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Leveraged trading and stock returns: Evidence from international stock markets☆

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ABSTRACT

Are margin traders as well-informed as short sellers when it comes to leveraged investing? Our paper, utilizing a unique dataset on stock-level short selling and margin trading from three international stock markets, reveals that while short selling has cross-sectional return predictability, margin trading does not. In comparison to short selling, margin-trading activities demonstrate a stronger correlation across stocks and weakly predict firm fundamentals. This suggests that margin traders are less likely to possess a firm-specific information advantage. Our findings at the investor account level also indicate that margin traders are less sophisticated than short sellers.

1. Introduction

Leveraged investors play a crucial role in financial markets as they leverage their positions through borrowing capital or stocks from brokers in pursuit of amplified returns. Given that taking leverage comes with inherent risks and costs, leveraged investors are expected to possess a high degree of sophistication and an information advantage. Previous studies primarily focus on the informational efficiency of short-sellers in leveraged trading.[1] In this study, we aim to expand on these findings by conducting a comparative

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[1] The informativeness of short selling has been well established. First, research shows that an increase in short interest predicts lower future stock returns (e.g., Christophe et al., 2004; Asquith et al., 2005; Cohen et al., 2007; Boehmer et al., 2008; Diether et al., 2009; Rapach et al., 2016). Second, short sellers act as a form of whistle-blower, effectively detecting the misconduct of managers (Karpoff and Lou, 2010; Massa et al., 2015). Third, short sellers have sophisticated skills in analyzing both private and public information (Engelberg et al., 2012; Khan and Lu, 2013). Lastly, retail short sellers have been found to trade on private information related to specific stocks (Gamble and Xu, 2017).

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analysis of short selling and margin trading, which are the two main types of leveraged trading.[2] Utilizing a unique dataset spanning three international stock markets, we investigate whether short sellers and margin traders are equally informed, and examine the effects of their trades on cross-sectional return predictability.

Margin trading and short selling have similarities. When an investor buys using a margin account, she borrows money with collateral, pays an interest rate that is comprised of the prevailing rate plus a markup, and must maintain a required margin level throughout the holding period. On the other hand, a short seller borrows shares in the securities lending market, posts collateral to meet the margin requirement, and pays an equity loan fee that is dependent on the specific characteristics of the stock and the lending conditions in the market.

Both margin traders and short sellers may receive a margin call if the asset price moves against their intended direction. Forced liquidation of leveraged positions [i.e., fire sales as described by Shleifer and Vishny (2011)] may result in large realized losses from deleveraging risk, leading to potential instability in financial markets (Kabir and Hassan, 2005; Richardson et al., 2017; Bian et al., 2018b). Furthermore, regulators and brokers set participation criteria for leveraged trading, deterring inexperienced and unskilled investors (Heilmer and Simsek, 2019; Gao et al., 2024). Therefore, both types of leveraged trades are costlier and riskier than unlevered long positions, and as such, they may be more informed about future stock prices.

By contrast, short selling has distinct characteristics that may contribute to its superior informativeness compared to margin trading. First, short selling is generally considered riskier than margin trading. Due to the positive equity premium and the tendency of asset prices to appreciate over the long term, margin calls on short positions may occur more frequently than those on margin purchase positions. Furthermore, loan fees can sometimes reach very high levels and shorted shares can be recalled (e.g., Engelberg et al., 2018). During periods of high volatility and low liquidity, the potential for large-scale short squeezes can result in significant losses for short sellers.

Second, the cost for short sellers to obtain negative firm news is higher than the cost for margin traders to obtain positive news, due to the asymmetric nature of firms' information diffusion. This is because managers are reluctant to disseminate bad news since they may face a reduction in compensation and career concerns when such news is released to the public (e.g., Nagar et al., 2003; Kothari et al., 2009; Solomon, 2012; Piotroski et al., 2015; Jung et al., 2018). Moreover, firms may even strategically release positive news regarding certain corporate behaviors (Ahern and Sosyura, 2014; Edmans et al., 2018). Consequently, it is more challenging and expensive for outside investors to acquire negative firm news.

Third, irrational, optimistic investors are more likely to participate in the market when market sentiment is high, while pessimistic investors are left out due to short selling constraints during low-sentiment periods (Yu and Yuan, 2011).[3] Similarly, Barber and Odean (2008) find that noisy investors trade more aggressively during high-sentiment periods. As a result, short sellers who rely on a pessimistic market environment tend to be more sophisticated and rational than margin traders who leverage on optimistic sentiment. The effect of investor behavioral biases on the trading activities of short sellers and margin traders is also likely to be heterogeneous, with a smaller effect observed for short sellers during high market-wide sentiment periods.

All three of the mechanisms discussed above suggest that short sellers have a greater informational advantage, which allows their trades to better predict individual stock returns compared to those of margin traders. The much higher risk faced by short sellers may also deter them from trading based on subtle signals or less apparent information. Consequently, the perceived informational advantage of short sellers might merely reflect the increased risks they bear compared to margin traders. Unfortunately, we cannot completely disentangle this risk-based channel from the information channel. Rather than ruling out the "higher-risk of short seller" explanation, we argue that these two channels are closely related and the risk channel probably enhances the information channel, leading to a likely overestimation of the return predictability of short sellers' informational advantage.

To investigate the informativeness and return predictability of leveraged trading, we exploit a unique dataset that encompasses short-selling and margin-trading transactions for 6024 stocks from the Chinese A-share stock market, the Japanese stock market, and the Taiwanese stock market. To our knowledge, this dataset is the most comprehensive source within the current literature on leveraged trading, providing direct information on both short-selling and margin-trading activities for individual stocks. By contrast, due to data limitations, previous studies examining margin trading usually rely on derivatives, such as options with embedded leverage (e.g., Bali and Murray, 2013; Frazzini and Pedersen, 2022). Moreover, using a proprietary dataset on the trading behavior of Chinese retail investors in both spot and margin accounts, we can identify the characteristics of investors that influence their short-selling and margin-trading activities.

We introduce two metrics for our study: a short-selling measure and a margin-trading measure. These measures reflect the extent of leveraged trading activities. We then create value-weighted quintile portfolios based on these two measures. Our results show that stocks with higher levels of net short selling have lower future returns. The strategy of purchasing the lowest quintile of short-selling stocks and selling the highest quintile of short-selling stocks generates an excess return of 6.76% per year and a Fama-French three-factor alpha of 7.28% per year, both of which are statistically significant at the 5% level. On the other hand, our findings indicate that margin trading does not predict future stock returns in the cross-section.

We perform several additional tests. First, our findings show that the pattern of informed short selling and uninformed margin trading is present in each of the three international markets. Second, our conditional double-sorting analyses reveal that the return

[2] Alternatively, sophisticated investors can also take leverage in the options market (e.g., Chakravarty et al., 2004; Ryu and Yang, 2018). Unless stated otherwise, margin-trading activity in this paper means buying stocks on margin.

[3] Other studies that examine how investor sentiment and short sale constraints jointly affect asset prices include Stambaugh et al. (2015), Shen et al. (2017), Chen et al. (2020), and Chen et al. (2023).

predictability of short selling remains unchanged even when controlling for margin trading, while a high level of margin trading does not result in higher future returns, regardless of the intensity of short selling. Lastly, we demonstrate that our results are robust even after controlling for various established return predictors, such as market capitalization, book-to-market ratio, momentum effect, short-term reversal, and idiosyncratic volatility.

We also delve deeper into the reasons behind the informational advantage of short sellers compared to margin traders. First, we observe that an abnormal increase in short selling prior to earnings announcements predicts a lower unexpected earnings surprise, while margin-trading activities are not associated with unexpected earnings surprises, suggesting that short sellers are more likely to possess firm-specific information than margin traders. Second, we find that individual stocks' margin-trading activities are more likely to comove compared to short selling. The higher level of comovement in margin trading suggests that margin traders may have less firm-specific information on individual stocks and that their trading decisions may be driven by market-wide factors, such as investor sentiment. Third, by exploiting the proprietary dataset of individual investors' leveraged transactions from a nationwide brokerage firm in China, we compare the characteristics of short sellers and margin traders. We find that relative to margin traders, short sellers tend to have more sophisticated investment skills, longer investment experience, and fewer behavioral biases. They also hold more diversified portfolios and fewer risky stocks. Finally, we find that the correlation of rationality measures to short-selling intensity is stronger when market sentiment is high.

Our study is among the first to compare the information content of two types of leveraged traders in global stock markets. As leveraged investors, short sellers have been documented as informed investors and their trades predict future stock returns. Due to the lack of margin-trading data, the majority of studies focus on short sellers (e.g., Christophe et al., 2004; Asquith et al., 2005; Cohen et al., 2007; Boehmer et al., 2008; Diether et al., 2009; Rapach et al., 2016; Boehmer et al., 2018).

There are two papers that also examine margin trading and are related to our study. Chang et al. (2014) examine the impact of margin-trading and short-selling activities on market efficiency and returns in the Chinese A-share market. Their findings suggest that margin trading is associated with lower contemporaneous returns, but does not predict future returns, whereas intensified short-selling activities improve price efficiency and negatively predict future returns. Our research differs from theirs in several ways. First, we expand the scope of the study to include three international markets and examine the informativeness and return predictability of both short selling and margin trading. Second, we investigate factors that contribute to the differences in informativeness between these two types of leveraged traders. Lastly, we utilize a proprietary dataset, allowing us to gain a deeper understanding of the characteristics and behaviors of both types of leveraged traders.

