Does idiosyncratic risk deter short-sellers? Evidence from a First-time Introduction of Short-selling *

Song Wang
Graham School of Management
Saint Xavier University
Chicago, IL 60655
(407) 797-0702

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Abstract

This study uses a unique exogenous event, the first-time introduction of short-selling in a stock market, to examine whether idiosyncratic risk deters investors from selling short on negative information. I find that after short-selling is allowed, stocks with relatively higher idiosyncratic risk are associated with relatively less short-selling. Moreover, short-selling activity immediately following the introduction is highly informative and causes significant and permanent price declines. For stocks with relatively higher idiosyncratic risk, the prices decline less immediately following the introduction but decline more in subsequent periods. Overall, the findings provide strong support for the idea advanced by Shleifer and Vishny (1997) that idiosyncratic risk deters arbitrageurs with negative information from taking short positions in overvalued stocks. The results are robust to controls for firm size, dispersion of analyst opinions, liquidity, transaction costs, and cross-listing.

JEL classification: G12; G14; G15; G18; D53; D80; D81
Keywords: Short-sales constraints; Idiosyncratic risk; Limits to arbitrage; Stock returns

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Abstract

This study uses a unique exogenous event, the first-time introduction of short-selling in a stock market, to examine whether idiosyncratic risk deters investors from selling short on negative information. I find that after short-selling is allowed, stocks with relatively higher idiosyncratic risk are associated with relatively less short-selling. Moreover, short-selling activity immediately following the introduction is highly informative and causes significant and permanent price declines. For stocks with relatively higher idiosyncratic risk, the prices decline less immediately following the introduction but decline more in subsequent periods. Overall, the findings provide strong support for the idea advanced by Shleifer and Vishny (1997) that idiosyncratic risk deters arbitrageurs with negative information from taking short positions in overvalued stocks. The results are robust to controls for firm size, dispersion of analyst opinions, liquidity, transaction costs, and cross-listing.

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1. 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.[1] 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,

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

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.[2] 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.[3] In stark contrast to the U.S. setting, every short-sale

[2] 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).

[3] 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

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. [4] 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.[5] Thus, examining the impact of idiosyncratic risk on short-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.

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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.

[4] 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.

[5] 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). 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.

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.

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.

2. Model and empirical hypotheses

2.1. 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.[6] 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:

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

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.[7] The overall overvaluation of the firm

[6] 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.

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

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:*

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

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 $F\left(1-\pi_i\right)>0$) 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.

2.2. 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).[8] If market prices incorporate the negative information

[8] 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

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 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.

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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.

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.

3. Institutional setting, data and methodology

3.1. Short sale practices in China

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.[9]

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.[10] 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

[9] 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.

[10] 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.

requirement in the US, and excludes most of the individual investors from participating in short-selling.[11]

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).

[11] 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.

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).

3.2. 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)[12], 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

[12] 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.

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 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.

3.3. Idiosyncratic risk as a deterrent to arbitrage

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:

$$R_{PetroChina,t} = 0.0133 * R_{Yanzhou,t} + 0.478 * R_{Oilfield,t} + 0.097 * R_{Tianan,t}$$

$R_{PetroChina,t}$ 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.

3.4. Abnormal return and significance test

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

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

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

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.

4. Empirical tests upon the introduction event

4.1. 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. [13] 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 0.518%, which is not significantly different from zero at 10% level (p-value=0.36) either. The

[13] 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.

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.

4.2. Idiosyncratic risk constraining short-selling activities

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.

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.

4.3. Valuation effect of short-selling and idiosyncratic risk

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.

4.4. 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 A1 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 A2 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.

4.5. 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.

5. Empirical tests at the monthly level

5.1. 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.

6. 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.

References

Ali, A., Hwang, L., Trombley, A. M., 2003. Arbitrage risk and the book-to-market anomaly. Journal of Financial Economics 69, 355-373.

Aitken, M. J., Frino, A., McCorry, M. S., Swan., P. L., 1998. Short sales are almost instantaneously bad news: Evidence from the Australian stock exchange. The Journal of Finance 53, 2205–2223.

Ang, A., Hodrick, R., Xing, Y., Zhang, X., 2006. The cross-section of volatility and expected returns. Journal of Finance 61, 259–299.

Ang, A., Hodrick, R., Xing, Y., Zhang, X., 2009. High idiosyncratic volatility and low returns: International and further U.S. evidence. Journal of Financial Economics 91, 1-23.

Asquith, P., Pathak, P., Ritter, J., 2005. Short interest, institutional ownership, and stock returns. Journal of Financial Economics 78, 243–276.

