeRat_j + \gamma_2 PriceRat_j + \gamma_3 VarianceRat_j + \varepsilon_j \qquad (10)$$

$SpreadRat_j$ is the ratio of the median of pre-event time-weighted bid-ask spread divided by the median of post-event spread for stock j. $DepthRat_j$, $VolumeRat_j$, $PriceRat_j$, and $VarianceRat_j$ are defined analogously to measure the change in depth, daily trading volume, price and volatility. For each of the liquidity variables, volume, price and volatility are taken as the control variables. The parameter estimates of these regressions are presented in Table 12. The estimates of the intercept are predicted to have positive sign and they are of primary importance. Table 12 indicates an increase in the spread as the intercept is +1.15 with an associated significant level less than 1%. On the other hand, the intercept of depth indicates no significant change. Since it is reasonable to believe that the credit trades is an exogenous increase in volume and depth, the insignificant change in depth and order flow suggests that uninformed traders trade in smaller volumes to avoid being hit by informed trades. Overall my result indicates an aggravating market depths and an increase in trading costs; the market liquidity condition is worsened by restricted margin eligibility.

Spread Decomposition Surrounding Eligibility

If more informed trades are involved in margin trading, the information asymmetry rises and the adverse selection component of the spread increases as a fraction of the total spread. Roll (1984) developed a simple model of measuring the effective spread of microstructure transactions: $EstSpread_{jt} = 2\sqrt{-Cov}$ where, COV is the first-order autocovariance of the transaction prices. Based on Roll (1984)'s work, George, Kaul and Nimalendran (1991) incorporate the bid-to-bid prices correlated with transaction prices to take off the frictions induced by time-varying expected returns in the trading process. They define COV as the serial covariance of the difference between the returns based on transaction prices and the return based on bid-to-bid prices. To decompose the spread into adverse selection components and order processing costs, I apply the estimation model in the spirit of George et al (1991):

$$EstSpread_{jt} = \delta_0 + \delta_1 QuotedSpread_{jt} + \delta_2 Event_t + \delta_3 (QuotedSpread_{jt} \times$$

$$Event_{jt}) + \varepsilon_{jt} \qquad j=1,2,...,n; \qquad (11)$$

I first use intraday data to estimate the effective spread $EstSpread_{jt}$ for the pre-allowance period and the post-allowance period on a daily basis. I incorporate a dummy variable "Event" that takes the value of 0 if the period is pre-event and 1 otherwise. I then regress the effective spread on quoted spread, event dummy and their interaction variable. δ_3 is the coefficient of the interaction variable and it is the primary important coefficient in my observation. A negative δ_3 implies an increase in the proportion of the bid-ask spread determined by adverse selection costs; it also suggests the order processing costs taking less proportion in the bid-ask spread. Table 13 provides the estimates the coefficients in the above equation. The results in Table 13 indicate that the introduction of margin trading is associated with a significant

increase in the adverse selection component. In this particular market, the order trading costs does not ideally explain the variation of the effective spread. A low level of δ_1 indicates the effective spread is not quite explained by quoted spread but mostly determined by adverse selection, as δ_1 is only 0.023 whereas it shall take the value of 1 if no adverse selection is involved. δ_3 takes a negative value at 1% significant level. δ_1 and δ_3 together implies, the proportion of spread explained by order-processing cost, other than adverse selection, decreases from 0.023 in the pre-event period to 0.001 in the post-event period. Margin eligibility not only increases the spread, but also reduces the fraction of the increase spread being determined by adverse selection costs. In other words, the increase in spread is mainly driven by the induced adverse selection. This dramatic change of coefficients indicates that information asymmetry deteriorates severely upon the introduction of margin trading. In addition, δ_2 is positive and statistically greater than 0. It further supports my previous argument that the margin trading increases the flow of information by increasing bid-ask spread.

Panel B of Table 13 provides the results for separated groups of stocks based on their margin trading volumes under the same specification of panel regression. For the group with higher level of margin buying or higher level of short-selling, δ_3 is negative as predicted and it is both economically and statistically significant. In contrast, δ_3 for the groups with lower level of margin buying or short-selling is not statistically significant and the economical magnitude is much lower than its counterparts. Moreover, $\delta2$ is higher for the groups with active margin trading, suggesting a more increase in the effective spreads for these groups. Overall, the adverse selection component increase more for stocks with higher level of margin trading and short-selling.

Impact of Margin Eligibility on the Weight Placed on Public Information

Madhavan and Smidt (1991) developed an intraday security price movement model to detect the information asymmetry in the stock trading. In their models, market makers use Bayesian rules to update their beliefs about the expected value of the stock. The expected stock value is represented as a combination of the prior mean based on public information and a revision due to a noisy signal based on private information contained in the current order flow. The relative weight placed on public information is then inversely related to the degree of information asymmetry in the market. I estimate the following version of the reduced form model for the revision in transaction price using transaction level data in both pre-allowance and post-allowance periods:

$$\Delta P_{jt} = \beta_{1j}q_{jt} + \beta_{2j}D_{jt} - \beta_{3j}D_{jt-1} + \epsilon_{jt} - Z_{jt}\epsilon_{jt-1} \tag{12}$$

Where ΔP_{jt} is the revision in price at trade t, q_{jt} is the signed transaction size, D_{jt} equals +1 for a buy and -1 for a sell, and there is first-order auto correlation in the error term. The relative weight placed by the market maker on public information is estimated as $PRIOR_j = \beta_{3j}/\beta_{2j}$. Madhavan and Smidt (1991) show that $PRIOR_j$ is inversely related to the level of information asymmetry in the market. This follows from the fact that in a market with a higher level of information asymmetry, each trade conveys more new information, and therefore has a higher impact on the price revision. This will result in a higher value of β_{2j} relative to β_{3j}, and therefore lower value of $PRIOR_j$.

I expect to see the values of PRIOR become lower in the post-allowance period if the induced margin trading activities increase the level of information asymmetry and adverse selection. In Table 14, I provide the results on the ratio of the weight placed on public

information. I find that PRIOR decrease by a median of 1.8 percent upon margin eligibility, suggesting that market-makers place relatively higher weight on the information contained in the most recent trade in determining the new price. The increase in PRIOR is significant at the 0.01 level and supports the hypothesis that margin eligibility results in a higher level of information asymmetry in the underlying stock market. Once again the increased weight on private information is more driven by the stocks with higher level of margin trading. As it shows in the lower section of the table, the stocks with higher level of margin trading has the PRIOR decreases more than that of the stock with lower level of margin trading. For example the ratio of post-event PRIOR divided by pre-event PRIOR is 98.29% on average for the high margin trading group, compared to 99.035 for the low margin trading group. The proportion of stocks with decreased PRIOR is 69% for high margin trading group, compared to the 60% for low margin trading group. The decrease is also more statistically significant showed by the lower p-value.

The Impact of Margin Trading Introduction on Informativeness of Trades

I use an approach developed by Hasbrouck (1991,1993) to measure the changes in the degree of asymmetric information after margin changes. The advantage of this approach is that it explicitly model the effects of trade size on price and quote revisions. The Hasbrouck technique is based on a model that decomposes a security's quote midpoint into its random walk and its stationary components. Specifically, the quote midpoint, qt, is defined as the sum of the true price, mt, and a term that embodies microstructure imperfections, st. the efficient price is assumed to evolve as a random walk, i.e., mt+wt, where the innovation wt reflect updates to the public information set and have the properties Ewt=0, $Ew_t^2 = \sigma_w^2$, $Ew_t w_T$=0 for $t \neq T$.

In this framework, a summary measure of information asymmetry is defined as:

$$R_w^2 = \frac{Var[E(w_t|x_t - E(x_t|\emptyset_{t-1}))]}{Var[w_t]} = \sigma_{w,x}^2 / \sigma_w^2 \tag{13}$$

Where xt is a vector of trade attributes defined as $+(trade\ volume)^{1/2}$ or $-(trade\ volume)^{1/2}$ if the trade is a buy or sell respectively. $\emptyset_{t-1}$ is the public information set prior to the trade at t. To measure R_w^2, Hasbrouck uses a vector autoregression (VAR) model for revisions in quotes, $r_t = q_t - q_{t-1}$ and trade attributes, xt, defined as:

$$r_t = a_1 r_{t-1} + a_2 r_{t-2} + \cdots + b_1 x_{t-1} + b_2 x_{t-2} + \cdots + v_{1,t} \tag{14}$$

$$x_t = c_1 r_{t-1} + c_2 r_{t-2} + \cdots + d_1 x_{t-1} + d_2 x_{t-2} + \cdots + v_{2,t} \tag{15}$$

Where the error terms are mean zero and serially uncorrelated with $Var(v_{1,t}) = \sigma_1^2$, $Var(v_{2,t}) = \Omega$, and $E(v_{1,t}, v_{2,t}) = 0$. The Vector Moving Average (VMA) representation corresponding to the VAR model is:

$$r_t = v_{1,t} + a_1^* v_{1,t-1} + a_2^* v_{1,t-2} + \cdots + b_0^* v_{2,t} + b_1^* v_{2,t-1} + b_2^* v_{2,t-2} + \cdots \tag{16}$$

$$x_t = c_0^* v_{1,t} + c_1^* v_{1,t-1} + c_2^* v_{1,t-2} + \cdots v_{2,t} + d_1^* v_{2,t-1} + d_2^* v_{2,t-2} + \cdots \tag{17}$$

With

$$\sigma_{w,x}^2 = \sum_{j=0}^{\infty} b_j^* \Omega b_j^{*'} \qquad \text{and} \qquad \sigma_w^2 = \sigma_{w,x}^2 + (1 + \sum_{j=1}^{\infty} ba_j^*)^2 \sigma_1^2 \tag{18}$$

In the spirit of Mayhew et al (1995) and Kumar (1998), I take 5 and 10 lags in the VAR model and VMA respectively. R_w^2 is computed for each firm in the pre-and post-introduction period. My hypothesis predicts that R_w^2 would increase after the margin introduction. The results of this analysis are presented in Table 15. As can be seen from the table, the value of R_w^2 increases as predicted after the margin introduction. This shows that the informativeness of stock trades increases upon the introduction of margin trading. The results indicate that margin

eligibility is associated with an increase with the informativeness of the price with the significance of 10%. As predicted, Panel B shows that the increase is higher and more statistical significant for the stocks with more margin trading activities. Table 16, I regress R_w^2 of post-event period on the accumulated level of margin trading for the same period, while controlling for the R_w^2 of pre-event period. Despite a small sample of observations, the margin trading variable does have explanatory power in the regression at 10% significance level. This evidence is consistent with my hypothesis that more margin trading could increase the information content of the marginable stocks.

<div align="center">Conclusion</div>

The margin trading practice in China is unique because the exchange regulator imposes high and strict institutional requirements for participation. These requirements disproportionally affect the uninformed traders and informed traders and increase the information content of margin trades. In this study, I find that the introduction of margin trading is associated with an increase in the bid-ask spread, price volatility, and the adverse selection component of the spread. While margin trading could typically leads to higher trading volume and an improved depth, no significant changes are found in the orders flows and market depth after controlled for price, volume and volatility. It indicates the uninformed traders are discouraged by informed trades. Moreover, I also find the informativeness of price increases for the marginable stocks and the relative weight placed on public information decreases. These results are mostly driven by stocks that have higher level of margin trading. Overall, my results suggest that high restriction on margin trading could encourage informed trading activities.

The regulatory implication for the Fed is the following: besides margin requirement, several other restrictions could potentially serve as venues to curb the margin trading behavior, for example: margin loan rate and the amount of minimum margin. By imposing strict restrictions, the Fed may not necessarily reduce informed trading and market volatility, because the concentration of informed traders for margin trading is also likely to increase as a result of higher restrictions. My results of microstructure evidence suggest that margin restriction may not be an effective policy tool for controlling volatility, improving market liquidity or reducing firms' cost of capital. However, it does improve the overall informational environment of the security, as it stimulates the information collecting and disseminating process and hence more information could be incorporated into the prices. Despite an increase in the intraday volatility, the price could become more efficient by additional information content, thus the probability of mispricing and market bubble could be reduced. In the future, I would like to investigate through this direction.

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ESSAY III: DOES SHORT-SELLING LEAD TO SEASONED EQUITY OFFERING DISCOUNT? AN EXAMINATION OF THE EFFECTS OF THE AMENDEMENTS TO SEC RULE 105

Introduction

On October 9th, 2007, the SEC put in effect the amendments to Rule 105 under Regulation M, as an effort to further regulate short-selling activities prior to seasoned equity offering and to further safeguard the capital raising process during issuances. If the amendment is binding, traders with short positions established in a restricted pre-issue period cannot purchase shares in the offering. In comparison, the pre-amended Rule 105 only disallowed using offering shares to cover short positions. The objective of the new amendment was to eliminate the ability, potentially provided by the un-amended rule, of short-sellers to use SEO shares to indirectly cover short positions established in the restricted period prior to the SEOs.

The objective of this paper is to examine the effects of the amendment to Rule 105 on the trading behavior of short-sellers. In particular, I examine how the ability to hedge short positions affects whether short-sellers trade in an attempt to manipulate prices and how their trading affects SEO discounts. Several articles empirically examine the effect of pre-issue short sale constraints imposed by Rule 105 on the pricing of seasoned equity offers (e.g., Safieddine and Wilhelm, 1996; Corwin, 2003; Kim and Shin, 2004; Henry and Koski, 2010; Autore, 2011). For example, Safieddine and Wilhelm (1996) find evidence of manipulative trading before Rule 10b-21 (a previous version of rule 105), but no evidence under the rule. Kim and Shin (2004), on the other hand, argue that the rule also reduces informative short selling and reduces market efficiency. Henry and Koski (2010) find that short-selling prior to SEOs tend to be manipulative

under the pre-amendment Rule 105. No study to date, however, has examined the effects of the new amendment that could substantially strengthen the rule.

Previous studies suggest two general motives for short selling during SEO periods: information and manipulation (Gerard and Nanda 1993; Henry and Koski 2010). The information-motivated traders sell short based on negative private information. The manipulative traders sell short against their information even the information is normally positive. Both types of trades could profit from the ability of investors to purchase SEO shares to close their short positions. On the one hand, if investors could cover their short position through fixed, discounted SEO prices, the risk exposure of their short-sale trades could decrease and it would be easier for traders to with negative information to sell short during the SEO period. On the other hand, there is also a motivation for manipulation through short-selling prior to SEOs. In order to manipulate stock prices, a group of traders sell short without negative information or even with positive information. By trading against their information, manipulative short-sellers could exacerbate investors' uncertainty on the value of offerings. During the SEO bidding process, uninformed bidders of SEO shares require larger discount in prices to compensate the risk they are taking. Several studies have actually shown that uncertainty on stock values is positively associated with SEO discounts. For example, Corwin (2003) documents that SEO discount is positively related with pre-event volatility, bid-ask spread and pre-offer cumulative abnormal returns, which are indicators of price uncertainty. Therefore, by increase market uncertainty, manipulative short-sellers could artificially increase SEO discount and earn profit by using SEO shares to cover.