In another related paper, Deuskar et al. (2020) find that margin capacity has a strong correlation with aggregate macro variables, such as S&P 500 returns, due to the conservatism of informed margin investors prior to adverse market conditions. Our paper differs from theirs in that we concentrate on the cross-sectional return predictability, whereas they examine the time series relationship.

Broadly speaking, our paper also contributes to the literature on the influence of leveraged trading on market quality. The impact of leverage on financial markets has been widely discussed, with some scholars contending that leveraged investors enhance price efficiency and curtail excess volatility (e.g., Seguin, 1990). By contrast, others suggest that leveraged traders tend to be speculative and destabilize the market (e.g., Hardouvelis, 1990; Hardouvelis and Peristiani, 1992; Chowdhry and Nanda, 1998; Bhojraj et al., 2008; Bian et al., 2018a, b; Hansman et al., 2018; Heilmer and Simsek, 2019). Differing from these earlier studies, we emphasize the variations among leveraged investors in terms of their impact on market efficiency.

The remainder of the paper is organized as follows. In Section 2, we describe the data and the construction of variables. In Section 3, we present the main empirical findings. In Section 4, we investigate the possible explanations for the return predictability of short selling and margin trading. We conclude in Section 5.

2. Data and variable construction

In this section, we provide an overview of the institutional background of leveraged trading in three distinct markets. We also outline the details of our data construction process.

2.1. Institutional background

Since the 2007–2009 global financial crisis, short selling has attracted more attention and has been a subject of considerable research. In comparison, the literature on margin trading is limited and there are even fewer studies that compare the roles of these two types of leveraged trading behaviors.

The scarcity of evidence on margin trading can be attributed to data limitations. While short-selling data is readily available for many markets (Boehmer et al., 2022), publicly available margin-trading data for individual stocks is limited to only a few markets. We overcome these limitations by utilizing a unique set of databases on stock-level short selling and margin trading in three international markets: the Chinese A-share stock market, the Japanese stock market, and the Taiwanese stock market. According to the World Federation of Exchanges, these three markets account for 17.3% of the global market capitalization and 15.9% of the total number of listed stocks as of the end of 2019.

2.1.1. Chinese A-share market

Leveraged trading was first introduced in the Chinese stock market in 2010. On March 31 of that year, the two main stock exchanges, the Shanghai Stock Exchange and the Shenzhen Stock Exchange launched a pilot program that allowed investors to buy eligible stocks with margin borrowing or by engaging in short selling. The program initially covered 90 stocks selected from the SSE50

Index and the SZSE Component Index, and these stocks had to meet specific criteria, such as: i) being listed for at least three months, ii) having a minimum number of shares outstanding of 100 (200) million and a minimum market capitalization of RMB 500 (800) million for margin trading (short selling), and iii) having at least 4000 shareholders. Generally, stocks that qualified for the program were large, liquid, and well-established companies.

Since its initial introduction in 2010, several revisions have been made to the list of eligible stocks for leveraged trading in the Chinese stock markets.[4] Over our sample period of July 2010 to December 2019, we include 1074 stocks that were included in the list of eligible stocks for leveraged trading at some point before 2019.

The market share of aggregate margin balance as a fraction of total market capitalization is plotted in Panel A of Fig. 1. The market share of aggregate margin trading increased from zero in 2010 to nearly 3% in 2014, as the number of eligible stocks for margin trading expanded. However, a ban on illicit share financing by the China Securities Regulatory Commission (CSRC) on June 13, 2015 resulted in a sharp decrease in leveraged trading activities and a fluctuation around 2%. By contrast, the market share of aggregate short selling is much smaller, averaging below 0.04% of total market value from 2010 to 2015. After the 2015 stock crisis in the Chinese A-share market, the market share of aggregate short selling decreased to 0.01% and fluctuated between 0.01% and 0.03% from 2016 to 2019.

2.1.2. Japanese stock market

Leveraged trading has a long history in Japan, dating back to 1951. The country has two forms of leveraged transactions: the standardized margin transaction and the negotiable margin transaction. In standardized margin transactions, the lending fee and settlement period are regulated by stock exchange rules and only stocks with sufficient liquidity are eligible. Securities companies can borrow stocks and cash from securities finance corporations under rules set by stock exchanges for this type of transaction. In negotiable margin transactions, the lending fee and settlement period are privately negotiated between the investor and the securities company, and all listed stocks are eligible.[5]

For each margin trade in the Japanese stock market, investors must provide an initial margin of at least 30% of the transaction value or 300,000 yen (2736 USD). The maintenance margin, which must be maintained throughout the duration of the transaction, is set at a minimum of 20% of the transaction value. If the margin balance falls below the required threshold due to marking to market, investors must deposit additional margin to meet the minimum maintenance margin. The exchanges have the authority to implement administrative and operational restrictions on margin transactions in cases of potentially harmful, speculative transactions. This could include increasing the margin requirement, increasing the cash portion of the deposited margin, or restricting or prohibiting margin trades for individual stocks or the market as a whole when margin transactions become excessively overheating.

We obtain data from Nikkei China (Hong Kong) Ltd. for both short selling and margin trading in Japan from January 2003 to June 2016.[6] Panel B in Fig. 1 shows that during our sample period, the market share of aggregate margin-trading balance in Japan fluctuates between 0.4% and 2%, while the market share of aggregate short-selling balance fluctuates between nearly 0.2% and 0.5%. The peak of margin trading in the Japanese stock market was reached in 2005, and it gradually decreased until the bottom in 2008 during the global financial crisis, before recovering thereafter. Short-selling activities, on the other hand, have generally declined since 2004, although not in a strictly linear manner. Note that there is no clear comovement between the market shares of margin-trading and short-selling activities, or any evidence of a divergence.

2.1.3. Taiwanese stock market

Margin trading and short selling were introduced in Taiwan in 1974 and 1981, respectively. To be eligible for margin trading, stocks must be listed for at least six months and have a market price above their par value. Stocks that are excessively volatile, concentrated, or have excessive trading volume are disqualified. If margin trading or short interest exceeds 25% for a stock, margin trading or short selling is banned until the leveraged trading drops below 18%.

The Taiwan Stock Exchange sets the minimum maintenance margin level for all investors in the market. Securities companies can adjust the threshold based on the investor's credit and stock risk. They assign each stock a risk level based on factors such as concentration of margin transactions, maintenance margin level, corporate news, and professional media comments. Investors must maintain the margin above the specified maintenance requirement for the duration of the transaction. Marking to market is performed daily.

Panel C of Fig. 1 shows that the market share of margin trading in Taiwan decreases over time, although not consistently, from 6.4% in 1999 to below 0.9% in 2019. The market share of short selling, on the other hand, experiences more obvious fluctuations over time. While both market shares of margin trading and short selling exhibit a slow decreasing trend, there is no clear correlation between the two.

[4] In July 2010, six stocks were added to the original list. On December 5, 2011, 185 stocks were added and 18 were removed. In 2013, 461 stocks were added to the list and 59 were dropped, and 200 stocks were added and 27 were dropped on September 22, 2014. More recently, 132 stocks were added and 8 were dropped between 2016 and 2018.

[5] The major stock exchanges in Japan are the Tokyo Stock Exchange, the Osaka Securities Exchange, the Nagoya Stock Exchange, and the Japan Association of Securities Dealers Automated Quotation, with the majority of traded stocks listed on these four exchanges. Leveraged transactions are supported by three securities finance corporations in Japan: Japan Securities Finance Company, Osaka Securities Finance Company, and Chubu Securities Financing Company.

[6] Due to data limitations, stock-level short-selling and margin-trading data in Japan are unavailable after June 2016.