Au, A. S., Doukas, J. A., Onayev, Z., 2009. Daily short interest, idiosyncratic risk, and stock returns. Journal of Financial Markets 12, 290-316.

Autore, M. D., Billingsley, S. R., Kovacs, T., 2011. The 2008 short sale ban: Liquidity, dispersion of opinion, and the cross-section of returns of US financial stocks. Journal of Banking & Finance 35, 2252-2266.

Barber, B. M., Lyon, J. D., 1997. Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. Journal of Financial Economics 43, 341-372.

Boehme, R. D., Danielsen, B. R., Kumar, P., Sorescu, S. M., 2009. Idiosyncratic risk and the cross-section of stock returns: Merton (1987) meets Miller (1977). Journal of Financial Markets 12, 438-468.

Boehmer, E., Jones, C. M., Zhang, X., 2008. Which shorts are informed? The Journal of Finance 63, 491–527.

Boulton, T. J., Braga-Alves, M. V., 2010. The skinny on the 2008 naked short-sale restrictions. Journal of Financial Markets 13, 397-421.

Chang, E. C., Cheng, J. W., Yu, Y., 2007. Short-sales constraints and price discovery: Evidence from the Hong Kong market. The Journal of Finance 62, 2097–2121.

Chen, H., Singal, V., 2003. Role of speculative short sales in price formation: The case of the weekend effect. The Journal of Finance 58, 685–706.

China securities depository and clearing corporation Ltd, 2009. Annual Report. URL: http://www.sipf.com.cn/en/AboutSIPF/annualreport/index.shtml.

Danielsen, B., Sorescu, S., 2001. Why do option introductions depress stock prices? A study of diminishing short-sale constraints. Journal of Financial and Quantitative Analysis 36, 451–484.

Dechow, P. M., Hutton, A. P., Meulbroek, L., Sloan, R. G., 2001. Short-sellers, fundamental analysis, and stock returns. Journal of Financial Economics 61, 77-106.

Diamond, D., Verrecchia, R., 1987. Constraints on short-selling and asset price adjustment to private information. Journal of Financial Economics 18, 277–312.

Diether, K., Malloy, C., Scherbina, A., 2002. Differences of opinion and the cross-section of stock returns. Journal of Finance 57, 2113–2141.

Diether, K., Lee, K., Werner, I. M., 2009. Short-sale strategies and return predictability. Review of Financial Studies 22, 575-607.

Doran, J., Jiang, D. S., Peterson, D. R., 2010. Short-sale constraints and the idiosyncratic volatility puzzle: An event study approach. Working Paper, Florida State University.

Duan, Y., Hu, G., McLean, R. D., 2010. Costly arbitrage and idiosyncratic risk: Evidence from short sellers. Journal of Financial Intermediation 19, 564-579.

Fama, E. F., MacBeth, J. D., 1977. Risk, return, and equilibrium: Empirical tests. Journal of Political Economy 81, 607-636.

Figlewski, S., 1981. The informational effects of restrictions on short sales: Some empirical evidence. Journal of Financial and Quantitative Analysis 16, 463-476.

Figlewski, S., Webb, G. P., 1993. Options, short sales, and market completeness. Journal of Finance 48, 761-777.

Gao, Y., Mao, C. X., Zhong, R., 2006. Divergence of opinion and long-term performance of initial public offering. Journal of Financial Research 29, 113–129.

Jones, C. M., Lamont, O. A., 2002. Short-sale constraints and stock returns. Journal of Financial Economics 66, 207–239.

Kothari, S. P., Warner, J. B., 1997. Measuring long-horizon security price performance. Journal of Financial Economics 43, 301-339.

Mashruwala, C., Rajgopal, S., Shevlin, T., 2006. Why is the accrual anomaly not arbitraged away? The role of idiosyncratic risk and transaction costs. Journal of Accounting and Economics 42, 3-33.

McLean, R. D., 2010. Idiosyncratic risk, long-term reversal and momentum. Journal of Financial and Quantitative Analysis 45, 883–906.

Mendenhall, R. R., 2004. Arbitrage risk and post-earnings-announcement drift. Journal of Business 77, 875-894.

Miller, E., 1977. Risk, uncertainty, and divergence of opinion. Journal of Finance 32, 1151–1168.

Merton, R., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483–510.

Nagel, S., 2005. Short sales, institutional investors and the cross-section of stock returns. Journal of Financial Economics 78, 277-309.

Pontiff, J., 2006. Costly arbitrage and the myth of idiosyncratic risk. Journal of Accounting & Economics 42, 35-52.

Roberts, M. R., Whited, T., 2010. Endogeneity in empirical corporate finance. Handbook of the Economics of Finance. Volume 2, Elsevier.