The SEO discount resulted from manipulative enlarges the cost of capital for firms and leads to the unfairness in the capital market. In order to curb manipulative behaviors, SEC has adopted a series of rules to regulate short-selling activity and to reduce issue discounts. On

August 25, 1988, the SEC adopted Rule 10b-21 to prohibit the use of shares purchased in the SEO to cover short positions established after the filing of a registration statement. Safieddine and Wilhelm (1996) find that after the rule enforcement, the short-selling activity during the restricted period is significantly lower than the pre-enforcement level. Rule 10b-21 appears to have curbed short-selling activity and issuing firms suffered smaller issue discounts. This view is contradicted by the findings of Henry and Koski (2010). Using daily short-selling information, Henry and Koski (2010) examine the manipulative role of short sellers prior to SEOs and, more specifically, the relation between short selling activity and SEO discounts. Henry and Koski find that Rule 105 does not successfully prohibit manipulative short-selling around SEOs, as evidenced by a positive relation between SEO discounts and short-selling activity within the restricted period. Their findings are consistent with the observation of the SEC. In particular, the Commission has become aware of "attempts to obfuscate the prohibited covering" and "in some cases, strategies were used to disguise Rule 105 violations" (SEC Final Rule; Rule 34-56206). It seems a strengthened version of Rule 105 may be necessary in order to effectively prevent manipulative short selling.

Before the enforcement of the amendment, the SEC stated that "the rule (previously known as 10b-21 at that time) does not expressly prohibit short sellers from "directly or indirectly" covering short sales out of the offering" (SEC Final Rule; Rule 34-38067). At that time, the Commission decided not to add the term "indirectly" to Rule 10b-21 (now known as Rule 105) when that rule was adopted. Therefore, under the pre-amendment setting, traders could indirectly use SEO shares to cover short positions and potentially develop "a proliferation of strategies designed to conceal the prohibited covering and continued violations of the rule" (SEC Final Rule; Rule 34-38067). If the new amendment guarantees that no SEO shares could be used

to cover (or hedge) a short position, there is little incentive for manipulative short selling during the restricted period. Traders with negative information, however, would still have an incentive to trade on their information and sell short during the restricted period. By buying shares from market makers instead of SEO issuers, they can still earn profit from their information. Therefore, the amendment should significantly reduce manipulative short-selling while still leaving incentives for informed investors to trade on their information. As a consequence, short selling during the pre-SEO restricted period should become more informative (Gerard and Nanda, 1993), leading to more informative prices and thus to smaller SEO discounts.

Using a sample of SEOs between September 2009 and December 2011, I find strong evidence of informed short selling around SEO announcements. Around the issue dates, higher levels of short selling in the restricted period are strongly related to smaller issue discounts, which is consistent with the goal of SEC's amendment to curb manipulative trading. These effects are significant only for the non-shelf offerings in my sample. I find that the evidence of informative trading is much weaker for shelf offerings. My study makes several contributions to the literature. First, I expand the testing period to the post-amendment period. Henry and Koski (2010) find the evidence of manipulative trading during the pre-amendment period. My results are derived from a similar methodology and are motivated by a similar theoretical framework and show strong evidence of informative short-selling. My results suggest the SEC restrictions on short-selling squeeze out manipulative short-sellers from using SEO shares to cover their positions. Second, I find the short selling makes prices more efficient for the period around SEO. The documented negative abnormal return on the issue date is less pronounced when the level of pre-issue short selling is high. The post-issue price movement is uncorrelated with the short-selling, suggesting no price recovery due to short-selling and a permanent price decline due to

shout-selling. Last, I find the informative role of short sellers is more pronounced if announcement is made over a longer period before issue. It suggests that given more time, traders could better react to the announcement with more information collected. Thus short-selling could contain more information on the value of SEO shares and has a larger effect on SEO discount.

<div align="center">SEC Regulations on Seasoned Offering</div>

Before 1929, companies could issue stock at will. For regulation the Congress passed several Federal securities laws to enforce information disclosure of securities and regulate insider trading between 1933 and 1940. This series of laws is administered by the Securities and Exchange Commission (SEC), established by the Securities Exchange Act of 1934. The SEC requires firms to file with the SEC for issuance of stocks and disclose financial information of firms. After filing, a registration statement is effective and the issuer can sell its securities to the public. For many years an issuer has to sell its offered stock immediately after its filing with the SEC. Since 1982 firms could sale register securities up to two years before the issuance rather than issue immediately. This process is known as shelf registration.

The current SEC regulation toward seasoned issuance reflects in a series of rules in the package of Regulation M issued in 1997. Consisting of five new rules and a definitional rule, Regulation M replaces Rules 10b-6, 10b-6A, 10b-7, 10b-8, and 10b-21 under the Securities Exchange act of 1934. Rule 101 regulates the activities of underwriters and other distribution participates during the offering. Rule 102 covers the activities by the issuer or selling security holder during the offering. Rule 101 and Rule 102 specify a restricted period around offerings, during which the regulated parties cannot purchase a covered security directly or indirectly.

Regulation 103 requires Nasdaq market marker to effect all transactions "in its capacity with the specification of purchase limitation, bid lower bound and size, and notification to NASD during the market making process". Rule 104 refers to stabilizing activities by the lead underwriter to maintain the price of a security when it falls below the offer price. Rule 105 is an update version of Rule 10b-21 to further regulate the short-selling activities that use shares from seasoned equity offering to cover short positions. Even though Rule 105 retains the exclusion for shelf-registered offerings, the SEC holds reservations to revoke the exclusion of shelf-registration.

<u>Short-sale in Connection with Seasoned Offering</u>

In 1972, the SEC for the first time addressed short-selling activities around SEO in violation of the anti-manipulation provisions of the 1934 Exchange Act. At that time, it is a commonly recognized practice to establish short positions prior to offerings in order to drive down offer price and increase SEO discounts. Although short-sellers with negative information could also benefit from discounted seasoned offering shares, critics argue that the ability to cover a short position with shares purchased at the fixed offer price provides a strong incentive for traders to sell short in a manipulative manner that would not otherwise exist (Safieddine and Wilhelm 1997). The manipulative short-selling would reduce market efficiency and expose issuing firms to higher issuing costs. Although the SEC launched three proposals for curbing the manipulative short-selling activities, none of the proposed rule has become finally enforced until later.

In 1988, the first constraints on short sale prior to seasoned equity offers were imposed by SEC under Rule 10b-21. The rule prohibits short sellers from covering short positions with shares purchased in a seasoned equity offering if the position was established between the filing

dates and offer dates. In 1997 the Securities and Exchange Commission (SEC) replaced Rule 10b-21 with Rule 105 of Regulation M, under which the restricted period is limited to the five business days prior to the offering. In other words, the short positions covered by offer shares should only be established more than 5 days prior to the offering. The rule replacement creates a shorter restricted period if the filing date of SEO is beyond 5 days of issuance.

Several studies examine the relation between SEO discount and short-selling activities around SEO, as well as the effectiveness of the control of short-selling under rule 10b-21 (now Rule 105). Safieddine and Wilhelm, JR. (1996) find that before Rule 10b-21 is enforced, there is a significant positive relationship between SEO discount and the short-sale interest prior to the month of SEO. They find this relationship becomes insignificant and even negative after the rule is imposed. On the other hand, some argue that the rule compromises market efficiency and increase offer price discounts, for example, Charoenwong, Ding and Wang (2010) find that after the adoption of Rule 105, the speed of price discovery slows and price becomes less efficient on the offer day. In addition, Autore (2011) also finds that the rule does not influence the level of SEO discount, by comparing regular SEOs and shelf-registered SEOs, which are exempted from pre-issue short sale constraints until 2004. Rule 105 seems to be successful.

Under the pre-amendment version of Rule 105, the SEC said "the rule does not expressly prohibit short sellers from 'directly or indirectly' covering short sales out of the offering (SEC Final Rule; Rule 34-38067). The Commission decided not to add the term 'indirectly' to Rule 10b-21 (now Rule 105) at the time that rule was adopted, and no different arguments have been presented that would alter its decision". The "indirect" way could be the source that short-sellers camouflage themselves and conduct the prohibited covering, as short-sellers could purchase shares in different accounts other than the account for the short-sale

transactions. It is likely that traders develop a strategy that "conceal the prohibited covering and continued violations of the prior rule" (SEC Final Rule; Rule 34-52602). Even though the NASD urged that Rule 105 be amended to define expressly the covering "directly" and "indirectly", the SEC did not specify the term in any related documents.

However, till recently some evidence suggests that the rule may not effectively curb manipulative short-selling activities prior to SEOs. In a study using short-sale data during Regulation SHO period (Jan 2005-Dec 2006), Henry and Koski (2010) examine whether short selling around SEO reflects informed or manipulative trading. On the one hand, when they use monthly short interest data, they find similar results of Safieddine and Wilhelm, JR. that under the rule, short-selling is weakly related with SEO discount. On the other hand, using daily short selling data with more testing power, they find strong evidence of manipulative short-selling. Specifically, they find that the level of short-selling in the restricted period increases with SEO discount and conclude that the rule excludes some but not all manipulative trading.

The SEC has also become aware of the trading activities that are not compliant with the essence of Rule 105—using SEO shares to cover short positions. The SEC finds numerous "attempts to obfuscate the prohibited covering". This reflects in a number of litigations by the SEC on the deceptive behaviors of purchasing SEO shares to cover short positions in the restricted period. A more strict regulation seems to be necessary. On October 9, 2007, the Securities and Exchange Commission (SEC) effects the amendment to Rule 105 of Regulation M to further regulate short-selling activities prior to seasoned equity offering (SEO). The amendment is in accordance with the SEC's purpose to prevent manipulative trading and to safeguard capital raising process during the issuance. When the amendment is binding, traders with short positions established in the restricted pre-issue period cannot purchase offering shares.

In comparison, the pre-amended rule only disallows using issued shares to cover the short positions.

The imposed amendment completely eliminates the covering element of the prior rule, especially the covering activities that are carried out indirectly. Even without the explicit definition of "directly" or "indirectly", the amendment undoubtedly ensures that short sellers cannot use SEO shares to cover the positions. This study examines the effect of the amendment on the manipulative role of short selling under the effect of the amendment that substantially strengthens the rule. A number of articles empirically examine the period before the amendment for the relationship between short selling and SEO discount (e.g., Safieddine and Wilhelm, 1996; Corwin, 2003; Kim and Shin, 2004; Henry and Koski, 2010; Autore, 2011). In this article, we fill the void by exploring the relationship under the amendment.

<div align="center">Theoretical Framework and Hypothesis</div>

Discount in SEO is the percentage difference between offer price and the previous day's closing price. A lower offer price compared to previous day's closing price means a larger SEO discount. The first study that documents systematic SEO discount in United States is Smith (1977) with a discount rate around 2% on average. Since then numerous studies document SEO discount with an increasing trend across years.

Since discounts in SEO represent a substantial cost to issuing firms, a number of theories try to explain SEO discount. Some explanations to SEO discount are based on uncertainty and information asymmetry among different parties during the offer process, for example Loderer, Sheehan, and Kadlec (1991). The model developed by Rock (1986) addresses that the documented discount is a compensation required by uninformed investors to compensate the

possibility that informed investors will take away good issues and leave disproportionate bad issues to them. Even uninformed bidders could win the bids, there is a probability that they overpay the shares they participate in, and exposed to the "winners' curse" problem. Therefore, a price discount in issued shares is necessary to attract uninformed traders and float the market. To this point, Beatty and Ritter (1986) document a positive relationship between uncertainty on share values and underpricing of initial public issues. Although the market is subject less uncertainty in seasoned equity offering compared to initial public offering, it is generally expected the ex-ante uncertainty about new issues could lead to more discount during the issue process.

According to Gerard and Nanda (1993), informed short selling makes market prices more efficient, but manipulative short selling makes market prices less efficient. Inefficient prices imply large issue discounts. In the Gerard and Nanda (1993) framework, the issuer must set the offer price such that uninformed bidders have zero expected profits; otherwise, they would not participate. Gerard and Nanda show that the equilibrium SEO issue price, P_Q^*, under these conditions will be:

$$P_Q^* = E[\tilde{V}|Q] + \frac{Cov[\tilde{a}U,\tilde{V}|Q]}{E[\tilde{a}U|Q]} \tag{19}$$

Where $\tilde{a}U$ is the number of new shares allocated to uninformed bidders, $\tilde{V}$ is the end of period value of the stock, and Q is secondary market net order flow. Note that $Cov[\tilde{a}U,\tilde{V}|Q]$ is negative. Uninformed traders tend to get more shares in deals with lower fundamental values, the standard winner's curse problem.

Since $P_Q^* < E[\tilde{V}|Q]$, the SEO offer price will be set a discount to $E[\tilde{V}|Q]$, the equilibrium price absent an SEO. The magnitude of the discount will depend on the severity of the winner's

curse problem. Secondary market order flow, Q, affects the equilibrium offer price through its impact on the equilibrium price absent an SEO and the impact on the second term, the discount. Manipulative traders won't necessarily profit through the first term, because the market price responds to the selling pressure (Kyle 1985). So, without the SEO, there is no opportunity for profitable manipulation. However, manipulative trading increases the discount by reducing the informativeness of the secondary market order flow. Gerard and Nanda show that even if traders have positive information, they may want to sell before the offering to conceal their information. This strategy is optimal if they can recover secondary market losses by purchasing at a sufficiently reduced price in the offering. Therefore, manipulative short selling may be profitable because of the impact of secondary market trading on the discount. Consistent with the theory, I test the following hypotheses:

H1A. Higher levels of informed short selling before SEO issue dates should be associated with smaller issue discounts.

H1B. Higher levels of manipulative short selling before SEO issue dates should be associated with larger issue discounts.

H2A Informed short selling before SEO issue dates should be associated with a permanent price decline.

H2B. Manipulative short selling before SEO issue dates should be associated with a post-issue price recovery.

H3. If the amendments to Rule 105 is effective, short selling at least six days before the issue date should be greater than short selling closer to the issue date.