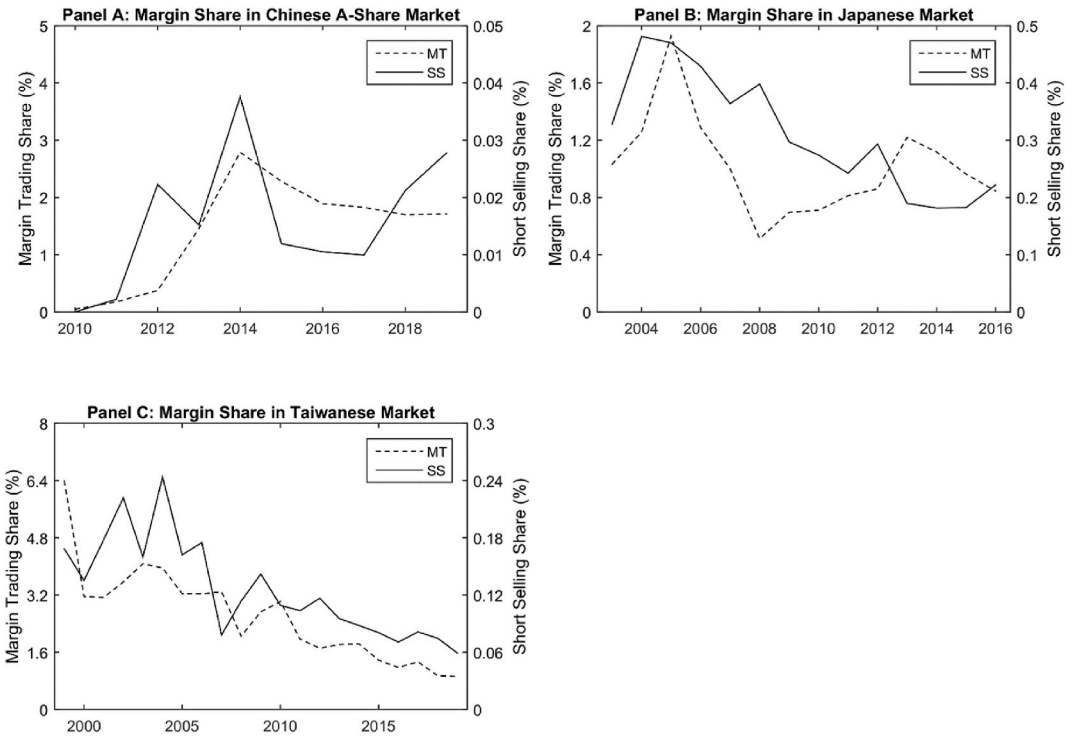

Fig. 1. Share of Aggregate Margin Balance over Time. This figure shows the market share of aggregate margin-trading (*MT)* and short-selling (*SS*) balance in the Chinese A-share market, Japanese market, and Taiwanese market. The sample period is from July 2010 to December 2019 for the Chinese A-share market, January 2003 to June 2016 for the Japanese market, and January 1999 to December 2019 for the Taiwanese market.

2.2. Data and construction of variables

We obtain leveraged transactions, stock returns, firm financial data, and earnings announcements for Chinese stocks from the China Stock Market & Accounting Research (CSMAR) database provided by GuoTaiAn (GTA). Data on bond and bill returns for China are from the RESSET database. For Japanese stocks, we use data from Nikkei China (Hong Kong) Ltd. For Taiwanese stocks, we use data from the *Taiwan Economic Journal* for margin trading and stock returns and Datastream for financial statements. Earnings announcements for Japanese and Taiwanese stocks are from IBES. We exclude marginable exchange-traded funds (ETFs) from our sample. Our sample covers the Chinese A-share market from July 2010 to December 2019, the Japanese stock market from January 2003 to June 2016, and the Taiwanese stock market from January 1999 to December 2019.

We introduce two measures to capture short-selling and margin-trading activities for each stock. We define our short-selling measure for stock i in week t, $SS_{i,t}$, as the ratio of stock i's net short sold shares in a week to the average weekly traded shares over the past 52 weeks. The net short sold shares are calculated as the total short sold shares minus the repaid shares. We define the margin-trading measure for stock i in week t, $MT_{i,t}$, as the ratio of stock i's net purchases on margin in a week to its average trading volume over the past 52 weeks. The net margin purchases are determined by subtracting the margin repayment amount from the total margin-trading amount. For both measures, we require a minimum of 40 weeks of observations as of the week the portfolio is formed.

Note that while short selling is measured in terms of the number of shares in all three markets, margin trading is measured in terms of the dollar amount in the Chinese A-share market due to data limitations. The key variables of interest in our study, *SS* and *MT*, incorporate information from both opening and covering trades by using net shares short sold and net margin purchases as numerators.[7] In the following tests, we use the two measures as the sorting variables to construct stock portfolios and explore the underlying factors that contribute to the return predictability of leveraged trading.

2.3. Summary statistics

We present the summary statistics for the short-selling measure (*SS*) and the margin-trading measure (*MT*) in Panel A of Table 1. Panel A.1 reports the summary statistics for stocks across all three markets, while Panels A.2 to A.4 report the summary statistics for each market separately. Our sample encompasses 6024 distinct stocks and 3.2 million stock-week observations. The Chinese A-share market is represented by 1068 marginable stocks with 277,710 stock-week observations; the Japanese stock market by 3287 stocks

[7] Boehmer et al. (2018) show that short sellers use positive private information in covering trades.

with over 1.8 million stock-week observations; and the Taiwanese stock market by 1669 stocks with 1.1 million stock-week observations.

Several findings are worth highlighting. First, the average *SS* is 0.02%, which is significantly lower than the average value of *MT*, which is 0.12%. This suggests that short selling is less pervasive compared to margin trading.

Second, both *SS* and *MT* exhibit significant variation over time and across stocks. The overall standard deviations of *SS* and *MT* are 1.42% and 8.08%, respectively, which are much higher than their means. The average standard deviations of *SS* and *MT* at the time-series level across all stocks are 0.93% and 6.14%, respectively. The average cross-sectional standard deviations of *SS* and *MT* across all weeks are 1.53% and 8.63%, respectively.

Third, the Chinese A-share market exhibits a larger average margin-trading (*MT*) intensity at 0.44%, compared to the Japanese market's value of 0.07% and the Taiwanese market's value of 0.12%. However, the Chinese A-share market also shows a smaller average short-selling (*SS*) intensity at 0.00%,[8] in contrast to the Japanese market's value of 0.02% and the Taiwanese market's value of 0.04%. These results align with our previous observation that the asymmetry between margin trading and short selling is more pronounced in China's A-share market.

Panel B of Table 1 presents the average cross-sectional and time-series correlations between *SS* and *MT* for both for the full sample and for each market individually. Overall, *SS* and *MT* have a positive and statistically significant cross-sectional correlation (0.20, *t*-stat. = = 41.04) and time-series correlation (0.11, *t*-stat. = 29.94). The results suggest that stocks with heavy short selling are often highly bought on margin within a given week, indicating that short-selling and margin-trading activities tend to move together for individual stocks. Examining the correlations more closely in each market reveals the strongest positive cross-sectional and time-series correlations in the Taiwanese stock market, smaller and less significant correlations in the Japanese market, and even negative correlations in the Chinese A-share market. These findings suggest that there may be a relatively lower dispersion of opinions between short sellers and margin traders in Taiwan, but a higher dispersion in China's A-share market.

3. Return predictability of leveraged trading

In this section, we compare the cross-sectional return predictability of the two types of leverage trading, margin trading and short selling, to determine which forces dominate.

3.1. Baseline findings

To investigate the relationship between leveraged trading and future stock returns, we create weekly value-weighted quintile portfolios based on short selling (*SS*) or margin trading (*MT*). Firms are ranked 1 to 5 in each market based on their *SS* or *MT* quintile at the beginning of each week. We calculate the value-weighted returns of *SS*-sorted (*MT*-sorted) quintile portfolios in each market, then average the returns of each quintile portfolio across the three markets. The sample period is from January 1999 to December 2019.

Table 2 presents the value-weighted average weekly returns in excess of the risk-free rate (Ret^{ex}) and Fama-French three-factor risk-adjusted portfolio alphas (*Alpha*) for single-sorted quintile portfolios by *SS* or *MT*. The risk-free rate is the three-month Shanghai Interbank Offered Rate (SHIBOR) in the Chinese A-share market and the one-month Treasury-bill rate in the Japanese and Taiwanese markets. HML denotes the long-short portfolios. Unless otherwise specified, all *t*-statistics for portfolio returns are Newey-West five-lag adjusted.

The results Table 2 reveal three key observations. First, excess returns and risk-adjusted alphas for *SS*-sorted portfolios decrease in line with the level of short selling, resulting in a weekly return spread of −0.13% and an alpha spread of −0.14% per week, both with significant *t*-statistics. This suggests that heavily short sold stocks underperform, consistent with the previous studies (Engelberg et al., 2012; Khan and Lu, 2013; Gamble and Xu, 2017) showing that short sellers have an informational advantage in pre-empting or interpreting negative firm-specific news.

Second, unlike *SS*-sorted portfolios, *MT*-sorted ones do not generate significant return spreads. The HML portfolio yields an excess return of −0.04% (*t*-stat. = −0.73) and a -risk-adjusted alpha of −0.06% per week (*t*-stat. = −0.98). Moreover, stocks with low levels of net margin purchases show positive excess returns of 0.19% per week and alphas of 0.091% per week, both statistically significant at the 5% level. These findings suggest that high margin-trading intensities do not predict future stock returns, and that margin traders may not possess private information about individual stocks.

Third, we report the return and alpha differences between an HML margin-based strategy and an HML short sale-based strategy in the columns (5) and (6) of Table 2. The raw return difference of the two long-short portfolios is −0.17% (*t*-stat. = −2.20), suggesting that compared to a short sale-based strategy, the margin-based hedged portfolio underperforms by 0.17% per week. Such underperformance is also economically and statistically significant for the Fama-French three-factor adjusted alpha (−0.19% per week with a *t*-statistic of −2.54).

In summary, our results suggest that short sellers may be informed traders, while margin traders' activities do not necessarily indicate an informational advantage. This suggests that information cost and investors' pessimism may be more influential than leverage cost in leveraged traders' return predictability.

[8] More precisely, the average short-selling (*SS*) intensity in the Chinese A-share market is 0.002%.

Table 1
Summary statistics and correlation coefficients.