Saffi, P. A. C., Sigurdsson, K., 2011. Price efficiency and short selling. Review of Financial Studies 24, 821-852.

Shanghai Stock Exchange Margin Trading and Short Selling Regulation, 2010. URL http://www.sse.com.cn/sseportal/webapp/rzrq/sumdatainfo.

Shenzhen Stock Exchange Margin Trading and Short Selling Regulation, 2010. URL http://www.szse.cn/main/disclosure/rzrqxx/rzrqjy/.

Shleifer, A., Vishny, R. W., 1997. The limits of arbitrage. Journal of Finance 52, 35-55.

Senchack, A. J., Starks, L. T., 1993. Short sale constraints and market reaction to short interest announcement. Journal of Financial and Quantitative Analysis 28, 177-194.

Wurgler, J., Zhuravskaya, E., 2002. Does arbitrage flatten demand curves for stocks? Journal of Business 75, 583-608.

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

	All stocks			Low idiosyncratic risk stocks			High idiosyncratic risk stocks			High minus low	
Day:	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 $2\sqrt{-\text{Cov}}$ 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 * 10³/ 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 * 10^3 / Traded Shares*	– 8.160**	– 7.976**	– 7.335			
	(– 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*10^3 /Trade_shares*	– 5.637***		– 4.844***	– 5.055***	– 4.992***	
	(– 3.16)		(– 2.80)	(– 2.87)	(– 2.87)	
*Short_Shares*10^6 /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)
Dispersion of opinions			0.077			
			(0.72)			
IdioRisk (CAPM)Res						70.49**
						(2.04)
IdioRisk (matched)Res					106.0**	
					(2.29)	
N	94	94	93	94	93	93
Adjusted R^2	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 R^2	0.097	0.110	0.090	0.098	0.051

Table 6
Regression of long term short-selling activites on idiosyncratic risk in

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 (matched)		– 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 R^2	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 A1
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 A2
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-R^2	0.06	0.06	0.018	0.018	0.054	0.054

Figure 1
Daily and 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*.

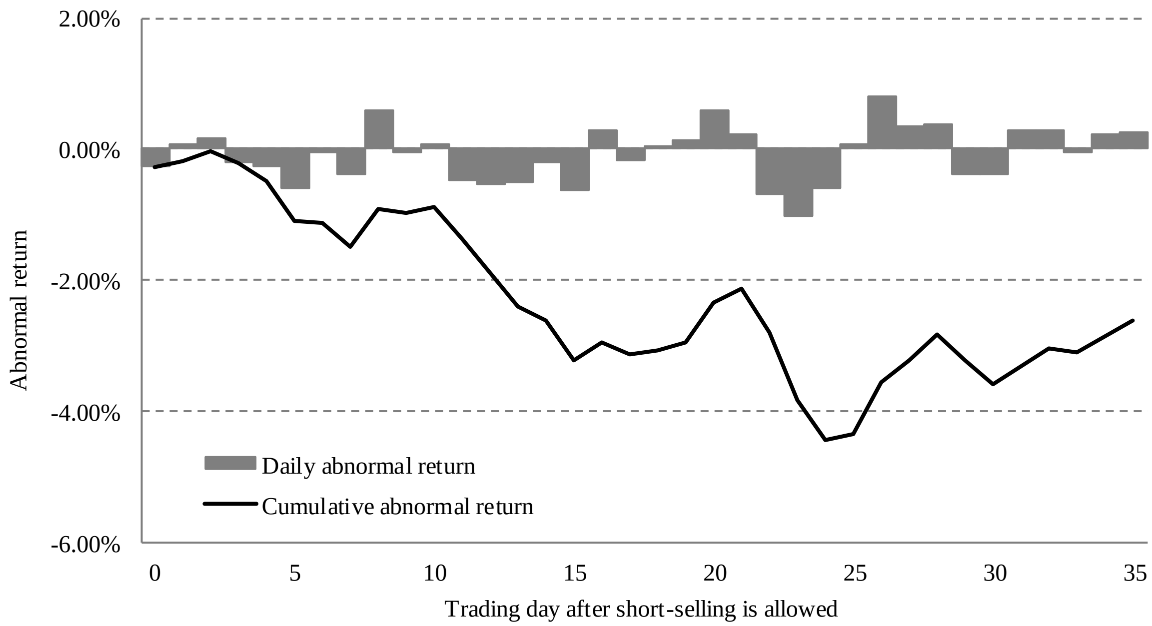

Figure 2
Cumulative abnormal returns after the introduction of short-selling conditional on idiosyncratic risk

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*.