Data and Methodology

To begin, I collect the short-selling information from the website of NYSE Arca. To the best of my knowledge, it is the only exchange that publicly discloses the daily short-selling information for each stock being traded in the exchange. NYSE Arca is owned by NYSE Euronext, which merged (as NYSE Group) with Archipelago Holdings in a reverse merger in Feb 2006. As of March 1st 2007, NYSE Arca is the second largest electronic communication network in terms of shares traded. Approximately one out of every six shares traded on the American financial markets is traded on the system. For New York Stock Exchange-listed securities or Tape A, it accounts for just over 10% of the shares traded. For NASDAQ-listed securities, NYSE Arca accounts for approximately 20% of the trading volume. For exchange-traded funds, NYSE Arca accounts for 30-40% of the traded volume. The short-selling data from NYSE Arca covers the period from year January 2010 to March 2012, as well as the June and July of 2009. The data period lies after the amendment of rule 105 and the data contains the information on total volume, short-sale volume, but not the flag associated with exemptions from short-sale rules and short-sale covering transactions. A number of studies that use daily short-selling information released by all Self-Regulatory Organizations pursuant to the SEC-mandated Regulation SHO (Diether, Lee and Werner 2009; Asquith, Oman and Safaya 2010; Henry and Koski 2010). Even though the data covers every transaction of short-sale trades in the major markets, the period the data covers is only for two years starting from January 2005 to December 2006 and is before the amendment to Rule 105. Therefore those data are not suitable for my study.

The SEO data is obtained from the Securities Data Corporation (SDC) global New Issues database for all U.S. public common stocks that were announced and issued for the respective period of short-selling data. I exclude IPOs, rights offerings, unit issues, closed-end funds, REITs, international offerings and offerings by non-U.S. firms. Moreover, I obtain firms' information of financial statement from Compustat and trading information from CRSP. After merging the short-sale information data, SEO samples and financial and trading information, I am left with a final sample of 408 offerings.

Table 17 provides a summary statistics for my SEO sample. Overall, the average offering issued 9.68 million shares and raised $132 million in proceeds. The majority of my sample offerings are from first listed on NASDAQ (238 out of 408). There are 143 offerings from firms listed on the NYSE, these firm issues are characterized by more shares offered, larger offering proceeds and higher offering price. The result is in the similar magnitude with that reported by Henry and Koski (2010) for the period of 2005 to 2006. Of the 408 offerings in my sample, 291 are shelf offerings. The close-to-offer return (negative SEO discount) is -5.13% for shelf offering and 0.74 for non-shelf offering. I also divide my total sample into three subsamples based on the number of days between announcement and issue date. Rule 105 applies to short sales made within 5 days of the offering, so this breakpoint allows for tests of the rule's effectiveness. There are 328 offerings with more than 5 trading days between announcement and issuance. On average, the discount level is 2.98%. In contrast, the discount level is almost twice large for the offerings with no announcement before the issue date (AD=ID) and announcements that are less than 5 days before issuance.

Gao and Ritter (2010) reports different types of SEO issuance has different length of period between announcement and issuance. In particular, they mention that fully marketed

offers, compared to accelerated offers, have longer time before the actual issuance of shares and hence better perspectives[19]. Even though they argue shifted demand is the reason for the difference, they also admit information asymmetry plays a role in the issuance process. The longer time means more time for investors to learn information about the issuance and reduce the uncertainty about the share values, and the shorter time suggests the opposite. My result in table 1 is consistent with this notion that longer period between announcement and issuance is associated with more uncertainty and hence higher discount. In Henry and Koski's report, the mean number of trading days between announcement and offering is less for shelf offering and more for non-shelf offerings. I find that for shelf offers the discount is higher, possibly due to shorter time between announcement and offering.

To test the hypotheses, I construct several statistics to measure abnormal returns and trading. Consistent with Henry and Koski (2010), I define abnormal short selling for an individual firm on day t, ABSS [t], as

$$\text{ABSS}[t] = \frac{SSVOL[t]}{AVESS} - 1 \tag{20}$$

Where $SSVOL[t]$ is the total short-selling volume on day t for that firm, and AVESS is the average daily short-selling volume for that firm during the benchmark period. Following Henry and Koski, I define the benchmark period as all of the days in my sample period, excluding days in the window from day -10 relative to the announcement date through day +10

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[19] Accelerated offers include bought deals and accelerated bookbuilt offers. A bought deal normally occurs within 24 hours after a bank or a syndicate wins a bid for shares. The issuing firm announces the offering for an open market sale, and usually the bank that offers the highest net price wins the deal. Bought deals are also known as overnight deals because of the timing. In accelerated bookbuilt offers, the winning bank usually forms a small underwriting syndicate and takes some time to sale the shares to institutional investors. The bank then negotiates the issuer to decide the offer price based on the book building process. The underwriting procedure is typically completed within 48 hours.

relative to the issue date. The abnormal trading volume for an individual firm on day t, ABVOL[t], as

$$ABVOL[t] = \frac{VOL[t]}{AVEVOL} - 1 \qquad (21)$$

Where VOL[t] is the total trading volume for the firm on day t, and AVEVOL is average daily trading volume for this firm during the benchmark period. To examine whether short-selling increases disproportionately with total trading volume, I compute an additional measure, abnormal relative short selling:

$$ABRELSS[t] = \frac{(1+ABSS[t])}{(1+ABVOL[t])} - 1 = \left[\frac{(SSVOL[t]/AVESS)}{(VOL[t]/AVEVOL)}\right] - 1 \qquad (22)$$

To explore the robustness of my results, I define short-selling relative to total volume as

$$RELSS[t] = \frac{SSVOL[t]}{VOL[t]} \qquad (23)$$

At the end, to measure abnormal returns on day t, ABRET[t], I compute the return on day t in excess of the return on the CRSP value weighted index on that day:

$$ABRET[t] = RET[t]-VWRM[t] \qquad (24)$$

Table 18 shows the trading information around announcement date and issue date. The mean abnormal return on the announcement is -0.7%, and the abnormal return on the issue date is -3.17%, both of which are significantly different from 0 at 1% level. The abnormal short-selling (ABSS) level is 46.21% during the restricted period [ID-5, ID-1] and 3.56% during the 5 day period before the restricted period or [ID-10, ID-6]. The evidence indicates that the short-selling activities are even higher during the restricted period than the unrestricted period. The other short selling variables point toward the same conclusion that the level of short-selling activities is less than the short-selling activities during the restricted period. Given this evidence, Hypothesis 3 does not hold.

<center>Announcement date results</center>

The test for announcement date follows the methodology employed by Hery and Koski (2010). My first group of tests examines short-selling and abnormal returns before and on SEO announcement. Following Hypothesis 1A, if short-sellers are informed, then the level of short-selling activities should be negatively related with the abnormal returns around SEO announcements. I use regression models following Christophe, Ferri, and Angel 2004, to test Hypothesis 1A and Hypothesis 1B. Table 19 shows weak evidence that short-sellers are informed about upcoming SEO announcements. In model 1, the coefficient of abnormal return on the announcement date ABRET [AD] is negatively related with abnormal short-selling on the announcement date ABSS [AD]. The coefficient is statistically significant at 1% level. The short-selling activities occurred before the SEO announcements [AD-5, AD-1] are not related with announcement abnormal return or the cumulative abnormal return before the announcement. The overall results suggest that short sellers are not necessarily informed of upcoming issues, instead the short sellers are more able to process the information contained in the SEO announcements.

<center>Issue Date Results</center>

To test Hypothesis 1, I regress each of the different measures of short-selling activity on SEO discount. The SEO discount is defined as the negative value of the percentage difference between the offer price and the previous day's closing price. If H1A (H1B) is valid, the relationship between SEO discount and short-selling should be negative (positive). To control for other factors that could affect SEO discount, I follow Henry and Koski (2010)'s framework. I include firm's market capitalization the day before the offering and the standard deviation of the

<center>82</center>

firm's stock return over the 30-day period ending 11 days prior to the offering. Motivated by Corwin (2003), I also control for deal size, measured as the number of shares offered in the SEO divided by the number of shares outstanding prior to the offering, to capture the price-pressure created by the new shares. Price changes prior to the offering is the cumulative abnormal return over the five days preceding the offering if it is positive then it takes the value of one and zero otherwise. To control for price clustering effects during the SEO offering, I create a dummy variable equal to one if the decimal portion of the offer price is 0.00, 0.25, 0.50, or 0.75 as suggested by Mola and Loughran (2004). I add in the logarithm of offer price into the regression to control the pricing practice of the underwriters that affect SEO discount. BE/ME is the ratio of book value of equity from the most recent fiscal year-end divided by the market value of equity at the end of the month prior to issue. I also add in a dummy variable for shelf-offer to capture any difference caused by offer type.

Table 20 contains the results of our OLS regressions for the offerings. The key variables I use to measure short-selling intensity is ABRELSS. This measure captures abnormal short selling after controlling for abnormal volume, given that both abnormal short-selling and abnormal volume are likely to be high during SEO. Our ABRELSS variable is estimated for the short-sale activities in a window prior to SEO. The coefficient of this variable is negative and highly significant. This result is consistent with the informative short-selling hypothesis under the Gerard and Nanda (1993) framework. Short selling seems to promote market efficiency and reduce the underpricing of offered shares. Similarly, the coefficients of ABSS[ID-10,ID-1] or RELSS[ID-10, ID-1] all have the negative sign and statistically significant. For a robustness check, I divide samples into two groups based on the waiting period from the SEO announcement. If the announcement date is apart from the issuance date within 5 days, which is

the restricted period under rule 105, then the samples fall into the first group (AD-ID<=5), otherwise the second group (AD-ID>5). I find that the negative relationship between short-selling and discount is more pronounced if the waiting period from announcement to issuance is over five days. As it is mentioned in Gao and Ritter (2010), more days between announcement and issuance means longer time for market participants to learn the value of the offering. Thus traders could have more time to gather information and exercise trades based on the information. On the other hand, if the SEO is announced shortly before the issuance, there is less time for traders to react, thus the short-selling occurs around SEO does not necessarily reflect trades the information on the offering.

In table 17, I document a significant abnormal return on the date of offering. I then regress short-selling activities on the abnormal returns. Table 22 shows that the abnormal return is less pronounced if the level of short-selling activities is high prior to the offering. This evidence is also consistent with the informative hypothesis: as more negative information is incorporated into stock prices through short-selling, the stock price would become more efficient and become less likely to have a sharp price decline.

To test H2A (H2B), I regress the abnormal returns post issuance on the short-selling activity during the issuance period. If the short-selling is information oriented as H2A predicts, I would see no significant relationship between the short-selling activity and post-issue abnormal return. If the short-selling orders mostly come from manipulative traders, the price would bounce back after excess short-selling, then we would expect a positive relationship between short-selling and abnormal returns post-issue. Consistent with my informative hypothesis, table 23 shows no significant relationship between short-selling and post issue performance. The result suggests that short-selling before SEO issue dates is associated with a permanent price decline

which is not followed by a price recovery, since short-sellers trading on negative private information could help prices to lower fundamental values.

Conclusion

This paper examines SEC amendment to Rule 105 and its effects on the informativeness of short-selling prior to seasoned equity offerings (SEOs). Pursuant to the amendment, after October 2007 investors with short positions established in the five days prior to a SEO are prohibited from purchasing any shares in the offering. Prior to the amendment, Rule 105 only disallowed investors with a pre-SEO short position from directly covering it with shares purchased in the offering, without explicitly prohibiting such investors from purchasing shares in the offering. The ability, prior to the amendment, to purchase shares in SEOs and effectively hedge existing short positions may have provided incentives to short-sellers for manipulative trading. Such incentives should have been reduced and possibly eliminated after the amendment.

Using a sample of SEOs between September 2009 and December 2011, I find strong evidence of informed short selling around SEO announcements. Around issue dates, higher levels of short selling in the restricted period are strongly related to smaller issue discounts, which is consistent with the intention of SEC's amendment to curb manipulative trading. These effects are significant only for the non-shelf offerings in my sample. I find that the evidence of informative trading is much weaker for shelf offerings. My study makes several contributions to the literature. First, I expand the testing period to the post-amendment period. Henry and Koski (2010) find the evidence of manipulative trading during the pre-amendment period. My results are derived from a similar methodology and are motivated by a similar theoretical framework and show strong evidence of informative short-selling. My results suggest the SEC restrictions

on short-selling squeeze out manipulative short-sellers from using SEO shares to cover their positions. Second, I find the short selling makes prices more efficient for the period around SEO. The documented negative abnormal return on the issue date is less pronounced when the level of pre-issue short selling is high. The post-issue price movement is uncorrelated with the short-selling, suggesting no price recovery due to short-selling and a permanent price decline due to shout-selling. Last, I find the informative role of short sellers is more pronounced if announcement is made over a longer period before issue. It suggests that given more time, traders could better react to the announcements with more information collected. Thus short-selling could contain more information on the value of SEO shares and has a larger effect on SEO discount.

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APPENDIX: TABLES AND FIGURES

Table 1 Summary Statistics

The sample consists of 95 stocks allowed for short-sale in the Chinese stock market after March 31, 2010. The table reports summary statistics for the firms' market size (in millions of Chinese Yuan), market-to-book ratio, public free float ratio, dispersion of opinions measured by the mean of analysts' forecast on earnings per share over the standard deviation of it, and the number of analysts forecasting. It also reports short-sale activities including shorted shares, total share traded, short sales scaled by total traded shares (*ShortShares/SharesTraded*) and short shares scaled by total shares outstanding (*ShortShares/SharesOutstand*) during the first 16 day window at the onset of the short-sale introduction. Panel C reports idiosyncratic risk variables. To measure idiosyncratic risk at the stock level, I follow the method of Wurgler and Zhuravskaya (2002) and estimate two models based on daily returns from the [-360,-20] calendar day window relative to the day on which short-sale is allowed. All returns are in excess of the return on treasury notes. The first model is the CAPM model, i.e. $R_{it} = \alpha + \beta R_{mt}$, where R_{mt} is the value-weighted market return in excess of the return on treasury notes. Instead of market returns, as independent variables the second model uses the excess return of three substitute stocks matched on industry, size, and book-to-market. This panel also reports summary statistics of the total variance of returns as well as the systematic variance, the idiosyncratic variance, and the *R*-squared from the two models.

Panel A: Firm characteristics	Mean	Median	Std. Dev.
Market Size in billion ￥	149.708	54.577	290.538
Public float ratio in percentage	71.550	77.919	27.602
Market-to-book	2.957	2.389	2.439
Analyst coverage	27	28	11
Dispersion of opinions (EPS)	0.247	0.171	0.309
Panel B: Short-selling activities	Mean	Median	Std. Dev.
Shorted shares	10546.3	0	54855.6
Trading volume (in million shares)	426.7	281.3	670.2
Shorted share $*10^3$/Shares traded	0.0233	0	0.0924
Shorted share $*10^6$/Shares outstanding	0.0737	0	0.3138
Panel C: Idiosyncratic risk	Mean	Median	Std. Dev.
Total variance of returns	0.00085	0.00079	0.00037
Systematic risk (CAPM)	0.00039	0.00034	0.00021
Systematic risk (matched)	0.00045	0.00039	0.00032
Idiosyncratic risk (CAPM)	0.00046	0.00042	0.00030
Idiosyncratic risk (matched)	0.00040	0.00032	0.00025
R-squared (CAPM)	0.46079	0.48653	0.13737
R-squared (matched)	0.51520	0.53428	0.20169

Table 2 Abnormal Returns around Short-sale Introduction

This table reports the market-adjusted abnormal returns around the introduction of short-selling in the Chinese stock market. Panel A reports the daily abnormal returns and Panel B reports the cumulative abnormal returns with the event day denoted as day 0. The sample consists of a total of 94 shortable stocks. The table reports the returns of for stocks and also for two equally-sized portfolios based on idiosyncratic risk. Significance levels from a bootstrapped one-tailed p-value are reported in parenthesis. The table also reports the difference in returns between low and high idiosyncratic risk stocks. In this case p-values are obtained from pooled t-tests.