Panel A: Short-selling and margin-trading variables

	Stocks	*N*	Mean	STD	P10	P25	Median	P75	P90
Panel A.1: Full sample									
SS	6024	3,223,440	0.02	1.42	−0.39	0.00	0.00	0.00	0.34
MT	6024	3,223,440	0.12	8.08	−5.26	−1.17	0.00	0.69	4.82
Panel A.2: Chinese A-share market									
SS	1068	277,710	0.00	0.12	−0.09	−0.02	0.00	0.02	0.09
MT	1068	277,710	0.44	4.49	−3.60	−1.60	−0.15	1.64	5.11
Panel A.3: Japanese market									
SS	3287	1,845,897	0.02	1.02	−0.09	0.00	0.00	0.00	0.09
MT	3287	1,845,897	0.07	4.84	−2.10	−0.29	0.00	0.27	2.13
Panel A.4: Taiwanese market									
SS	1669	1,099,833	0.04	2.05	−1.02	−0.16	0.00	0.09	0.95
MT	1669	1,099,833	0.12	12.11	−9.81	−3.83	−0.30	2.34	9.62

Panel B: Correlations between *SS* and *MT*

	Full Sample	Chinese A-share Market	Japanese Market	Taiwanese Market
Cross-sectional	0.20	−0.02	0.03	0.24
	(41.04)	(-3.06)	(5.11)	(45.84)
Time-series	0.11	0.04	0.05	0.26
	(29.94)	(9.72)	(7.08)	(52.19)

This table presents summary statistics and correlation coefficients. Panel A.1 presents the summary statistics of the full sample for the short-selling (SS) and margin-trading (MT) variables. SS (MT) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. Panels A.2 to A.4 present the summary statistics of SS and MT for the Chinese A-share market, Japanese market, and Taiwanese market, respectively. Panel B presents average cross-sectional and time-series Pearson correlation coefficients of SS and MT for the full sample and the three markets. The cross-sectional correlation is averaged across weeks, and the time-series correlation is averaged across stocks. Reported in parentheses are the t-statistics of average coefficients. The sample period is from July 2010 to December 2019 for the Chinese A-share market, January 2003 to June 2016 for the Japanese market, and January 1999 to December 2019 for the Taiwanese market.

Table 2
Short-selling and margin-trading-sorted portfolios: Full sample.

	(1)	(2)	(3)	(4)	(5)	(6)
	SS		*MT*		*MT - SS*	
	Ret^{ex}	*Alpha*	Ret^{ex}	*Alpha*	Ret^{ex}	*Alpha*
Low	0.12	0.03	0.19**	0.09**		
	(1.14)	(0.65)	(2.26)	(2.17)		
2	0.08	−0.01	0.06	−0.03		
	(0.89)	(-0.23)	(0.73)	(-0.78)		
3	0.12	0.02	0.02	−0.07*		
	(1.33)	(0.50)	(0.21)	(-1.94)		
4	0.05	−0.04	0.12	0.02		
	(0.59)	(-1.22)	(1.15)	(0.59)		
High	−0.01	−0.11***	0.15	0.04		
	(-0.13)	(-2.80)	(1.42)	(0.89)		
HML	−0.13**	−0.14***	−0.04	−0.06	−0.17**	−0.19**
	(-2.45)	(-2.59)	(-0.73)	(-0.98)	(-2.20)	(-2.54)

This table presents the excess returns and time-series regression alphas from the Fama-French three-factor model of portfolios in the full sample. At the beginning of each week, we sort stocks into quintile portfolios by short-selling (SS) and margin-trading (MT) variables relative to their peers in each market. SS (MT) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. The weekly percentage returns of portfolios are first value-weighted in each market and then averaged across three markets. Newey and West (1987) t-statistics adjusted for heteroskedasticity and autocorrelation are reported in parentheses. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from January 1999 to December 2019.

3.2. Individual markets

One concern with the baseline finding is the possibility of ignoring heterogeneity among stock exchanges in terms of their unique leveraged trading history, regulatory rules, and market structure. Consequently, the informativeness of short selling and margin trading may differ significantly across the three markets. To address this concern, we examine the cross-sectional return predictability of short selling and margin trading in each market separately.

Table 3 presents the results. In line with the baseline result, *MT* still fails to demonstrate cross-sectional return predictability in any

of the three individual markets. The risk-adjusted alphas for stocks with high and low levels of margin trading are both statistically and economically insignificant in both the Chinese A-share market and the Taiwanese stock market. In the Japanese stock market, the alpha spread between the long-short portfolios sorted by *MT* is 0.11% per week, however, it remains statistically insignificant and indistinguishable from zero. On the other hand, HML portfolios sorted by *SS* exhibit significantly negative excess returns and alphas across all three markets. The weekly alphas for the Chinese A-share market, the Japanese stock market, and the Taiwanese stock market are −0.14% (*t*-stat. = −2.17), −0.13% (*t*-stat. = −3.58), and −0.21% (*t*-stat. = −3.00), respectively.

Furthermore, our findings reveal that the sources of the return spreads sorted by *SS* vary among the three markets. In the Chinese A-share market, the short-leg (low-*SS*) portfolio accounts for two-thirds of the return spread, whereas it contributes to one-quarter in the Japanese stock market and one-fifth in the Taiwanese stock market. This variability in the contribution of the short-leg portfolio highlights that short sale restrictions are comparatively more stringent in the Chinese A-share market and more relaxed in the Japanese and Taiwanese stock markets.

Finally, when comparing the HML portfolios sorted by *MT* to those sorted by *SS*, the former underperforms the latter in both the Chinese A-share market (by 0.20% per week, *t*-stat. = 2.06) and the Taiwanese market (by 0.21% per week, *t*-stat. = 2.28). However, we observe no statistically significant difference in returns between the two HML portfolios in the Japanese market.

3.3. Double sorting

In the preceding section, we evaluate the cross-sectional return predictability of margin trading and short selling through single sorting. However, the results could be influenced by the correlation between margin-trading and short-selling activities, as indicated in Panel B of Table 1. To address this, we further examine the cross-sectional return predictability of one form of leverage trading while controlling for the other, using the technique of conditional double-sorting.

Table 4 present the results. The columns (1) and (2) show the Fama-French three-factor adjusted alpha of each *SS* portfolio, conditional on *MT*. Similar to the baseline findings in Table 2, the alpha decreases with *SS*, from 0.04% per week to −0.11% per week within the low-*MT* stocks. The weekly alpha spread is more economically and statistically significant for low-*MT* stocks (−0.15%, *t*-stat. = −2.33) than for high-*MT* stocks (−0.06%, *t*-stat. = −1.08), suggesting that informed short sellers may be more likely to exploit their private information when there is less interference from margin traders, who may act in a noisy and uninformed manner. This conclusion is also pronounced in the Japanese and Taiwanese stock markets, as displayed in Table IA.1 in the Internet Appendix.

We also analyze the performance of the *MT*-sorted portfolios within the top 50% and bottom 50% *SS* groups. The results are reported in the columns (3) and (4) of Table 4. Interestingly, when conditioned on low *SS*, the weekly alpha of the hedged HML portfolio sorted by *MT* is significantly negative, with a magnitude of −0.16% and a *t*-statistic of −2.16. This negative alpha spread can mainly be attributed to the positive alpha of 0.16% per week generated by the short leg. On the other hand, among high-*SS* stocks, the alpha spread of *MT*-sorted portfolios is statistically indistinguishable from zero.

In conclusion, despite the potential correlation between margin-trading and short-selling activities, a high level of short selling still predicts negative future returns even after controlling for margin trading, especially for stocks with low levels of margin trading. However, a high level of margin trading is not linked to higher future returns, regardless of the intensity of short-selling activities. In

Table 3
Short-selling and margin-trading-sorted portfolios.

	Chinese A-share Market		Japanese Market		Taiwanese Market	
	SS	*MT*	*SS*	*MT*	*SS*	*MT*
Low	0.09**	0.06	0.03	0.00	0.04	0.08*
	(2.09)	(1.01)	(0.53)	(0.03)	(0.86)	(1.82)
2	0.04	0.02	0.02	−0.02	0.01	−0.05
	(0.83)	(0.59)	(0.30)	(-0.35)	(0.33)	(-1.36)
3	0.01	0.00	0.01	−0.01	0.08**	−0.08**
	(0.13)	(0.06)	(0.23)	(-0.14)	(2.31)	(-2.34)
4	0.01	0.03	−0.02	0.07	−0.05	0.04
	(0.31)	(0.58)	(-0.33)	(0.98)	(-1.40)	(1.29)
High	−0.05	0.00	−0.10	0.11	−0.17***	0.08**
	(-1.00)	(0.06)	(-1.57)	(1.52)	(-3.75)	(1.97)
HML	−0.14**	−0.06	−0.13***	0.11	−0.21***	0.00
	(-2.17)	(-0.75)	(-3.58)	(1.56)	(-3.00)	(0.02)
			MB - SS			
HML	−0.20**		−0.02		−0.21**	
	(-2.06)		(-0.26)		(-2.28)	

Three markets This table presents the time-series regression alphas from the Fama-French three-factor model of portfolios in the three markets. At the beginning of each week, we sort stocks into quintile portfolios by short-selling (SS) and margin-trading (MT) variables in each market. SS (MT) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. The weekly returns are value-weighted in percentage. Reported in parentheses are Newey and West (1987) t-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from July 2010 to December 2019 for the Chinese A-share market, January 2003 to June 2016 for the Japanese market, and January 1999 to December 2019 for the Taiwanese market.

Table 4
Short-selling and margin-trading-sorted portfolios: Conditional sort.