Panel A: Daily market-adjusted abnormal returns in percentage

| Day: | All stocks | | | Low idiosyncratic risk stocks | | | High idiosyncratic risk stocks | | | High minus low | |
	Mean	p-value	N	Mean	p-value	N	Mean	p-value	N	Mean	p-value
− 5	− 0.435***	(0.00)	94	− 0.376*	(0.09)	47	− 0.494**	(0.01)	47	− 0.118	(0.73)
− 4	− 0.363**	(0.03)	94	− 0.343	(0.12)	47	− 0.383**	(0.05)	47	− 0.041	(0.61)
− 3	− 0.083	(0.50)	94	− 0.087	(0.27)	47	− 0.079	(0.73)	47	0.008	(0.23)
− 2	0.640	(0.90)	94	0.685	(0.76)	47	0.594	(0.89)	47	− 0.092	(0.36)
− 1	− 0.025	(0.61)	94	− 0.089	(0.74)	47	0.039	(0.49)	47	0.128	(0.35)
0	− 0.274***	(0.00)	94	− 0.293**	(0.04)	47	− 0.255**	(0.02)	47	0.038	(0.47)
1	0.075**	(0.04)	94	− 0.206***	(0.01)	47	0.383	(0.52)	47	0.590***	(0.00)
2	0.169	(0.20)	94	− 0.182**	(0.02)	47	0.553	(0.86)	47	0.735**	(0.02)
3	− 0.204**	(0.03)	94	− 0.124	(0.23)	47	− 0.272**	(0.05)	47	− 0.147	(0.69)
4	− 0.268***	(0.00)	94	− 0.497***	(0.00)	47	− 0.034	(0.14)	47	0.463*	(0.06)
5	− 0.589***	(0.00)	94	− 0.557*	(0.07)	47	− 0.636**	(0.01)	47	− 0.079	(0.59)
6	− 0.040	(0.21)	94	− 0.216	(0.15)	47	0.171	(0.47)	47	0.388*	(0.07)
7	− 0.371	(0.13)	94	− 0.731	(0.10)	47	− 0.004	(0.53)	47	0.726*	(0.07)
8	0.592	(1.00)	94	0.893	(1.00)	47	0.262	(0.98)	47	− 0.631**	(0.05)
9	− 0.061	(0.31)	94	− 0.503**	(0.03)	47	0.395	(0.94)	47	0.898***	(0.00)
10	0.067	(0.91)	94	0.064	(0.79)	47	0.054	(0.77)	47	− 0.009	(0.51)

*, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel B: Cumulative market adjusted abnormal returns in percentage

	All stocks			Low idiosyncratic risk stocks			High idiosyncratic risk stocks			High minus low	
	Mean	p-value	N	Mean	p-value	N	Mean	p-value	N	Mean	p-value
Day (– 15,– 1)	– 1.029	(0.68)	94	– 0.538	(0.89)	47	– 1.519	(0.31)	47	– 0.982	(0.32)
Day (– 10,– 1)	– 0.518	(0.36)	94	– 1.048	(0.22)	47	0.012	(0.62)	47	1.060	(0.20)
Day (– 5,– 1)	– 0.266	(0.86)	94	– 0.209	(0.78)	47	– 0.323	(0.68)	47	– 0.114	(0.82)
Day (0,5)	– 1.089***	(0.00)	94	– 1.841***	(0.00)	47	– 0.262*	(0.09)	47	1.580***	(0.01)
Day (0,10)	– 0.902***	(0.00)	94	– 2.334**	(0.01)	47	0.617	(0.30)	47	2.951***	(0.01)
Day (0,15)	– 3.239***	(0.00)	94	– 6.028***	(0.00)	47	– 0.315***	(0.00)	47	5.713***	(0.00)
Day (16,20)	– 1.118	(0.96)	94	1.135	(1.00)	47	– 3.383	(0.14)	47	– 4.519***	(0.00)
Day (16,30)	– 0.370	(1.00)	94	1.962	(1.00)	47	– 2.688	(0.77)	47	– 4.650***	(0.00)
Day (16,35)	0.607	(0.99)	94	3.101	(1.00)	47	– 1.850	(0.38)	47	– 4.951***	(0.00)

Table 3 Cross-sectional Tobit Regressions of Short-selling Activities over Idiosyncratic Risk

This table presents regression results of short-selling level regressed on idiosyncratic risk, various trading activity measures and past returns. SS denotes the level of short-selling activity measured as the number of shares sold short scaled by total share traded during the periods of (0,20) (0,15) and (0,10). Day 0 is defined as the day that stocks become eligible for short-selling. As suggested by Wurgler and Zhuravskaya (2002), IdioRisk (CAPM) and IdioRisk (matched) are residual variance of CAPM model and three-substitute stock model estimated using daily returns of period (-360, -20) with day 0 defined as the day an individual stock is allowed to be sold short. Market Size is the logarithm of the average of Market Size for the year prior to the event. Amihud illiquidity is the natural logarithm of the average daily absolute return divided by the dollar volume of pre-event period (-360, 20) as suggested by Amihud (2002). Effective spread is Roll's spread calculated as $2\sqrt{-\mathrm{Cov}}$ where Cov is the autocovariance of daily returns obtained from simulated closing prices of period (-360, -20). Dispersion of opinions is defined as the standard deviation of analyst forecasts of a firm's earnings per share in the event year divided by the mean of it. Analyst forecasts are carried out within one year prior to the event. NYSE listed is a dummy variable set to one when the stock is listed on NYSE and zero otherwise. HongKong listed is defined analogously. Panel A reports results for sample stocks with high idiosyncratic risk and Panel B reports results for all sample stocks. T-statistics are reported in the parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

Panel A: High idiosyncratic risk stocks

	SS [0,20]	SS [0,20]	SS [0,15]	SS [0,15]	SS [0,10]	SS [0,10]
Intercept	0.156	0.504*	− 2.518	0.406	0.013	0.019
	(0.08)	(1.72)	(− 1.59)	(1.44)	(0.49)	(0.83)
IdioRisk (CAPM)	− 1194.7*			− 1010.9**	− 56.76	
	(− 1.79)			(− 2.09)	(− 1.31)	
IdioRisk (matched)		− 943.4**	− 528.3*			− 62.68*
		(− 2.09)	(− 1.71)			(− 1.75)
Return 0	2.942	− 0.701	− 2.310	− 0.991	− 0.229	− 0.310
	(0.39)	(− 0.10)	(− 0.40)	(− 0.17)	(− 0.32)	(− 0.49)
Return (-5,-1)	0.956	1.773	0.459	0.510	− 0.159	− 0.080
	(0.38)	(0.75)	(0.27)	(0.27)	(− 0.73)	(− 0.44)
Effective Spread	1.227	0.495	0.984	1.206	0.127	0.077
	(1.17)	(0.62)	(1.56)	(1.58)	(1.43)	(1.19)
Dispersion of Opinions	− 0.846	− 0.840	− 0.425	− 0.463	− 0.027	− 0.030
	(− 1.22)	(− 1.22)	(− 0.92)	(− 0.94)	(− 0.48)	(− 0.58)
Amihud_iliquidity	− 0.024		0.053			
	(− 0.25)		(0.71)			
Hong Kong listed	− 0.082	− 0.091	− 0.127		0.003	0.001
	(− 0.58)	(− 0.62)	(− 1.15)		(0.24)	(0.11)
NYSE listed	− 0.069	0.044	− 0.021		0.003	0.003
	(− 0.24)	(0.18)	(− 0.10)		(0.13)	(0.18)
Market size			0.218**			
			(2.25)			
N	46	46	46	46	46	46
Pseudo R^2	0.291	0.324	0.569	0.347	− 0.355	− 0.508

Panel B: Low idiosyncratic risk stocks

	SS [0,20]	SS [0,20]	SS [0,15]	SS [0,15]	SS [0,10]	SS [0,10]
Intercept	-0.231	-0.207	-0.207	-0.141	-0.062	-0.069
	(-0.42)	(-0.38)	(-0.30)	(-0.20)	(-1.12)	(-1.13)
IdioRisk (CAPM)		-37.79	-37.50			-2.336
		(-0.43)	(-0.33)			(-0.44)
IdioRisk (matched)	191.3			-43.19	11.35	
	(0.47)			(-0.08)	(0.37)	
Return 0	0.755	0.733	-0.231	-0.080	-0.015	-0.022
	(0.39)	(0.39)	(-0.09)	(-0.03)	(-0.08)	(-0.13)
Return (− 5,− 1)	0.698	0.774	0.839	0.828	0.057	0.062
	(0.89)	(0.98)	(0.90)	(0.89)	(0.74)	(0.79)
Effective spread	0.112	0.178	0.306	0.286	-0.220	-0.230
	(0.21)	(0.33)	(0.47)	(0.44)	(-1.31)	(-1.35)
Dispersion of opinions	-1.098*	-1.017*	-0.985	-1.021	-0.041	-0.034
	(-1.95)	(-1.77)	(-1.46)	(-1.49)	(-0.94)	(-0.80)
Amihud illiquidity	-0.015	-0.016	-0.013	-0.011	-0.003	-0.003
	(-0.62)	(-0.62)	(-0.44)	(-0.35)	(-1.09)	(-1.12)
Hong Kong listed	-0.079	-0.069	-0.085	-0.086	-0.001	-0.001
	(-0.96)	(-0.87)	(-0.88)	(-0.87)	(-0.26)	(-0.13)
NYSE listed	0.021	0.003	0.030	0.039	-0.0001	-0.001
	(0.35)	(0.05)	(0.40)	(0.54)	(-0.03)	(-0.30)
N	47	47	47	47	47	47
Pseudo R^2	0.146	0.124	0.261	0.201	− 0.103	− 0.112

Panel C: All stocks

	SS [0,20]	SS [0,20]	SS [0,15]	SS [0,15]	SS [0,10]	SS [0,10]
Intercept	− 0.576	− 0.069	− 1.255	− 0.045	− 0.015	− 0.015[*]
	(− 0.68)	(− 0.70)	(− 1.54)	(− 0.48)	(− 1.61)	(− 1.73)
IdioRisk (CAPM)	− 169.30			− 261.40	− 5.52	
	(− 0.87)			(− 1.36)	(− 0.41)	
IdioRisk (matched)		− 138.30	− 58.17			− 9.61
		(− 0.84)	(− 0.39)			(− 0.70)
Return 0	− 0.461	− 0.428	− 1.062	− 1.933	− 0.074	− 0.074
	(− 0.16)	(− 0.15)	(− 0.38)	(− 0.69)	(− 0.29)	(− 0.29)
Return (− 5,− 1)	1.263	1.409	0.909	1.153	0.016	0.020
	(1.06)	(1.21)	(0.94)	(1.17)	(0.17)	(0.21)
Effective spread	0.888	0.613	0.793	0.802[*]	0.051	0.052
	(1.44)	(1.22)	(1.60)	(1.67)	(1.18)	(1.25)
Dispersion of opinions	− 0.394	− 0.383	− 0.078	− 0.267	− 0.014	− 0.009
	(− 1.11)	(− 1.04)	(− 0.26)	(− 0.88)	(− 0.51)	(− 0.33)
Amihud illiquidity	− 0.025		0.008			
	(− 0.65)		(0.21)			
Hong Kong listed	− 0.024	− 0.002	− 0.021		0.005	0.005
	(− 0.30)	(− 0.03)	(− 0.31)		(0.82)	(0.80)
NYSE listed	− 0.026	0.000	− 0.081		0.002	0.002
	(− 0.20)	0.00	(− 0.74)		(0.19)	(0.19)
Market size			0.070			
			(1.63)			
N	93	93	93	93	93	93
Pseudo R^2	0.146	0.124	0.261	0.201	− 0.103	− 0.112

Table 4 Cross-sectional Regressions of Cumulative Abnormal Returns over Idiosyncratic Risk at the Beginning of Short-sale Introduction

This table presents results of cumulative abnormal returns during the first 11, 15, 21 days of short-sale introduction regressed on idiosyncratic risk, various trading activity measures and short-selling activity level. The level of short-selling activity is measured as the number of shares sold short scaled by (a) total share traded during the same period, (b) total shares outstanding. As suggested by Wurgler and Zhuravskaya (2002), IdioRisk (CAPM) and IdioRisk (matched) are residual variance of CAPM model and three-substitute stock model estimated using daily returns of period (-360, -20) with day 0 defined as the day an individual stock is allowed to be sold short. Market Size is the logarithm of the average of Market Size for the year prior to the event. Turnover is the logarithm of average daily turnover of pre-event period (-360,-20). Amihud illiquidity is the natural logarithm of the average daily absolute return divided by the dollar volume of pre-event period (-360, 20) as suggested by Amihud (2002). Effective spread is Roll's spread calculated as $2\sqrt{-\text{Cov}}$ where Cov is the autocovariance of daily returns obtained from simulated closing prices. NYSE listed is a dummy variable set to one when the stock is listed on NYSE and zero otherwise. HongKong listed and Shanghai listed are dummy variables for listing in Hong Kong and Shanghai established analogously. Dispersion of opinions is defined as the standard deviation of analyst forecasts of a firm's earnings per share in the event year divided by the mean of it. Analyst forecasts are carried out within one year prior to the event. IdioRisk (CAPM)res and IdioRisk (matched)res are the residual variance of variable IdioRisk (CAPM) and IdioRisk (matched) regressed on Dispersion of opinion. T-statistics are reported in the parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

Panel A: High idiosyncratic risk stocks

	CAR [0,10]	CAR [0,10]	CAR [0,15]	CAR [0,15]	CAR [0,20]	CAR [0,20]
Intercept	0.502	0.623*	− 0.152**	0.372	1.114*	0.477
	(1.35)	(1.76)	(− 2.10)	(0.61)	(1.92)	(0.99)
*Short Shares * 10^3/ Traded Shares*	− 2.618**	− 2.141*	− 4.580***			
	(− 2.37)	(− 1.88)	(− 2.12)			
IdioRisk (CAPM)	112.3**				182.8**	
	(2.08)				(2.08)	
IdioRisk (matched)		82.63*	128.9*	182.7**		123.5*
		(1.87)	(1.79)	(2.17)		(1.86)
Market size	− 0.049**	− 0.048**		− 0.036	− 0.088***	− 0.028
	(− 2.63)	(− 2.56)		(− 1.14)	(− 3.24)	(− 0.91)
Effective spread	0.090	0.127	0.212	− 0.056	− 0.097	
	(0.77)	(1.05)	(0.96)	(− 0.24)	(− 0.51)	
Amihud illiquidity	− 0.022	− 0.010		− 0.070	− 0.087	0.004
	(− 0.42)	(− 0.20)		(− 0.67)	(− 1.09)	(0.17)
Turnover	− 0.015	− 0.007		− 0.080	− 0.089	
	(− 0.28)	(− 0.14)		(− 0.75)	(− 1.14)	
NYSE listed	− 0.003	0.006	0.019	0.0764	0.060	0.099
	(− 0.08)	(0.15)	(0.25)	(0.93)	(0.98)	(1.32)
Hong Kong listed	0.037*	0.033	0.008		0.035	0.011
	(1.75)	(1.55)	(0.20)		(1.10)	(0.28)
Shanghai listed	0.061***	0.064***	0.055		0.095**	
	(2.75)	(2.86)	(1.51)		(2.60)	
Dispersion of opinions	0.162	0.145	0.141	0.199		0.039
	(1.56)	(1.40)	(0.79)	(0.95)		(0.22)
N	46	46	46	46	47	46
Adjusted R^2	0.367	0.353	0.161	0.057	0.254	0.019

Panel B: Low idiosyncratic risk stocks

	CAR [0,10]	CAR [0,10]	CAR [0,15]	CAR [0,15]	CAR [0,20]	CAR [0,20]
Intercept	0.041	0.029	− 0.068	0.315	0.552	0.712[*]
	(0.19)	(0.12)	(− 1.03)	(0.94)	(1.37)	(1.81)
*Short Shares * 10³ /*	− 8.160[**]	− 7.976[**]	− 7.335			
Traded Shares	(− 2.48)	(− 2.40)	(− 1.08)			
IdioRisk (CAPM)	13.61				63.96	
	(0.67)				(1.59)	
IdioRisk (matched)		− 14.92	122.5	37.77		88.04
		(− 0.11)	(0.47)	(0.15)		(0.32)
Market size	0.012	0.011		− 0.009	− 0.015	− 0.014
	(1.11)	(0.87)		(− 0.43)	(− 0.72)	(− 0.68)
Effective spread	− 0.249	− 0.206	0.280	− 0.202	− 0.450	
	(− 1.22)	(− 0.98)	(0.88)	(− 0.53)	(− 1.14)	
Amihud illiquidity	− 0.018	− 0.016		− 0.131[**]	− 0.143[**]	0.024
	(− 0.52)	(− 0.46)		(− 2.14)	(− 2.16)	(1.40)
Turnover	− 0.038	− 0.033		− 0.173[***]	− 0.194[***]	
	(− 1.09)	(− 0.96)		(− 2.73)	(− 2.85)	
NYSE listed	− 0.016	− 0.012	0.014	0.0173	− 0.014	0.003
	(− 0.49)	(− 0.33)	(0.26)	(0.28)	(− 0.21)	(0.04)
Hong Kong listed	0.009	0.005	0.011		0.058	0.061
	(0.44)	(0.23)	(0.30)		(1.53)	(1.50)
Shanghai listed	− 0.026	− 0.026	− 0.034		− 0.005	
	(− 1.36)	(− 1.38)	(− 1.05)		(− 0.12)	
Dispersion of opinions	0.098	0.099	− 0.0001	0.064		− 0.053
	(1.36)	(1.37)	(− 0.00)	(0.49)		(− 0.35)
N	47	47	47	47	47	47
Adjusted R^2	0.106	0.095	-0.064	0.136	0.139	-0.010

Panel C: All stocks

	CAR [0,15]	CAR [0,15]	CAR [0,15]	CAR [0,15]	CAR [0,15]	CAR [0,15]
Intercept	1.218***	0.888***	0.721**	0.857**	0.984***	1.221***
	(4.27)	(2.72)	(2.09)	(2.61)	(3.27)	(4.47)
*Short_Shares*10³ /Trade_shares*	− 5.637***		− 4.844***	− 5.055***	− 4.992***	
	(− 3.16)		(− 2.80)	(− 2.87)	(− 2.87)	
*Short_Shares*10⁶ /Outstanding shares*		− 0.833***				− 0.905***
		(− 3.18)				(− 3.48)
IdioRisk (CAPM)	75.48**					
	(2.10)					
IdioRisk (matched)		126.5***	123.0**	130.4***		
		(2.65)	(2.59)	(2.71)		
Market size	− 0.045***	− 0.043***	− 0.031*	− 0.042***	− 0.039**	− 0.040***
	(− 2.99)	(− 2.93)	(− 1.93)	(− 2.82)	(− 2.59)	(− 2.65)
Turnover	− 0.063	− 0.089*	− 0.094*	− 0.093*	− 0.060	− 0.047
	(− 1.25)	(− 1.72)	(− 1.73)	(− 1.77)	(− 1.22)	(− 0.98)
Amihud illiquidity	− 0.027	− 0.063	− 0.063	− 0.066	− 0.033	− 0.011
	(− 0.57)	(− 1.21)	(− 1.18)	(− 1.26)	(− 0.66)	(− 0.25)
Effective spread	− 0.110	− 0.056	− 0.017	− 0.037	− 0.011	− 0.097
	(− 0.65)	(− 0.34)	(− 0.10)	(− 0.22)	(− 0.07)	(− 0.59)
NYSE listed	0.071*	0.071*	0.060	0.068*	0.075*	0.076*
	(1.71)	(1.75)	(1.45)	(1.67)	(1.85)	(1.89)
Hong Kong listed	0.050**	0.037	0.020	0.036	0.028	0.037
	(2.06)	(1.55)	(0.81)	(1.53)	(1.15)	(1.52)
Shanghai listed	0.056**	0.048*	0.051	0.050*	0.057**	0.058**
	(2.19)	(1.93)	(2.01)	(1.97)	(2.30)	(2.35)
			0.077			
Dispersion of opinions			(0.72)			
IdioRisk (CAPM)Res						70.49**
						(2.04)
IdioRisk (matched)Res					106.0**	
					(2.29)	
N	94	94	93	94	93	93
Adjusted R²	0.255	0.293	0.256	0.279	0.246	0.254

Table 5 Cross-sectional Regressions of Cumulative Abnormal Returns over Idiosyncratic Risk for the Subsequent Period (16, 35) after Short-sale Introduction

This table presents regression results of cumulative abnormal returns of period (16, 35) on idiosyncratic risk, various trading activity measures and short-selling activity level. Day 0 is defined as the day sample stocks become eligible for short-sale. As suggested by Wurgler and Zhuravskaya (2002), *IdioRisk (CAPM)* and *IdioRisk (matched)* are residual variance of CAPM model and three-substitute stock model estimated using daily returns of period (-360, -20). *Market Size* is the logarithm of the average of Market Size for the year prior to the event. *NYSE listed* is a dummy variable set to one when the stock is listed on NYSE and zero otherwise. *HongKong listed* and *Shanghai listed* are dummy variables for listing in Hong Kong and Shanghai established analogously. *Effective spread* is Roll's spread calculated as $2\sqrt{-Cov}$ where Cov is the autocovariance of daily returns obtained from simulated closing prices. *Amihud illiquidity* is the natural logarithm of the average daily absolute return divided by the dollar volume of pre-event period (-360, 20) as suggested by Amihud (2002). *Dispersion of opinions* is defined as the standard deviation of analyst forecasts of a firm's earnings per share in the event year divided by the mean of it. Analyst forecasts are carried out within one year prior to the event. *Turnover* is the logarithm of average daily turnover of pre-event period (-360,-20). T-statistics are reported in the parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

	CAR [16,35]	CAR [16,35]	CAR [16,35]	CAR [16,35]	CAR [16,35]
Intercept	− 0.106	− 0.298	− 0.144	− 0.098	− 0.493**
	(− 0.67)	(− 1.45)	(− 0.49)	(− 0.36)	(− 2.50)
IdioRisk (CAPM)					− 15.69
					(− 0.54)
IdioRisk (matched)	− 90.98**	− 85.71**	− 70.75*	− 78.33**	
	(− 2.63)	(− 2.48)	(− 1.74)	(− 2.15)	
Market Size	0.008	0.020*	0.008	0.008	0.029**
	(0.99)	(1.69)	(0.56)	(0.61)	(2.58)
NYSE listed		− 0.068*	− 0.058	− 0.057	− 0.072**
		(− 1.97)	(− 1.61)	(− 1.61)	(− 2.03)
Shanghai listed		− 0.015	− 0.017	− 0.016	− 0.020
		(− 0.76)	(− 0.81)	(− 0.76)	(− 0.94)
Hong Kong listed		0.006	0.021	0.022	0.003
		(0.33)	(1.01)	(1.08)	(0.17)
Effective spread			− 0.117	− 0.111	
			(− 0.83)	(− 0.79)	
Amihud illiquidity			− 0.020	− 0.001	
			(− 0.44)	(− 0.11)	
Dispersion of opinions			− 0.105	− 0.117	
			(− 1.15)	(− 1.35)	
Turnover			− 0.020		
			(− 0.43)		
N	94	94	93	93	94
Adjusted R²	0.097	0.110	0.090	0.098	0.051

Table 6 Regression of Long term Short-selling Activites on Idiosyncratic Risk

This table reports the regression results of the short-selling activities over idiosyncratic risks from March 31, 2010 to January 22, 2011. The introduction event is defined as one in which an individual stock is allowed to be sold short from the event day. The dependent variable is the daily short turnover ratio defined as the short shares over trading volume. The test variables are the monthly constructed idiosyncratic risk (*IdioRisk*), which takes the proxy of the residual variance of either CAPM model or three-matched-stock model as suggested by Wurgler and Zhuravskaya (2002). NYSE is a dummy variable set to one when the stock is listed on NYSE and zero otherwise. Shanghai dummy is one if the stock is listed on Shanghai market and zero if listed on Shenzhen market. Independent variables also include the stock return of day 0 and the period of (-5,-1), while the introduction event day is denoted as day 0. T-statistics of each coefficient is reported in the parenthesis. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

Panel A: All stocks

	OLS	OLS	Random Effect	Random Effect	Fixed Effect	Fixed Effect
Intercept	-0.555^{***}	-0.560^{***}	-0.653^{**}	-0.600^{*}	-0.778^{**}	-0.662^{*}
	(-4.23)	(-4.4)	(-2.08)	(-1.90)	(-1.97)	(-1.66)
IdioRisk(CAPM)	-107.11^{***}		-75.08^{***}		-72.08^{***}	
	(-4.67)		(-3.06)		(-2.87)	
IdioRisk(matched)		-80.80^{***}		-40.59		-34.95
		(-3.29)		(-1.40)		(-1.16)
Market size	0.053^{***}	0.054^{***}	0.055^{***}	0.051^{***}	0.054^{**}	0.047^{**}
	(7.04)	(7.06)	(3.01)	(2.76)	(2.41)	(2.05)
Book– to– market	-0.146^{***}	-0.140^{***}	-0.011	-0.001	0.025	0.034
	(-6.26)	(-5.95)	(-0.25)	(-0.03)	(0.54)	(0.72)
Return day 0	0.435	0.391	0.450^{*}	0.409	0.452^{*}	0.411
	(1.58)	(1.42)	(1.72)	(1.56)	(1.72)	(1.57)
Return [– 5,– 1]	-0.171	-0.227^{*}	-0.165	-0.217^{*}	-0.164	-0.216^{*}
	(-1.43)	(-1.91)	(-1.43)	(-1.90)	(-1.42)	(-1.89)
NYSE listed	-0.054^{*}	-0.052^{*}	-0.088	-0.088		
	(-1.77)	(-1.72)	(-0.74)	(-0.74)		
Hong Kong listed	-0.0010	-0.0003	-0.0004	0.0011		
	(-0.04)	(-0.02)	(-0.01)	(0.02)		
Shanghai listed	-0.183^{***}	-0.181^{***}	-0.203^{***}	-0.196^{***}		
	(-11.04)	(-10.91)	(-3.17)	(-3.05)		
Adjusted-R^2	0.0149	0.0143	0.0132	0.0125	0.0012	0.0007
Firm number	95	95	95	95	95	95

Panel B: High idiosyncratic risk stocks and low idiosyncratic risk stocks

	High Idiosyncratic Risk Stocks				Low Idiosyncratic Risk Stocks			
	Fixed	Random	OLS	OLS	Fixed	Random	OLS	OLS
Intercept	− 1.740**	− 0.817	− 0.764***	− 0.745***	0.870	0.778	− 0.514***	− 0.558***
	(− 2.12)	(− 1.57)	(− 3.24)	(− 3.16)	(1.57)	(1.54)	(− 3.35)	(− 3.59)
IdioRisk (CAPM)	− 70.77**		− 134.00**		− 88.55		− 123.95**	
	(− 2.12)		(− 4.54)		(− 1.51)		(− 2.37)	
IdioRisk		− 60.39*		− 132.52***		− 109.00		− 29.11
		(− 1.69)		(− 4.15)		(− 0.53)		(− 0.15)
Market size	0.110**	0.067**	0.066***	0.064***	− 0.043	− 0.024	0.050***	0.050***
	(2.45)	(2.22)	(4.80)	(4.70)	(− 1.38)	(− 0.84)	(5.65)	(5.67)
Book-to-market	0.169	− 0.038	− 0.090*	− 0.086***	0.069	0.056	− 0.134***	− 0.126***
	(0.72)	(− 0.30)	(− 1.88)	(− 1.80)	(1.63)	(1.35)	(− 4.96)	(− 4.67)
Return 0	0.316	0.290	0.299	0.267	0.832**	0.784**	0.67	0.606
	(0.88)	(0.81)	(0.80)	(0.71)	(2.21)	(2.07)	(1.62)	(1.47)
Return (-5,-1)	− 0.199	− 0.227	− 0.177	− 0.217	− 0.069	− 0.127	− 0.144	− 0.225
	(− 1.26)	(− 1.45)	(− 1.09)	(− 1.34)	(− 0.40)	(− 0.76)	(− 0.79)	(− 1.24)
NYSE listed		− 0.097	− 0.098	− 0.096		− 0.053	− 0.036	− 0.034
		(− 0.58)	(− 1.57)	(− 1.55)		(− 0.19)	(− 1.1)	(− 1.05)
Hong Kong listed		− 0.016	0.048**	0.046*		− 0.041	− 0.048**	− 0.047**
		(− 0.17)	(1.79)	(1.71)		(− 0.22)	(− 2.22)	(− 2.16)
Shanghai		− 0.198**	− 0.186***	− 0.192		− 0.248	− 0.163***	− 0.149
		(− 2.24)	(− 7.77)	(− 8.01)		(− 1.45)	(− 6.73)	(− 6.36)
Adjusted R²	0.0016	0.0751	0.0135	0.0130	0.0017	0.0208	0.0151	0.0145