	(1)	(2)	(3)	(4)
	SS		*MT*	
	Top 50% (*MT*)	Bottom 50% (*MT*)	Top 50% (*SS*)	Bottom 50% (*SS*)
Low	−0.01	0.04	−0.03	0.16***
	(-0.12)	(0.86)	(-0.65)	(3.01)
2	0.00	−0.00	−0.06	−0.03
	(0.05)	(-0.01)	(-1.23)	(-0.83)
3	−0.04	0.04	−0.06	−0.05
	(-0.96)	(0.92)	(-1.58)	(-1.30)
4	−0.02	−0.04	−0.02	0.00
	(-0.45)	(-0.98)	(-0.53)	(0.02)
High	−0.07	−0.11**	0.02	0.00
	(-1.66)	(-2.29)	(0.50)	(0.08)
HML	−0.06	−0.15**	0.06	−0.16**
	(-1.08)	(-2.33)	(0.92)	(-2.16)

This table presents the time-series regression alphas from the Fama-French three-factor model of portfolios sorted by short selling (SS) and margin trading (MT), controlling for the other variable. SS (MT) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. At the beginning of each week, we first sort stocks into a top 50% and a bottom 50% group by MT (SS), and then sort stocks into quintile portfolios by SS (MT) within each group. The weekly percentage returns of portfolios are first value-weighted in each market and then averaged across three markets. Reported in parentheses are Newey and West (1987) t-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from January 1999 to December 2019.

fact, the hedged portfolio sorted by *MT* even shows a statistically significant and negative alpha among stocks with low levels of short selling. These findings further support our baseline findings in Section 3.1.

3.4. Robustness tests

In this section, we present robustness tests on the informativeness of leveraged trading. These tests include controlling for firm characteristics, using alternative measures of leverage, and conducting Fama-MacBeth regression analyses.

3.4.1. Other firm characteristics

Margin-trading and short-selling activities tend to be correlated with some firm characteristics. For example, it is difficult to borrow or short-sell small, illiquid, or volatile stocks. Thus, margin trading and short selling could potentially proxy for other return predictors (see, e.g., Harvey et al., 2016; Hou et al., 2020).

Therefore, in this analysis, we control for five well-known return predictors that are likely to be related to leveraged trading activities when forming *SS*- and *MT*-sorted portfolios. These variables include the logarithm of market capitalization (*Size*), the book-to-market ratio (*BM*), the past one-year cumulative return after skipping one month ($Ret^{-52,-5}$), the past one-month cumulative return ($Ret^{-4,-1}$), and the idiosyncratic volatility estimated from the Fama-French three-factor model over the past 52 weeks (*Ivol*). Each week, stocks are first sorted into three groups based on one return predictor. Within each characteristic group, stocks are then further divided into five quintile portfolios based on *SS* or *MT*.

Table 5 presents the results. As illustrated in the left panel of Table 5, the alpha spreads of *SS*-sorted portfolios remain negative and statistically significant even after controlling for the five return predictors. The weekly alphas range from −0.07% (*t*-stat. = −2.15) for the *Size*-controlled HML portfolio to −0.11% (*t*-stat. = −2.54) for the $Ret^{-52,-5}$-controlled HML portfolio, while all have a smaller magnitude compared to the results from the univariate sorting as shown in Table 2. On the other hand, the right panel of Table 5 shows that the alpha spreads for the *MT*-sorted portfolios are slightly negative but statistically insignificant after considering these return predictors.[9]

3.4.2. Fama-MacBeth regression

Additionally, we conduct Fama-MacBeth cross-sectional regressions to examine the relationship between stock returns and short selling/margin trading. After controlling for known firm characteristics that affect future returns, our findings indicate that stocks with higher short-selling activities exhibit lower future returns, while the impact of margin trading is less distinct. When both short-selling and margin-trading measures are included in the regression, the predictive power of the short-selling measure remains unchanged. For convenience, the results of these Fama-MacBeth cross-sectional regressions are presented in Table IA.3 in the Internet Appendix.

[9] The results we obtain using the stock returns of each country are similar and can be found in Table IA.2 in the Internet Appendix.

Table 5
Short-selling and margin-trading-sorted portfolios: Controlling for other predictors.

	SS						*MT*					
	Low	2	3	4	High	HML	Low	2	3	4	High	HML
Size	−0.06*	−0.03	−0.04*	−0.06**	−0.14***	−0.07**	0.05**	−0.03	−0.08***	−0.05*	0.00	−0.05
	(-1.94)	(-0.97)	(-1.68)	(-2.26)	(-4.10)	(-2.15)	(1.97)	(-1.09)	(-3.06)	(-1.88)	(0.03)	(-1.44)
BM	0.00	0.01	−0.03	−0.06*	−0.11***	−0.11***	0.10***	−0.04	−0.04	−0.01	0.01	−0.09*
	(0.03)	(0.18)	(-1.09)	(-1.88)	(-3.17)	(-2.87)	(2.78)	(-1.38)	(-1.36)	(-0.24)	(0.26)	(-1.88)
$Ret^{-52,-5}$	−0.01	−0.03	−0.01	−0.08***	−0.12***	−0.11**	0.05	−0.06**	−0.10***	−0.02	0.03	−0.02
	(-0.17)	(-0.94)	(-0.40)	(-2.60)	(-3.06)	(-2.54)	(1.32)	(-1.97)	(-3.11)	(-0.75)	(0.90)	(-0.35)
$Ret^{-4,-1}$	0.00	0.02	0.02	−0.03	−0.10***	−0.10**	0.07*	−0.05	−0.05	0.01	0.02	−0.05
	(0.11)	(0.50)	(0.79)	(-0.94)	(-2.65)	(-2.40)	(1.80)	(-1.51)	(-1.56)	(0.16)	(0.40)	(-1.08)
Ivol	−0.01	−0.04	−0.02	−0.06*	−0.09**	−0.08*	0.06*	−0.06*	−0.09***	−0.03	0.04	−0.02
	(-0.36)	(-0.97)	(-0.58)	(-1.84)	(-2.35)	(-1.67)	(1.65)	(-1.90)	(-2.69)	(-0.74)	(1.19)	(-0.33)

This table presents the time-series regression alphas from the Fama-French three-factor model of portfolios sorted by short selling (SS) and margin trading (MT), controlling for five prominent return predictors in the literature. SS (MT) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. Other return predictors include logarithm of market value (Size), book-to-market ratio (BM), past 52-week excluding the most recent four-week cumulative return (Ret-52,-5), past four-week cumulative return (Ret-4,-1), and idiosyncratic volatility with respect to the Fama-French three-factor model estimated over the past 52 weeks (Ivol). At the beginning of each week, we sequentially sort stocks into three portfolios according to one predictor and then into quintiles by SS (MT). In each SS (MT) quintile, we calculate the average return across three predictor groups and estimate the time-series regression alpha. The weekly percentage returns of portfolios are first value-weighted in each market and then averaged across three markets. Reported in parentheses are Newey and West (1987) t-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from January 1999 to December 2019.

3.4.3. Alternative leveraged trading measures

We also sort stocks into portfolios based on alternative measures of short-selling and margin-trading activities. These measures are calculated as the ratio of the weekly net short-selling or net margin-trading amounts to the total number of outstanding shares.

The findings we obtain through the use of alternative leverage trading measures align with those obtained from the original measures. Specifically, greater levels of short-selling activities are linked to lower future stock returns. The excess return spread and alpha spread between the high- and low-*SS* portfolios are both approximately −0.14% per week, which is similar to the benchmark case. However, the return spread between the high- and low-*MT* has a larger negative magnitude of −0.10% when we use the alternative *MT* measure (with marginal statistical significance), compared to the value of −0.04% we observe with the original measure. It is noteworthy that, contrary to the expectation that margin trading positively predicts stock returns in the cross-section, our empirical findings show a negative sign. This outcome further reinforces our conjecture that margin trading, on average, is not informative. To conserve space, the results are presented in Table IA.4 in the Internet Appendix.

We prefer using the average weekly traded shares over the past 52 weeks as the denominator for our *SS* and *MT* measures, as opposed to using the total number of outstanding shares, for several reasons. First, the average weekly traded shares over the past 52 weeks account for the time-series variation or a trending pattern in spot trading intensities of individual stocks when comparing cross-sectional leveraged trading intensities. Second, traded shares can better reflect the active transaction in individual stocks than the number of shares outstanding, as a large portion of the latter are held by strategic investors with little trading volume. Third, our main measures using traded shares as the denominator are consistent with the literature [e.g., the shorting share of volume, represented as the proportion of shares sold short relative to the total trading volume, as employed by Boehmer et al. (2008)].

4. Mechanisms of return predictabilities of leverage trades

The findings we discuss in Section 3 suggest that short-selling activities predict future stock returns, while margin trading does not. We conduct additional analyses to gain further insight into the informational advantage of short sellers compared to margin traders. We begin by examining whether unexpected earnings can be predicted by the two types of leveraged trading activities prior to earnings announcements. Then, we investigate the correlation between margin-trading and short-selling activities. Lastly, we examine the characteristics of short sellers using a unique account-level dataset in the Chinese A-share market.