Table 7 Regressions of Monthly Return on Idiosyncratic risk of Previous Month

This table reports the fixed-effect regression results of the monthly return as the dependent variable over idiosyncratic risk. The test period is 10 months after the introduction event. *Idiosyncratic risk* is the residual variance of either CAPM model or three-matched-stock model as Wurgler and Zhuravskaya (2002) suggest. I estimate *idiosyncratic risk* on a monthly basis using the daily data within month. Variable *Idiosyncratic risk, T-1* is constructed using daily data of previous months. *Variable Idiosyncratic risk, T* is constructed using daily data of current month. The control variables include market beta estimated on same method, logarithm term of Market Size and book-to-market ratio of each stock. T-statistics of each coefficient is reported in the parenthesis. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-8.210^{***}	-7.969^{***}	-4.260^{***}	-5.015^{***}	-6.243^{***}	-6.72^{***}
	(-12.19)	(-11.67)	(-5.72)	(-6.78)	(-8.73)	(-9.31)
IdioRisk (CAPM), T-1	-142.0^{***}				-147.5^{***}	
	(-10.60)				(-11.06)	
IdioRisk (matched), T-1		-151.3^{***}				-157.1^{***}
		(-9.21)				(-9.46)
IdioRisk (CAPM), T			102.89^{***}		103.20^{***}	
			(6.60)		(6.92)	
IdioRisk (matched), T				87.04^{***}		90.99^{***}
				(4.60)		(4.86)
Market beta	0.062^{***}	0.061^{***}	0.049^{***}	0.047^{***}	0.048^{***}	0.044^{***}
	(4.89)	(4.72)	(3.64)	(3.37)	(3.82)	(3.35)
Log(Market size)	0.439^{***}	0.425^{***}	0.218^{***}	0.261^{***}	0.330^{***}	0.356^{***}
	(11.85)	(11.33)	(5.34)	(6.42)	(8.38)	(8.99)
	0.220^{***}	0.206^{***}	0.096^{**}	0.116^{***}	0.166^{***}	0.171^{***}
Book-to-market ratio	(5.89)	(5.47)	(2.45)	(2.93)	(4.47)	(4.51)
Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.2507	0.228	0.1907	0.1654	0.2925	0.2469
Firm_NO	92	92	92	92	92	92

Table 8 Cross-sectional Regressions of Cumulative Abnormal Returns Prior to Short-sale Introduction

This table presents regression results of cumulative abnormal returns of periods (-5,-1), (-10,-1) and (-15,-1) on idiosyncratic risk, various trading activity measures and short-selling activity level. As suggested by Wurgler and Zhuravskaya (2002), *IdioRisk (CAPM)* and *IdioRisk (matched)* are residual variance of CAPM model and three-substitute stock model estimated using daily returns of period (-360, -20) with day 0 defined as the day an individual stock is allowed to be sold short. *Market Size* is the logarithm of the average of Market Size for the year prior to the event. *Book-to-market* is the book value of common equity scaled by Market Size. *Turnover* is the log of average daily share turnover for the pre-event period (day -360 to -20). *Amihud illiquidity* is the log of average daily absolute return divided by the dollar volume for the pre-event period (-360, 20) as suggested by Amihud (2002). *Effective spread* is Roll's spread calculated as $2\sqrt{-Cov}$ where Cov is the autocovariance of daily returns obtained from simulated closing prices. *NYSE listed* is a dummy variable set to one when the stock is listed on NYSE and zero otherwise. *HongKong listed* and *Shanghai listed* are dummy variables for listing in Hong Kong and Shanghai established analogously. T-statistics are reported in the parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

	CAR $[-5,-1]$	CAR $[-5,-1]$	CAR $[-10,-1]$	CAR $[-10,-1]$	CAR $[-15,-1]$	CAR $[-15,-1]$
Intercept	-0.164	-0.084	-0.001	0.058	-0.140	-0.105
	(-1.56)	(-0.92)	(-0.01)	(0.43)	(-0.80)	(-0.70)
IdioRisk (CAPM)		6.101		-1.519		-7.573
		(0.53)		(-0.09)		(-0.40)
IdioRisk (matched)	24.07		14.97		5.82	
	(1.57)		(0.64)		(0.23)	
Market size	0.001	0.000	-0.003	-0.004	-0.003	-0.003
	(0.20)	(0.04)	(-0.47)	(-0.55)	(-0.32)	(-0.36)
Book- to- market	0.000	0.000	-0.004	-0.004	-0.005	-0.005
	(-0.02)	(-0.07)	(-0.72)	(-0.76)	(-0.86)	(-0.90)
Turnover	-0.012	-0.003	0.020	0.028	0.016	0.022
	(-0.73)	(-0.18)	(0.79)	(1.18)	(0.58)	(0.87)
Amihud illiquidity	-0.016	-0.005	0.014	0.023	0.005	0.012
	(-0.96)	(-0.36)	(0.56)	(1.00)	(0.20)	(0.48)
Effective spread	0.096	0.085	0.153	0.148	0.081	0.082
	(1.80)	(1.58)	(1.90)	(1.84)	(0.91)	(0.93)
NYSE listed	-0.010	-0.010	0.007	0.007	0.012	0.012
	(-0.74)	(-0.70)	(0.32)	(0.32)	(0.51)	(0.50)
Hong Kong listed	0.004	0.006	0.003	0.004	0.002	0.001
	(0.53)	(0.74)	(0.28)	(0.34)	(0.14)	(0.12)
Shanghai listed	0.003	0.005	0.004	0.005	0.017	0.018
	(0.41)	(0.61)	(0.33)	(0.44)	(1.24)	(1.32)
N	95	95	95	95	95	95
Adjusted-R^2	-0.016	-0.042	-0.029	-0.034	-0.024	-0.023

Table 9 Cross-sectional Regressions of Cumulative Abnormal Returns over Idiosyncratic Risk for Stocks Not eligible for Short-selling

This table presents regression results of cumulative abnormal returns (CAR) of non-event firms on idiosyncratic risk and various trading activity measures for firms with that are not eligible for short-selling. The cumulative abnormal returns are for the period of (0,5), (0,10) and (0,15) with day 0 defined as the day short-sale practice is introduced to eligible stocks. As suggested by Wurgler and Zhuravskaya (2002), *IdioRisk (CAPM)* and *IdioRisk (matched)* are residual variance of CAPM model and three-substitute stock model estimated using daily returns of period (-360, -20). *Market Size* is the logarithm of the average of Market Size for the year prior to the event. *Book-to-market* is the book value of common equity scaled by Market Size. *Turnover* is the logarithm of average daily turnover of pre-event period (-360,-20). *Amihud illiquidity* is the natural logarithm of the average daily absolute return divided by the dollar volume of pre-event period (-360, 20) as suggested by Amihud (2002). *Effective spread* is Roll's spread calculated as $2\sqrt{-Cov}$ where Cov is the autocovariance of daily returns obtained from simulated closing prices. T-statistics are reported in the parentheses. *, **, and *** denote significance at the 10%, 5% and 1% levels, respectively.

	CAR [0,5]	CAR [0,5]	CAR [0,10]	CAR [0,10]	CAR [0,15]	CAR [0,15]
Intercept	0.249***	0.249***	0.134**	0.135**	0.497**	0.499***
	(8.44)	(8.44)	(2.77)	(2.80)	(6.51)	(6.54)
IdioRisk (CAPM)		-0.003		-0.029		-0.045
		(-0.14)		(-0.96)		(-0.94)
IdioRisk	-0.025		-0.014		0.047	
	(-0.44)		(-0.15)		(0.33)	
Market size	-0.005**	-0.005**	-0.010***	-0.010***	-0.019***	-0.019***
	(-3.07)	(-3.06)	(-3.86)	(-3.78)	(-4.56)	(-4.47)
Book-to-market	-0.021***	-0.021***	-0.026**	-0.026**	-0.028	-0.029
	(-3.64)	(-3.63)	(-2.71)	(-2.72)	(-1.85)	(-1.88)
Turnover	-0.009	-0.009	-0.020**	-0.019**	-0.061***	-0.059***
	(-1.96)	(-1.94)	(-2.79)	(-2.63)	(-5.41)	(-5.19)
Amihud illiquidity	0.0002	0.0002	-0.019**	-0.018**	-0.043***	-0.041***
	(0.05)	(0.05)	(-2.77)	(-2.59)	(-3.92)	(-3.70)
Effective spread	0.003	0.003	-0.011	-0.011	-0.053	-0.053
	(0.29)	(0.29)	(-0.65)	(-0.66)	(-1.93)	(-1.93)
N	1502	1502	1502	1502	1502	1502
Adjusted-R²	0.06	0.06	0.018	0.018	0.054	0.054

Table 10 Impact of Margin Trading Introduction on the Bid-Ask Spread on Volatility

Relative bid-ask spreads, depth and volatility for a sample of 89 marginable stocks in the period of January 2010 to June 2010. The relative bid-ask spread on a stock is defined as the ratio of the difference between the ask and bid price to the midpoint of the ask and bid price. Depth is the share volumes transacted at the quoted prices. Volatility is the intraday variance of the mid-point of asks and bid price. The bid-ask spread (volatility) ratio is the median value of the weighted average of all bid-ask spreads quoted (volatility) in the period of three months after introduction divided by the median value of the weighted average of all bid-ask spreads quoted (volatility) on each day in the period three month before the introduction. The weight used is the amount of time the quote is valid. Using the midpoint of bid-ask spread instead of actual transaction price is to avoid the bouncing biases caused by using bid price or ask price separately.

	Spread Ratio	Depth Ratio	Variance Ratio
Mean	1.227	1.244	1.597934
Median	1.202	1.162	1.560279
Proportion of stocks with increases in the post period	94.38%	68.53%	100%
One-tailed signed rank probability for change in the post period	0.00	0.00	--

Table 11 Impact of Margin Eligibility on the Order Flow

It shows the trading volume, trading frequency and transaction size ratios for a sample of 89 stocks that become marginable during the period of January 2010 to June 2010. The sample period covers the three months before and three months after the introduction event on March 31, 2010. Trading volume is the accumulated transacted shares on a trading day. Trading frequency is the number of trades per day. Transaction size is defined as the number of shares purchased/sold in a transaction. The ratio is the median value of the measure of order flow under consideration in the period three months after the margin introduction divided by the median value of the same variable in the period three months before introduction.

	Volume Ratio	Trading Freq Ratio	Transaction Size
Mean	1.0638	1.005	1.061
Median	0.969	0.998	0.95
Proportion of stocks with increases in the post period	46.07%	38.20%	47.19%
One-tailed signed rank probability for change in the post period	0.4	0.9	0.69

Table 12 The Relationship between Changes in Liquidity, Order Flow, Price and Volatility

$$SpreadRat_j = \beta_0 + \beta_1 VolumeRat_j + \beta_2 PriceRat_j + \beta_3 VarianceRat_j + \varepsilon_j$$
$$DepthRat_j = \gamma_0 + \gamma_1 VolumeRat_j + \gamma_2 PriceRat_j + \gamma_3 VarianceRat_j + \varepsilon_j$$

SpreadRat is the ratio of the relative bid-ask spread in the period three months after margin eligibility to the period three months before margin eligibility. VolumeRat, PriceRat, VarianceRat and DepthRat are the corresponding post to pre period ratios for daily trading volume, price per share, volatility of returns based on the average of the bid and ask prices and depth. The p-value for one-tailed test for two-tailed test of the null hypothesis that the coefficient is zero is in parentheses.

	Dependent Variable	
Independent Variables	SpreadRat	DepthRat
Intercept	1.14983	0.15587
	(0.00)	(0.51)
VolumeRat	-0.10913	0.70883
	(0.00)	(0.00)
PriceRat	-0.30592	-0.09177
	(0.00)	(0.59)
VarianceRat	0.21185	0.18488
	(0.00)	(0.09)
Adjusted R-square	0.4488	0.5458

Table 13 Impact of Margin Trading on the Adverse Selection Component of Bid-Ask Spread

Ordinary least squares (OLS) estimates of coefficients from cross-sectional regressions of the following form:

$$\text{EstSpread}_{jt} = \delta_0 + \delta_1 \text{QuotedSpread}_{jt} + \delta_2 \text{Event}_{jt} + \delta_3 (\text{QuotedSpread}_{jt} \times \text{Event}_{jt}) + \varepsilon_{jt} \quad j=1,2,\ldots,n,$$

Where $EstSpread_{jt} = 2\sqrt{-Cov}$, and COV is the serial covariance of the difference between the returns based on transaction prices and the return based on bid-to-bid prices, $QuotedSpread_{jt}$ is the median of the last quoted bid-ask spread during the trading day. For stock j in pre-allowance days and post-allowance days, and $Event_{jt}$ takes on a value of 1 after allowance and 0 before allowance. The sample includes 89 stocks granted with margin eligibility on March 2010. The p-value for two-tailed test of the null hypothesis that the coefficient is zero is in parentheses. The effective spread cannot be estimated if the serial covariance is positive. None of the estimated serial covariances were positive for my sample of stocks.

Panel A Total Sample

δ_0	δ_1	δ_2	δ_3	Adj-R^2
0.00025	0.02349	0.00007	-0.02240	0.030
(0.00)	(0.00)	(0.00)	(0.00)	

Panel B Subsample based on Margin Trading and Short-Sale

$\delta 0$	$\delta 1$	$\delta 2$	$\delta 3$	Adj-R2
High Level of Margin Trading				
0.00024800	0.02461	0.00006645	-0.02352	0.0446
(0.00)	(0.00)	(0.00)	(0.00)	
Low Level of Margin Trading				
0.00025613	0.02166	0.00003704	-0.00356	0.020
(0.00)	(0.00)	(0.00)	(0.65)	
High Level of Short-Sale				
0.00023845	0.02674	0.00007887	-0.02565	0.062
(0.00)	(0.00)	(0.00)	(0.00)	
Low Level of Short-Sale				
0.00025875	0.02186	0.00003186	-0.00420	0.015
(0.00)	(0.00)	(0.00)	(0.51)	

Table 14 Impact of Margin Eligibility on the Weight Placed on Public Information

This table shows the comparison of the ratios of weight placed on public information (PRIOR) three months before and three months after margin eligibility for a sample of 89 stocks. The weight placed on public information (PRIOR) is calculated using the Bayesian model for intraday price movements developed in Madhavan and Smidt (1991). The reported ratio is the value of PRIOR before the eligibility over the value of the PRIOR after the eligibility.