4.1. Predictability of leveraged trading on unexpected earnings surprises

The differential predictability of margin trading and short selling may stem from the informational advantage of leveraged traders. To explore this possibility, we investigate whether leveraged trading activities before earnings announcements can predict unexpected earnings surprises. As earnings announcements are considered the most informative regular corporate events (Beaver, 1968; Ball and Shivakumar, 2008), informed investors are expected to act on their private information and trade ahead of these announcements. Therefore, an increase in short selling should predict negative unexpected earnings surprises while abnormal margin trading is unlikely to predict the direction of unexpected earnings.

Following Hou et al. (2015), we measure standardized unexpected earnings (*SUE*) as the change in the quarterly earnings per share from the same quarter a year ago, normalized by the standard deviation of these changes over the previous eight quarters (with a minimum requirement of six quarters). The explanatory variable $ABSS_{-1}$ ($ABMT_{-1}$) is the time-series abnormal short selling (margin trading), measured as a stock's weekly short selling (margin trading) in the week prior to the earnings announcement minus the average value over the previous 52 weeks. We also control for the stock return and abnormal trading volume in the week prior to the announcement.

Table 6 reports the results. Column (1) shows that pre-announcement abnormal short-selling activities indeed negatively predict SUE, with an estimated coefficient of −9.06 and a *t*-statistic of −4.36. On the other hand, we do not see any clear evidence that margin trading can predict unexpected earnings, as indicated by the economically and statistically insignificant regression coefficient in column (2). When regressing SUE on both abnormal short selling and margin trading prior to the announcement, we still observe that only short selling negatively predicts SUE (column (3)).

These findings imply that elevated abnormal short-selling activities could signal undisclosed negative shocks to firms' earnings. Therefore, short sellers capitalize on their informational advantage on firm fundamentals by shorting those negative SUE stocks in advance. By contrast, pre-announcement abnormal margin-trading activities are not informative about SUE, aligning with our primary findings that margin trading lacks predictive power for stock returns in the cross-section. To conserve space, results for the three individual markets are presented in Table IA.5 in the Internet Appendix.

4.2. Comovement of leveraged trading

If leveraged traders possess firm-specific information, we would expect to see that their transactions are not synchronized across stocks. On the other hand, if leveraged trading reflects market-wide information or sentiment from inexperienced investors, we would expect to see more synchronized transactions.

Inspired by this reasoning, we assess the degree to which individual stocks' leveraged trading activities can be attributed to market-wide leveraged trading activities. Specifically, for each stock, we perform a time-series regression of the individual stock's short selling (*SS*) or margin trading (*MT*) on the market-wide short selling or margin trading, calculated as the cross-sectional average of *SS* or *MT*. The higher the regression R^2 values, the more likely it is that leveraged trading activities across stocks are driven by systematic factors

Table 6
Predictability of leveraged trading on unexpected earnings surprises.

	(1)	(2)	(3)
$ABSS_{-1}$	−9.06***		−9.06***
	(-4.36)		(-4.35)
$ABMT_{-1}$		−0.14	−0.13
		(-0.44)	(-0.40)
RET_{-1}	0.00	0.00	0.00
	(1.05)	(0.93)	(1.05)
$ABVOL_{-1}$	−0.01	−0.01	−0.01
	(-0.71)	(-0.76)	(-0.64)
Adj. R^2	0.1%	0.1%	0.1%
Obs.	65,170	65,170	65,170

This table reports the results of the OLS regressions of standardized unexpected earnings on abnormal short-selling and margin-trading activities before earnings announcements. The dependent variable, standardized unexpected earnings (SUE), is defined as the change in the latest quarterly earnings per share from the same quarter a year ago, normalized by the standard deviation of these changes over the previous eight quarters (with a minimum requirement of six quarters). The variable $ABSS_{-1}$ ($ABMT_{-1}$) is the time-series abnormal short selling (margin trading), measured as a stock's weekly short-selling variable SS_t (weekly margin-trading variable MT_t) in the week prior to the earnings announcement minus the average SS_t (MT_t) over the previous 52 weeks. The variables SS_t and MT_t are the ratio of weekly net short-selling amount and net margin-trading amount to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks, respectively. The variable RET_{-1} is the stock's return in the week prior to the announcement. The variable $ABVOL_{-1}$ is the abnormal trading volume in the week prior to the announcement, normalized by the average weekly volume over the previous year. Market dummies are included in all specifications. Reported in parentheses are heteroskedasticity-robust *t*-statistics. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. The sample period is from January 1999 to December 2019.

rather than firm-specific ones.

Table 7 reports the mean and median of adjusted R^2s for the time-series regressions of individual stocks' *SS* (*MT*) on market-wide *SS* (*MT*). The average adjusted R^2 value is 1.67% for *SS* and 7.48% for *MT*. The difference between the average R^2 computed using *SS* and *MT* is statistically significant, with a *t*-statistic of −37.77. Similar results are obtained when we use the median R^2 values.

We also perform the same analysis in each of the three markets separately, with the results presented in Table IA.6 in the Internet Appendix. The degree of comovement of margin-trading activities is substantially greater than that of short-selling activities in each market. For example, in the Chinese A-share market, the comovement of margin-trading activities is the highest, as indicated by the high mean (median) adjusted R^2_{MT} of 28.10% (28.45%), while the mean (median) adjusted R^2_{SS} is only 4.43% (2.85%). This observation aligns with the prevalent view that Chinese investors, including those who purchase stocks on margin, tend to exhibit herding behavior.

In summary, the low degree of comovement of short selling across stocks relative to that of margin trading suggests that short selling is likely driven by firm-specific information.

4.3. Characteristics of leveraged traders

In this subsection, we utilize a proprietary dataset that encompasses individual investors' leveraged transactions from June 2012 to May 2015, including their trading history and personal characteristics, to gain insight into the distinct characteristics of margin traders and short sellers.

We obtain the proprietary dataset from one of the largest nationwide brokerage firms in China. The account characteristics data file includes information about investors' age, gender, account opening date, and account expiration date if applicable. It is important to note that prior to April 13, 2015, investors were only allowed to have one stock account in China. We apply two filters to refine the raw database. First, we remove stock accounts that opened after April 13, 2015. Second, we drop stock accounts that had never engaged in leveraged transactions. After these filters, 10,184 accounts are left.

Next, we classify these 10,184 accounts into two groups: "short sellers" are defined as those with at least one short-selling transaction, while "margin traders" are defined as those with only margin-trading transactions. The first group comprise 1039 accounts with 9091 investor-month observations, while the second group comprise 9145 accounts with 56,149 investor-month

Table 7
Comovement of short selling and margin trading.

	N	Mean	Median
$R^2_{adj,SS}$	6024	1.67	0.30
$R^2_{adj,MT}$	6024	7.48	2.74
Difference		−5.81	−2.44
t-stat/*z*-stat		(-37.77)	(-43.39)

observations. The disproportionate number of accounts between the two groups of leveraged traders indicates the higher prevalence of margin traders compared to short sellers in the Chinese A-share market.

To evaluate the rationality of these leveraged investors, we introduce a strong rationality measure and three semi-strong rationality measures. Following Odean (1998), investors' disposition effect (*Disposition*) is used as the strong rationality measure, with a lower disposition level indicating greater rationality. The three semi-strong rationality measures are the logarithm of the number of positions ever taken (*Experience*), the number of years since the account was opened (*AccountAge*), and the number of stocks held by an investor at the beginning of each month (*HoldStock*). These measures are constructed following Feng and Seasholes (2005) and Dhar and Zhu (2006). The larger these semi-strong rationality measures, the greater the rationality of investors.

The control variables include investors' gender (*Gender*), age (*Age*), aggregate portfolio value (*Capital*), the cumulative realized gain (*Gain,* in RMB million), the monthly portfolio turnover (*Turnover*), the CAPM beta (β), and the idiosyncratic volatility relative to the Fama-French three-factor model (*Ivol*).

Table 8 presents the summary statistics for the two types of leveraged traders. First, short sellers exhibit a lower disposition effect, with a mean (median) value of 0.11 (0.10), compared to margin traders, who have a mean (median) value of 0.15 (0.14). Both differences are statistically significant. Second, short sellers are more experienced, with a mean (median) value of the number of positions of 5.34 (5.37), which is higher than the mean (median) value for margin traders of 4.96 (4.98). However, the difference in account age between short sellers and margin traders is not statistically significant. On average, short sellers hold slightly more stocks, 4.76, compared to 4.41 stocks held by margin traders. This suggests that if holding a diversified portfolio is an indicator of investor sophistication, short sellers may be more sophisticated than margin traders.

A few additional observations are worth mentioning. Seventy-eight percent of short sellers are male, while 71% of margin traders are male. Margin traders tend to be slightly older, with a mean age of 44.65, compared to short sellers, whose mean age is 42.71. Short sellers hold slightly smaller portfolios, but their realized gains are similar to those of margin traders. One notable finding is that short sellers have a portfolio turnover that is about 50% higher than that of margin traders. Another noteworthy finding is that the CAPM beta and idiosyncratic volatility of stocks held by short sellers are statistically lower than those held by margin traders, suggesting that short sellers prefer stocks with less risk compared to margin traders.

Overall, our primary analysis of the proprietary account-level data provides evidence that margin traders and short sellers are distinct in nature. Our findings indicate that compared to margin traders, short sellers exhibit less disposition effect, have more experience, hold a larger number of stocks, trade more frequently, and maintain portfolios with lower risk.