Total Sample	Before	After	After/Before
Mean	0.932	0.919	98.61%
Median	0.941	0.924	98.19%
Proportion with PRIOR decreases			64%
Probability for change in PRIOR in post-allowance period			0.00
Low Level of Margin Trading	Before	After	After/Before
Mean	0.9299403	0.9201190	99.03%
Median	0.9399541	0.9232976	98.23%
Proportion with PRIOR decreases			60%
Probability for change in PRIOR in post-allowance period			0.12
High Level of Margin Trading	Before	After	After/Before
Mean	0.9341088	0.9184493	98.29%
Median	0.9418447	0.9252952	98.24%
Proportion with PRIOR decreases			69%
Probability for change in PRIOR in post-allowance period			0.00

Table 15 Impact of Margin Eligibility on the Informativeness of Trades in the Underlying Stock

Changes in the summary informativeness of trades (R_w^2) upon the introduction of margin trading and short-selling. The summary informativeness of stock trades is estimated using the technique in Hasbrouck (1991). The sample of 89 stocks had involved in margin trading and short selling since the introduction event day-March 31st 2010. The pre-event period covers from January 1st to March 30st 2010, and post-event period cover from March 31st 2010 to June 30st 2010.

Panel A

	Mean	Median
R_w^2 before margin trading	0.005367	0.004246
R_w^2 after margin trading	0.005965	0.004656
Difference	0.000541	0.000409
One tailed P-value	(0.032)	
Wilcoxon Signed rank z-stat		(0.0934)

Panel B	Low Level of Margin Trading		High Level of Margin Trading	
	Mean	Median	Mean	Median
R_w^2 before margin trading	0.005122	0.003949	0.005612	0.004588
R_w^2 after margin trading	0.005331	0.004539	0.006586	0.005034
Change in R_w^2	0.000209	-0.000100	0.000974	0.00054
$R_w^2\ after/R_w^2$ before	1.216874	0.980977	1.268845	1.136797
Wilcoxon signed p-value		(0.739)		(0.014)
One-tailed t-test P-value	(0.385)		(0.02)	

Table 16 The Impact of Margin Trading Introduction on the Informativeness of Trades

The dependent variable is the informativeness of trades (R_w^2) based on the three month trades after the introduction of margin trading. The independent variable are the accumulated margin trading amount during the three month period for each stock and the informativeness of trades based on the three month trades before the introduction. Changes in the summary informativeness of trades (R_w^2) upon the introduction of margin trading and short-selling. The summary informativeness of stock trades is estimated using the technique in Hasbrouck (1991). The sample of 89 stocks had involved in margin trading and short selling since the introduction event day-March 31st 2010. The pre-event period covers from January 1st to March 30st 2010, and post-event period cover from March 31st 2010 to June 30st 2010.

	Intercept	Accumulated Margin Trading	R_w^2 before	Adjusted R2	Observations
Estimate	0.000778	0.13101	0.74175	0.5403	89
P-value	(0.3259)	(0.0785)	(.0001)		

Table 17 Summary Statistics of SEO Firms

This table gives mean values of various firm and offering characteristics of our sample of 408 seasoned equity offerings (SEO) from September 2009 to March 2012. Results are reported for the full sample (Row 1), by market (Row 2-4), for shelf offerings versus non-shelf offerings (Row 5-6), and for different subsamples according to the length of the waiting period (Row 7-9). Close-to-offer return is the percentage difference between the closing price the day before issuance and the offer price. Offer-to-close return is the percentage difference between the Offer Price and the closing price on the day of issuance. Pre-issue shares outstanding, Pre-issue NYSE Arca volume and Pre-issue CRSP volume are all taken the day before the issue date.

	N	Close-to-offer return (%)	Offer-to-close return (%)	Offer Amount (mil)	Offer Proceeds (mil)	Offer Price (mil)	Pre-issue shares outstanding (mil.)	Pre-issue volume (000s) NYSE Arca	Pre-issue volume (000s) CRSP
Total	408	-3.45	2.84	9.68	135.42	18.39	74.04	180.3	1319.9
NYSE	143	-3.96	1.78	11.94	245.90	19.73	118.20	296.3	1952.8
Amex	27	-0.84	1.95	6.67	23.69	5.80	54.93	73.8	690.9
NASDAQ	238	-3.43	3.58	8.77	86.46	13.20	49.68	122.6	1011.0
Non-shelf	117	0.74	2.84	8.44	125.01	17.00	59.91	119.5	890.1
Shelf	291	-5.13	2.84	10.13	139.22	18.90	79.73	204.7	1492.7
AD=ID	23	-5.74	4.30	7.80	109.09	20.30	105.87	88.9	856.3
0<(AD-ID)<=5	57	-5.22	1.88	16.64	185.62	26.33	73.46	469.5	3233.5
(AD-ID)>5	328	-2.98	2.90	8.67	129.01	17.48	71.91	136.4	1019.9

Table 18 Abnormal Short-selling Activities

This table summarizes measures of trading volume and short-selling intensity for various windows around the SEO announcement date and the issue date. SSVOL is daily NYSE Arca short-sale share volume. VOL is daily total share volume. VOL Arca is daily share volume in NYSE Arca. ABSS is daily short-sale volume divided by average short-sale volume calculated over the benchmark period. ABVOL is daily total volume divided by average total volume calculated over the benchmark period. RELSS is daily short-sale share volume divided by daily total share volume. ABRET is the abnormal return calculated as the daily stock return minus the CRSP value-weighted index return. ABRELSS is abnormal short-sale volume divided by abnormal total volume. We measure these variables as daily means over various windows relative to the SEO announcement date (AD) and issue date (ID). [AD-5, AD-1] is the window from five days prior to the AD through one day prior to the AD. The other windows are analogously defined. The asterisks denote statistical significance for a t-test. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels, respectively, for the abnormal measures and differences in means.

	AD-5,AD-1	AD	ID-10,ID-6	ID-5,ID-1	ID	ID+1,ID+5
SSVOL	46,413	64,717	43,952	64,305	213,365	88,475
VOL	829,949	1,067,517	779,409	1,018,814	3,850,733	1,724,529
VOL Arca	95,440	132,244	88,343	123,752	529,547	215,308
RELSS	0.0536	0.0531	0.0536	0.0594	0.0662	0.0461
RELSS Arca	0.4467	0.4461	0.4510	0.4722	0.4135	0.3728
ABSS	0.3965	0.3941***	0.0356	0.4621***	5.7710***	0.8885***
ABVOL	0.1357	0.3112**	-0.1012***	0.1357***	5.0558***	1.0583***
ABVOL Arca	0.1994	0.4705***	-0.0289	0.2831***	7.8257***	1.4843***
ABRELSS	0.1261***	0.1156***	0.1644***	0.2814***	0.4249***	-0.0135
ABRELSS Arca	0.0805***	0.0772***	0.0816***	0.1386***	-0.0209	-0.1224***
ABRET	0.0044***	-0.0070***	0.0018***	-0.0015*	-0.0317***	0.0017***
CAR	0.0198***	-0.0070***	0.0093***	-0.0077**	-0.0318***	0.0158***

Table 19 Regressions of preannouncement or announcement-date short selling on announcement-date returns

This table reports results of regression of preannouncement abnormal short selling ABSS[AD-5,AD-1], relative short selling RELSS[AD-5,AD-1], abnormal relative short selling ABRELSS[AD-5,AD-1] as well as announcement date short selling variables: ABSS[AD], RELSS[AD], ABRELSS[AD]. The test variables are abnormal return five days before or on announcement date: ABRET[AD-5,AD-1], ABRET[AD]. Additional independent variables include controls for abnormal volume ABVOL. t-statistics are in parenthesis.

	ABSS [AD]	RELSS [AD]	ABRELSS [AD]	ABSS [AD-5,AD-1]	RELSS [AD-5,AD-1]	ABRELSS [AD-5,AD-1]
Intercept	0.261***	0.003	0.064	0.147**	0.002	0.123***
	(3.02)	(0.57)	(0.52)	(2.56)	(0.54)	(4.45)
ABRET [AD]	-7.476***	0.0146	0.264	-0.348	0.0119	0.0867
	(-3.80)	(0.37)	(0.29)	(-0.27)	(0.43)	(0.14)
ABRET [AD-5,AD-1]	3.548	0.102	3.05	0.808	0.047	1.41
	(0.73)	(1.12)	(1.46)	(0.25)	(0.73)	(0.97)
ABVOL[AD-5,AD-1]	0.409***			1.791***		
	(17.77)			(116.81)		
RELSS[Benchmark]		1.005***	0.782		1.040***	
		(9.56)	(0.33)		(14.13)	
N	472	472	472	472	472	472
Adjusted R-squared	0.444	0.16	-0.001	0.972	0.295	-0.002

Table 20 Regression Models of SEO Discount on Short-selling Activities

This table presents results of regressions of the SEO discount on various firm and offering characteristics, and measures of trading activity and short-selling intensity prior to the issue date (ID).The SEO discount is defined as he negative value of the percentage difference between the offer price and the previous day's closing price. Log market cap is the logarithm of market capitalization the day before issuance. Volatility is the standard deviation of daily returns calculated over the 30 trading days ending 11 days prior to the offering. Relative offer size is the number of shares offered as a percentage of pre-issue shares outstanding. Positive CAR [-5,-1] is cumulative abnormal return over the five days prior to issuance day is positive, and zero otherwise. Log price is the logarithm of the price on the day before issuance. BE/ME is the ratio of book equity from the most recent fiscal year-end to the market value of equity at the end of the month prior to the issue date. Offer price cluster is a dummy variable equal to one if the decimal portion of the offer price is .00, .25, .50, or .75. NYSE dummy is a dummy variable equal to one if the firm is traded on the NYSE. Shelf dummy is a dummy variable equal to one if the offering is a shelf registration. Short selling is measured as abnormal relative short selling (ABRELSS), abnormal short selling (ABSS), and relative short selling (RELSS). Volume is measured as abnormal volume (ABVOL). Shelf*SSVar is an interaction term between Shelf dummy and the short-selling variable. [ID-10, ID-1] is the window from ten days prior to the ID through one day prior to the ID. The other windows are analogously defined. t-statistics are in parenthesis.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-0.496**	-0.345	-0.33	-0.412	-0.221	-0.254
	(-1.98)	(-1.39)	(-1.33)	(-1.63)	(-0.91)	(-0.95)
Log market cap	0.0438**	0.0329	0.033	0.0379*	0.029	0.0477**
	(2.04)	(1.55)	(1.56)	(1.75)	(1.42)	(2.22)
BE/ME	-0.00038	-0.00402	-0.00248	-0.00903	0.000713	-0.0143
	(-0.01)	(-0.11)	(-0.07)	(-0.25)	(-0.02)	(-0.39)
Volatility	-0.0334	-0.0185	-0.0205	-0.0268	-0.0254	-0.0393
	(-1.24)	(-0.69)	(-0.77)	(-0.99)	(-0.98)	(-1.37)
Log price	-3.195***	-3.027***	-3.042***	-3.608***	-3.145***	-3.297***
	(-4.48)	(-4.33)	(-4.36)	(-4.93)	(-4.66)	(-4.66)
Relative offer size	0.294***	0.326***	0.332***	0.315***	0.390***	0.336***
	(2.68)	(3.02)	(3.09)	(2.81)	(3.72)	(3.07)
Positive CAR [-5,-1]	0.0447	0.0351	0.0384	0.0432	0.029	0.0311
	(1.24)	(0.99)	(1.09)	(1.20)	(0.85)	(0.87)
Offer price cluster	0.0620*	0.059	0.0563	0.0542	0.0644*	0.0605
	(1.67)	(1.62)	(1.55)	(1.45)	(1.83)	(1.59)
Shelf dummy	0.0768*	0.0519	0.0268	0.0695*	-0.043	-0.214
	(1.91)	(1.30)	(0.64)	(1.73)	(-0.99)	(-1.63)
NYSE dummy	-0.0685	-0.0628	-0.0604	-0.0623	-0.0432	-0.0585
	(-1.58)	(-1.48)	(-1.43)	(-1.44)	(-1.04)	(-1.23)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
ABRELSS[ID-10,ID-1]		-0.215***	-0.270***			
		(-3.96)	(-4.37)			
Shelf*ABRELSS[ID-10,ID-1]			0.0818*			
			(1.86)			
ABSS [ID-5,ID-1]				-0.0114		
				(-1.01)		
ABVOL[ID-5,ID-1]				0.0475**		
				(2.28)		
ABRELSS[ID-10,ID-6]					-0.807***	
					(-4.83)	
ABRELSS[ID-5,ID-1]					-0.571***	
					(-6.85)	
Shelf*ABRELSS[ID-5,ID-1]					0.580***	
					(5.41)	
Shelf*ABRELSS[ID-10,ID-6]					0.869***	
					(4.25)	
RELSS [-5,-1]						-0.684***
						(-3.23)
Shelf*RELSS [-5,-1]						0.570**
						(2.27)
RELSS [Benchmark]						1.503
						(1.06)
N	361	361	361	361	361	361
Adjusted R-square	0.085	0.121	0.127	0.093	0.185	0.104

Table 21 Regression Models of SEO Discount on Short-selling Activities Conditional on Waiting Period from Announcement to Issuance

This table presents results of regressions of the SEO discount on various firm and offering characteristics, and measures of trading activity and short-selling intensity prior to the issue date (ID).The samples are divided into two sub sample groups based on the waiting period from the SEO announcement. If the announcement date is apart from the issuance date within 5 days, which is the restricted period under rule 105, then the samples fall into the first group (AD-ID<=5), otherwise the second group (AD-ID>5). The SEO discount is defined as he negative value of the percentage difference between the offer price and the previous day's closing price. The SEO discount is defined as the negative value of the percentage difference between the offer price and the previous day's closing price. Variables for the level of short-selling volumes and trade volumes are defined in the previous tables. The control variables are also defined in the previous table. t-statistics are in parenthesis.