Table 8
Summary statistics for leveraged individual investors.

	Short Sellers			Margin Traders			Difference			
	N	Mean	Median	*N*	Mean	Median	Mean	*t*-stat	Median	*z*-stat
Panel A: Strong rationality measure										
Disposition	9091	0.11	0.10	56,149	0.15	0.14	−0.03	(-15.46)	−0.04	(-15.51)
Panel B: Semi-strong rationality measures										
Experience	9091	5.34	5.37	56,149	4.96	4.98	0.37	(34.25)	0.38	(32.37)
AccountAge	9091	8.69	7.50	56,149	8.70	7.50	−0.01	(-0.23)	0.00	(-0.57)
HoldStock	9091	4.76	4.00	56,149	4.41	3.00	0.35	(8.70)	1.00	(6.31)
Panel C: Control variables										
Gender	9091	0.78	1.00	56,149	0.71	1.00	0.07	(15.73)	0.00	(14.66)
Age	9091	42.71	42.17	56,149	44.65	44.50	−1.94	(-19.27)	−2.33	(-21.91)
Capital	9091	13.17	13.11	56,149	13.33	13.26	−0.16	(-12.28)	−0.15	(-11.47)
Gain	9091	0.22	0.05	56,149	0.21	0.07	0.01	(1.49)	−0.01	(-2.73)
Turnover	9091	44.99	2.70	56,149	29.57	1.84	15.43	(12.21)	0.86	(25.13)
β	9091	1.10	1.11	56,149	1.12	1.12	−0.01	(-4.90)	−0.01	(-4.64)
Ivol	9091	0.02	0.02	56,149	0.02	0.02	0.00	(-18.26)	0.00	(-20.42)

This table reports the summary statistics for leveraged individual investors. Leveraged individuals' trading and account information data are provided by a large nationwide securities company in China. Leveraged trading data are from June 2012 to May 2015, and stock trading history data are from January 2002 to May 2015. An investor is included in our sample if he or she has at least one leveraged trade over the sample period. Panel A reports the summary statistics for the strong rationality measure. *Disposition* is the disposition effect of investor *i* estimated up to month *t,* as defined in Odean (1998). Panel B reports the summary statistics for the semi-strong rationality measures. *Experience* is the logarithm of number of positions ever taken by investor *i* up to month *t*. *AccountAge* is the number of years between the time when the account is opened and month *t*. *HoldStock* is the number of stocks held by investor *i* at the beginning of month *t*. Panel C reports the summary statistics for control variables. *Gender* takes the value of one for a male investor and zero for a female investor. *Age* is the age of investor. *Capital* is the logarithm of an investor's holding value, the sum of portfolio value and cash balance, at the beginning of month *t*. *Gain* is the cumulative realized gain (in million RMB) of investor *i* up to month *t*. *Turnover* is the average monthly portfolio turnover (the ratio of the total purchase and sale value to the portfolio value at the beginning of the month) of investor *i* estimated up to month *t*. β and *Ivol* are the CAPM beta and idiosyncratic volatilities with respect to the Fama-French three-factor model of an investor's portfolio at the beginning of month *t*. The *t*-statistics for difference in mean and Wilcoxon-Mann-Whitney *z*-statistics for difference in median are reported in parentheses.

4.4. Rationality of leveraged traders

The trading decisions made by short sellers are likely to be more rational than margin traders due to the asymmetrical impact of investor sentiment on these two types of investors. During high sentiment periods, irrational optimists are more likely to engage in margin trading, while pessimistic investors face constraints on short selling. As a result, we can evaluate the rationality of leveraged traders and examine how investor sentiment influences this rationality. To do so, we conduct panel regressions to examine the relationship between an investor's short-selling intensity and measures of rationality, as well as the interactions between these measures and market-wide sentiment. The dependent variable in our analysis is $ShortSell_{i,t}$, a dummy variable that takes a value of one if an investor engages in short selling in a given month, and zero otherwise. As our sample only includes leveraged traders, a value of zero in our data indicates that the trader is engaged in margin-trading transactions.

Table 9 presents the results of the panel regressions. In column (1), the estimated coefficient for *Disposition* is −3.70, which is highly significant (*t*-stat. = −4.96). The negative coefficient indicates that short selling, compared to margin trading, is less susceptible to the disposition effect, a strong rationality measure. The coefficient for the disposition effect measure remains similar in magnitude even when controlling for additional variables (column (2)).

Columns (3) to (8) present the panel regression results of an examination of the relationship between short-selling intensity and other semi-strong measures of rationality. In column (3), we find that investor trading experience is positively associated with short-selling intensity, as evidenced by a coefficient of 1.22 and a *t*-statistic of 6.31. Additionally, columns (5) and (6) reveal that investors with a longer account history are more likely to engage in short selling, although the statistical significance of the coefficient of *AccountAge* is marginal. In column (7), the coefficient of *HoldStock* is not significantly different from zero. However, after controlling for all relevant variables, the number of stocks held by investors is positively correlated with short-selling intensities, while still with no statistical significance, as shown by in column (8).

In conclusion, our results demonstrate a significant correlation between both strong and semi-strong measures of rationality and investors' short-selling intensities. Investors who exhibit fewer behavioral biases, possess longer trading experience, and hold more

Table 9
The rationality of leveraged traders.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disposition	−3.70***	−3.99***						
	(-4.96)	(-5.39)						
Experience			1.22***	1.19***				
			(6.31)	(6.22)				
AccountAge					0.06	0.05		
					(1.63)	(1.46)		
HoldStock							−0.00	0.01
							(-0.30)	(0.65)
Gender	1.14***	1.11***	1.03***	1.02***	1.21***	1.21***	1.29***	1.27***
	(3.28)	(3.15)	(3.08)	(3.01)	(3.48)	(3.43)	(3.68)	(3.58)
Age	−0.26**	−0.28**	−0.36***	−0.37***	−0.32***	−0.33***	−0.27**	−0.28**
	(-2.23)	(-2.35)	(-3.03)	(-3.14)	(-2.74)	(-2.82)	(-2.28)	(-2.39)
Age²/100	0.20	0.22*	0.28**	0.30**	0.26**	0.27**	0.21*	0.23*
	(1.60)	(1.79)	(2.23)	(2.41)	(2.07)	(2.21)	(1.67)	(1.82)
Capital		−0.71***		−0.60***		−0.65***		−0.66***
		(-6.93)		(-5.83)		(-6.40)		(-6.39)
Gain		0.20*		0.14		0.21*		0.21*
		(1.66)		(1.20)		(1.78)		(1.76)
Turnover		0.00***		0.00***		0.00***		0.00***
		(247.84)		(209.93)		(269.37)		(266.33)
β		−4.36***		−4.57***		−4.46***		−4.49***
		(-7.83)		(-8.21)		(-8.19)		(-8.25)
Ivol		−2.34		−5.81		−1.49		−1.71
		(-0.31)		(-0.73)		(-0.19)		(-0.22)
Obs.	65,240	65,240	65,240	65,240	65,240	65,240	65,240	65,240
Adj. R^2	0.004	0.010	0.007	0.012	0.002	0.008	0.002	0.008

This table presents the panel regression results of the rationality of leveraged traders. The dependent variable is $ShortSell_{i,t}$, which takes the value of one when investor *i* short-sells at least one stock at month *t* and is zero otherwise. *Disposition* is the disposition effect of investor *i* estimated up to month *t*, as defined in Odean (1998). *Experience* is the logarithm of number of positions ever taken by investor *i* up to month *t*. *AccountAge* is the number of years between the time when the account was opened and month *t*. *HoldStock* is the number of stocks held by investor *i* at the beginning of month *t*. *Gender* takes the value of one for a male investor and zero for a female investor. *Age* is the age of investor. *Capital* is the logarithm of an investor's holding value, the sum of portfolio value and cash balance, at the beginning of month *t*. *Gain* is the cumulative realized gain (in million RMB) of investor *i* up to month *t*. *Turnover* is the average monthly portfolio turnover (the ratio of the total purchase and sale value to the portfolio value at the beginning of the month) of investor *i* estimated up to month *t*. *β* and *Ivol* are the CAPM beta and idiosyncratic volatilities with respect to the Fama-French three-factor model of an investor's portfolio at the beginning of month *t*. We include month dummies in all specifications. We multiply all slope coefficients by 100. Reported in parentheses are *t*-statistics two-way clustered by investor and month. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from June 2012 to May 2015.

diverse portfolios are more prone to engage in short selling.

4.5. Rationality and investor sentiment

Finally, we examine the impact of the interaction between investor rationality and market-wide sentiment on both margin trading and short selling. As demonstrated in Yu and Yuan (2011), there is increased stock market participation by sentiment-driven traders during high sentiment periods, as they are reluctant to sell when they receive negative news. Additionally, short sellers face the risk of a short squeeze, especially during high sentiment periods when overpricing is difficult to rectify (Stambaugh et al., 2012). Hence, we anticipate that the higher rationality of short sellers relative to margin traders would play a more significant role during high sentiment periods than during low sentiment periods.