	AD-ID >5			AD-ID <=5		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
INTERCEPT	-0.405	-0.514*	-0.562*	-0.0203	0.0177	0.0321
	(-1.30)	(-1.69)	(-1.84)	(-0.19)	(0.16)	(0.30)
ABRELSS [ID-10,ID-1]	-0.129**			0.0251		
	(-2.50)			(1.34)		
RELSS [ID-10,ID-1]		-0.297*			-0.00434	
		(-1.95)			(-0.10)	
ABSS [ID-10,ID-1]			0.0196			0.00388
			(1.21)			(0.98)
Beta	0.0355**	0.0406**	0.0437***	0.00735	0.00889	0.00873
	(2.16)	(2.51)	(2.70)	(1.19)	(1.39)	(1.42)
Cluster	0.0682	0.0758*	0.0484	0.00773	0.00606	0.00898
	(1.53)	(1.66)	(1.07)	(0.59)	(0.45)	(0.66)
BE/ME	0.00402	0.0188	0.0174	0.0109	0.00723	0.0145
	(0.09)	(0.43)	(0.40)	(0.81)	(0.54)	(0.95)
Log market value	0.0322	0.0488*	0.0411	0.00383	0.000487	0.000112
	(1.24)	(1.92)	(1.59)	(0.41)	(0.05)	(0.01)
NYSE	-0.0748	-0.101*	-0.0794	-0.0188	-0.0153	-0.0214
	(-1.36)	(-1.81)	(-1.43)	(-1.48)	(-1.21)	(-1.53)
RELSIZE	0.286**	0.305**	0.312**	0.0532	0.0791*	0.0127
	(2.20)	(2.34)	(2.39)	(1.15)	(1.74)	(0.16)
Volatility	-2.880***	-2.830***	-2.919***	0.666	0.566	0.563
	(-3.53)	(-3.45)	(-3.50)	(1.63)	(1.36)	(1.38)

Table 22 Regression Models of SEO Discount on Short-selling Activities Conditional on Waiting Period from Announcement to Issuance- continued

Positive CAR	0.0499	0.0479	0.0657	0.0111	0.0131	0.0110
	(1.11)	(1.06)	(1.46)	(0.97)	(1.12)	(0.95)
Log Price	-0.0178	-0.0218	-0.0244	-0.0191**	-0.0151	-0.0166*
	(-0.54)	(-0.66)	(-0.73)	(-2.02)	(-1.60)	(-1.81)
Shelf	0.0810	0.0853*	0.0948*	0.0257*	0.0262*	0.0238
Dummy	(1.62)	(1.71)	(1.89)	(1.78)	(1.77)	(1.61)
N	293	293	293	57	57	57
Adjusted R^2	0.110	0.102	0.095	0.421	0.398	0.410

Table 23 Regression Models of Abnormal Return on Short-selling Activities

This table reports regressions of market adjusted abnormal return on the day of seasoned equity offering. on various firm and offering characteristics and measures of short-selling intensity prior to the issue date (ID). The SEO discount is defined as the negative value of the percentage difference between the offer price and the previous day's closing price. Variables for the level of short-selling volumes and trade volumes are defined in the previous tables. The control variables are also defined in the previous table.

Dependent variable: Abnormal return (ABRET)						
INTERCEPT	-0.0773*	-0.0252	-0.0406	-0.0199	-0.0445	-0.0574
	(-1.66)	(-0.57)	(-0.87)	(-0.45)	(-0.97)	(-1.23)
BE/ME	0.00225	-0.00154	-0.00169	0.00245	-0.00096	-0.00034
	(0.34)	(-0.24)	(-0.25)	(0.38)	(-0.15)	(-0.05)
Log market value	0.00445	0.0011	0.000646	0.000123	0.00229	0.00144
	(1.12)	(0.29)	(0.16)	(0.03)	(0.58)	(0.36)
Log price	0.00605	0.00598	0.00706	0.00886*	0.00681	0.00666
	(1.22)	(1.25)	(1.32)	(1.84)	(1.37)	(1.24)
Volatility	0.0868	0.0289	0.0841	0.0596	0.079	0.0914
	(0.67)	(0.23)	(0.64)	(0.47)	(0.60)	(0.69)
Rel offer size	-0.0578***	-0.0631***	-0.0549***	-0.0806***	-0.0537***	-0.0578***
	(-2.87)	(-3.24)	(-2.71)	(-4.05)	(-2.66)	(-2.83)
Positive CAR	-0.00567	-0.00674	-0.00651	-0.00402	-0.0067	-0.00588
	(-0.86)	(-1.06)	(-0.98)	(-0.63)	(-1.01)	(-0.88)
Cluster	-0.00126	-0.00173	-0.00413	-0.00505	-0.0028	-0.00328
	(-0.18)	(-0.26)	(-0.58)	(-0.76)	(-0.41)	(-0.46)
Shelf	-0.0207***	-0.0216***	-0.0204***	-0.0220***	-0.0194**	-0.0226***
	(-2.78)	(-3.02)	(-2.70)	(-3.09)	(-2.57)	(-3.02)
NYSE	-0.00879	-0.00897	-0.00535	-0.0074	-0.0091	-0.0034
	(-1.10)	(-1.17)	(-0.60)	(-0.97)	(-1.14)	(-0.38)

Dependent variable: Abnormal return (ABRET)						
ABRELSS [ID-5,ID-1]	0.0267*** (3.32)					
ABSS [ID-5,ID-1]		0.00261*** (6.27)				
ABVOL [ID-5,ID-1]		-0.00135*** (-4.93)				
RELSS [ID-5,ID-1]			0.0369** (2.47)			
AVERELSS [ID-5,ID-1]			0.049 (0.19)			0.0667 (0.25)
ABSS [ID-10,ID-1]				0.0127*** (5.07)		
ABVOL [ID-10,ID-1]				-0.00597* (-1.68)		
ABRELSS [ID-5,ID-1]				0.0162*** (2.99)		
RELSS [ID-10,ID-1]						0.0455* (1.86)
N	361	361	361	361	361	361
ADJ. R-SQ	0.093	0.158	0.08	0.157	0.088	0.073

Table 24 Regressions of Post-Event Return on Short-selling Activities

This table reports results of regressions of returns after the issue date on pre-issue short selling for the full sample of events. Pre-issue short selling is defined as abnormal short selling (ABSS), relative short selling (RELSS), or abnormal relative short selling (ABRELSS). Pre-issue short selling is measured over days [ID-10, ID-6]. Post-issue abnormal returns are measured over days [ID+1, ID+5] in all models. The control variables include all the control variables in the previous two tables.

|	CAR110	CAR110	CAR110	CAR110	CAR110	CAR110
INTERCEPT	-0.109	-0.0824	-0.116	-0.147	-0.106	-0.135
	(-0.80)	(-0.62)	(-0.86)	(-1.08)	(-0.79)	(-1.00)
SHELFDUMMY	0.00879	0.0145	0.0158	0.00902	0.0135	0.0118
	(0.40)	(0.68)	(0.72)	(0.42)	(0.61)	(0.55)
ABRELSS[ID-5, ID-1]	-0.00143					
	(-0.06)					
ABSS[ID]		-0.0003				
		(-0.24)				
ABVOL[ID]		-0.00161*				
		(-1.94)				
RELSS[ID]			0.0502			
			(1.16)			
AVERELSS [BENCHMARK]			1.172			1.319*
			(1.55)			(1.72)
ABSS [ID-5,ID-1]				-0.00034		
				(-0.04)		
ABVOL[ID-5,ID-1]				-0.0113		
				(-1.05)		
ABRELSS[ID]					0.0158	
					(0.99)	
RELSS[ID-5,ID-1]						0.0249
						(0.35)
CONTROL ALL OTHER VARIABLES	Yes	Yes	Yes	Yes	Yes	Yes
N	361	361	361	361	361	361
ADJ. R-SQ	0.078	0.099	0.088	0.083	0.08	0.085
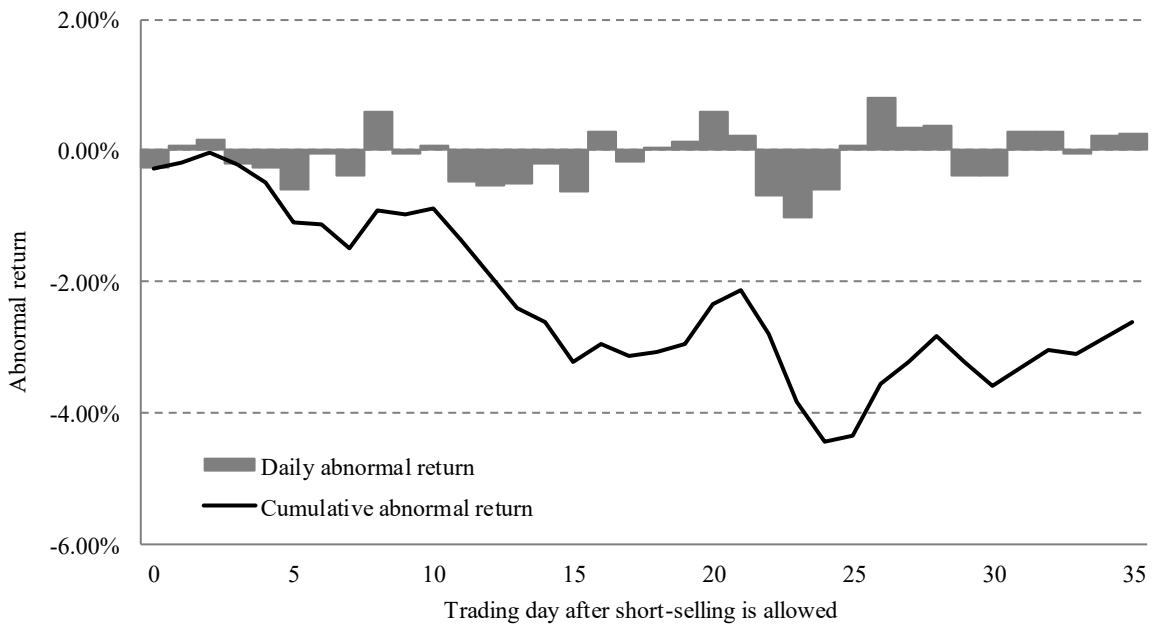
Figure 1 Daily Cumulative Abnormal Returns after the Introduction of Short-selling
The figure plots daily abnormal returns and cumulative abnormal returns for the pilot stocks allowed for short-selling. Day 0 is the first date that short-selling is allowed. Abnormal returns are returns in excess of the market portfolio. Cumulative abnormal returns are measured as the sum of the daily abnormal returns from day 0 to day t.
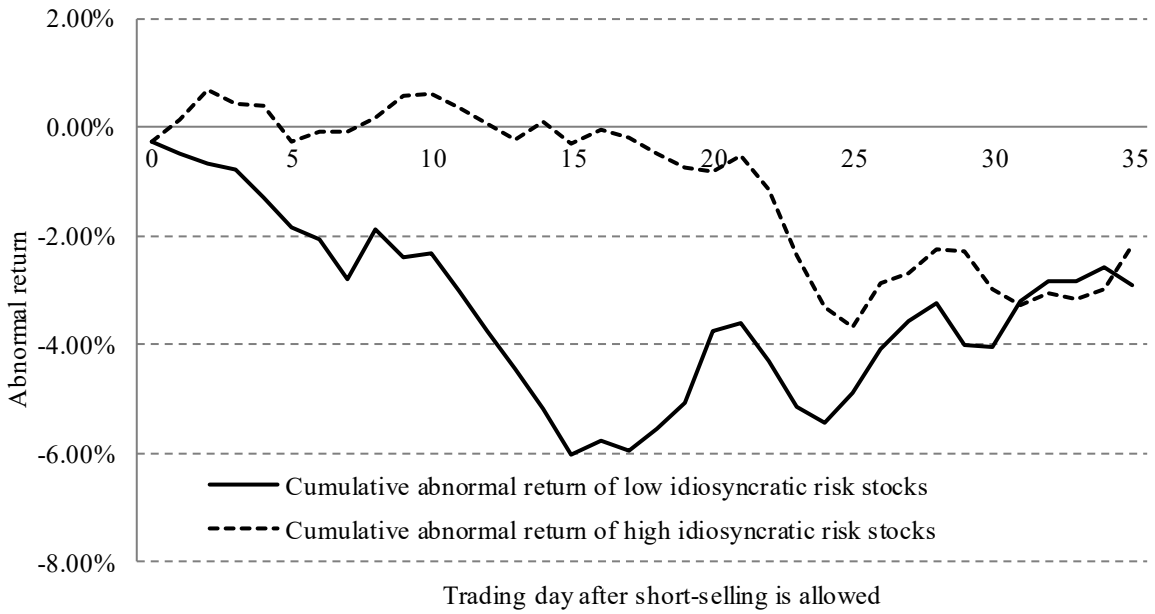
Figure 2 Cumulative Abnormal Returns after the Introduction of Short-selling Conditional on Idiosyncratic Risk

The figure plots cumulative abnormal returns for the pilot stocks allowed for short-selling. The sample stocks are divided in two equally-sized portfolios conditional on the level of idiosyncratic risk. Abnormal returns are returns in excess of the market portfolio. Cumulative abnormal returns are measured as the sum of the daily abnormal returns from day 0 to day t.
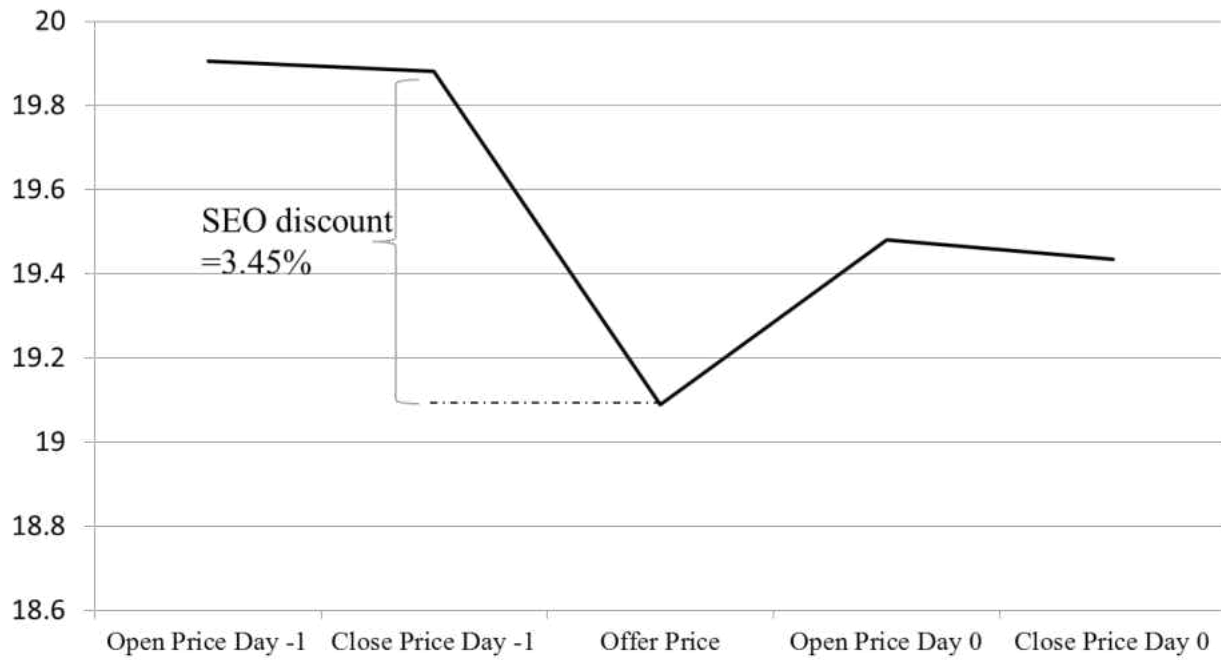
Figure 3 Average opening and closing prices around the SEO issue date
This figure plots the average prices of stocks at various stages during SEO process. The prices include offer price, the closing and open prices one day before and one day after the offering.