To save space, we report the results in Section 6 (Table IA.7) of the Internet Appendix and only discuss the main findings here. Our results provide strong support for above prediction: the coefficient of the interaction term between *Disposition* and the sentiment proxy is negative and statistically significant. The size of the coefficient on the interaction variable is approximately one-third and one-fifth of the coefficient for *Disposition*, indicating that short sellers are likely to be investors with weaker behavioral biases, particularly during high sentiment periods.

In addition, we find that investors' trading experience, account age, and number of holding stocks are positively correlated with their short-selling intensity. Moreover, the coefficients of the interaction term of semi-strong rationality measures with $Sentiment_{B\&W2006}$ are positive, implying a rising correlation between these measures and short-selling activities in the high-sentiment period. When using the alternative sentiment proxy, we find similar results. Therefore, compared to margin traders, short sellers are more sophisticated with weaker behavioral bias, especially when market-wide sentiment is high. The detailed results are presented in Table IA.7 in the Internet Appendix.

5. Conclusion

In this paper, we investigate whether leveraged investors are informed. Utilizing a unique dataset of short-selling and margin-trading activities for 6024 stocks in the Chinese, Japanese, and Taiwanese stock markets, we analyze the cross-sectional return predictability of both types of leveraged trading behaviors. Our findings reveal that short sales negatively predict future stock returns in the cross-section. By contrast, margin trading demonstrates no statistically significant relation with returns.

We explore the reasons for short sellers' informational advantage over margin traders. We find that short selling increases prior to negative earnings announcements, while margin trading remains unchanged before positive earnings releases. Additionally, margin-trading activities tend to be more correlated across stocks than short sales. Using a proprietary dataset of individual investors' leveraged transactions from a Chinese brokerage firm, we discover that short sellers tend to possess more advanced investment skills, longer experience, fewer biases, and hold more diverse portfolios with less risky stocks. Lastly, our evidence suggests short sellers exhibit stronger rationality than margin traders, especially during periods of high market sentiment. All the factors collectively contribute to the return predictability of short selling.

CRediT authorship contribution statement

Zhuo Chen: Writing – original draft, Methodology, Investigation, Funding acquisition. **Pengfei Li:** Methodology, Investigation, Data curation. **Zhengwei Wang:** Supervision, Resources, Investigation, Funding acquisition, Data curation. **Bohui Zhang:** Writing – review & editing, Supervision, Resources, Conceptualization.

Data availability

Data will be made available on request.

Internet Appendix for "Leveraged trading and stock returns: Evidence from international stock markets"

The Internet Appendix provides results that are not contained in the main text. In particular, it contains the robustness test for portfolios in individual markets, the robustness test with the alternative measure of short-selling and margin-trading activities, the Fama-MacBeth approach, and the leveraged trading prior to earnings announcements in individual markets.

Robustness test for portfolios in individual markets

Table IA.1 presents the results of the cross-sectional return predictability of one leverage trading, say *SS* (*MT*), after controlling for the other leverage trading, *MT* (*SS*), using the conditional double sorting method, in Chinese A-share market, Japanese stock market, and Taiwanese stock market.

Table IA.2 reports the alpha spread of *SS*- and *MT*-sorted portfolios after controlling for five well known return predictors in individual market. *Size* is the logarithm of market capitalization; *BM* is the book-to-market ratio of equity; $Ret^{-52,-5}$ is the past one-year cumulative return (skipping a month); $Ret^{-4,-1}$ is the past one-month cumulative return; *Ivol* is the standard deviation of the residual estimated from the Fama-French three-factor model over the past 52 weeks. Specifically, in each week, we first sort all stocks into three

groups according to one return predictor. Within each characteristic group, we further sort stocks into five quintile portfolios according to *SS* or *MT*. Then, within each quintile rank of *SS* or *MT*, we calculate the average value-weighted returns and alphas of stocks with the same quintile rank *SS* or *MT* across all three characteristic-sorted groups.

Robustness test from Fama-Macbeth approach

Table IA.3 reports the results of Fama-MacBeth cross-sectional regressions. For each week, we estimate a regression of stock returns on short-selling and margin-trading activities as well as control variables, and then report average coefficients and *t*-statistics from such cross-sectional regressions. All *t*-statistics are adjusted using the Newey and West (1987) procedure and account for heteroscedasticity and autocorrelations. We include market dummies in all specifications to capture the influence of intra-market difference of short-selling and margin-trading activities on stock returns. In each specification, we control for the following variables: *Size* is the logarithm of market capitalization; *BM* is the book-to-market ratio of equity; factor loadings (β_{MKT}, β_{SMB}, β_{HML}) w.r.t the Fama-French three-factor model estimated over the past 52 weeks; $Ret^{-52,-5}$ is the past one-year cumulative return (skipping a month); $Ret^{-4,-1}$ is the past one-month cumulative return; *Ivol* is the standard error of residual from Fama-French three-factor model estimated over the past 52 weeks; *Amihud* is the Amihud (2002) illiquidity measure; *Turnover* is the average turnover calculated over the previous 52 weeks.

Robustness test with alternative leveraged trading measures

Table IA.4 reports the value-weighted average weekly returns in excess of risk free rate (Ret^{ex}) and Fama-French three-factor risk-adjusted portfolio alphas (*Alpha*) of single-sorted quintile portfolios formed weekly sorted by *SS_Ratio* or *MT_Ratio*. *SSRatio* (*MTRatio*) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to total shares outstanding. At the beginning of each week, we sort stocks into quintile portfolios each week according to *SS_Ratio* or *MT_Ratio*. We calculate the value-weighted average return for each quintile portfolio. Specifically, within each market, we assign firms a rank (one to five) based on the firm's quintile at the beginning of each week. We calculate the value-weighted returns of *SS_Ratio* (*MT_Ratio*) sorted quintile portfolios in each market and then average the returns of each quintile portfolio across three markets. The risk free rate is measured by the three-month Shanghai Interbank Offered Rate (SHIBOR) in the Chinese A-Share market and the one-month T-bill rate in the Japanese and the Taiwanese markets. HML refers to the portfolio that takes a long position in the high-*SS_Ratio* (-*MT_Ratio*) quintile portfolio and a short position in the low-*SS_Ratio* (-*MT_Ratio*) quintile portfolio. Unless stated otherwise, all *t*-statistics for portfolio returns are adjusted using Newey-West five-lags.

Predictability of Leveraged Trading on Unexpected Earnings Surprises in individual markets

Table IA.5 reports the OLS regressions of standardized unexpected earnings on abnormal short-selling and margin-trading activities before earnings announcements in Chinese A-share market, Japanese stock market, and Taiwanese stock market.

Comovement of leveraged trading in individual market

Table IA.6 reports the mean and median of adjusted R^2s for time-series regressions of individual stocks' *SS* (*MT*) on market-wide *SS* (*MT*) in three markets separately. For each stock, we run the time-series regression of an individual stock's *SS* (*MT*) on the market-wide short selling (margin trading), which is calculated as the cross-sectional average of *SS* or *MT*. The larger are the regression R^2s, the more likely is that leveraged trading activities across stocks are driven by systematic factors rather than firm-specific ones.

Rationality and investor sentiment

Table IA.7 reports the panel regressions of short-selling intensity on the rationality measures and the sentiment proxies. We introduce two market-wide sentiment proxies in our analysis: the Baker and Wurgler (2006) sentiment index ($Sentiment_{B\&W2006}$[10]) and the active account fraction ($Sentiment_{Active}$), which is defined as the ratio of the number of active investor accounts to the total number of accounts with non-zero stock holdings at the end of the same month. Active accounts are those that have at least one transaction each month. Both sentiment proxies are standardized to have a mean of zero and a standard deviation of one. In our regressions, we interact rationality measures with the two sentiment proxies as our explanatory variable for short-selling intensities. We also control

[10] In line with Baker and Jeffrey, 2006, we construct a sentiment index based on the first principal component of the correlation matrix of five variables: the closed-end fund discount, the share turnover of the Chinese A-share market, the average first-day return of initial public offerings (IPOs), the sum of equity issues and long-term debt issues, and the natural logarithm of the number of new investors. We replace the number of IPOs in their original study with the number of new investors, as IPOs are strictly regulated by the China Securities Regulatory Commission (CSRC) and banned during certain periods. Additionally, it is widely accepted that the variation in the number of new investors is highly correlated with market sentiment in China. We define the first-day IPO return as the cumulative return from the IPO date to the first day when the closing price does not hit the price limit. All five series have been standardized, and the first principal component explains 33.3% of the sample variance. The sentiment index covers the period from January 2006 to June 2015.

for other characteristics, including *Gender*, *Age*, *Capital*, *Gain*, *Turnover*, β, and *Ivol*, in all specifications.

Table IA.1
Short-Selling and Margin-Trading-Sorted Portfolios: Conditional Sort in Three Markets

Panel A: Chinese A-share Market				
	SS		*MT*	
	Top 50% (*MT*)	Bottom 50% (*MT*)	Top 50% (*SS*)	Bottom 50% (*SS*)
Low	0.09*	0.06	0.09	0.04
	(1.93)	(0.91)	(1.30)	(0.49)
2	0.06	−0.00	0.05	−0.02
	(1.10)	(-0.04)	(0.92)	(-0.34)
3	−0.06	0.08	−0.09	0.08
	(-0.94)	(1.36)	(-1.42)	(1.47)
4	−0.04	0.04	−0.02	0.07
	(-0.64)	(0.67)	(-0.28)	(1.53)
High	−0.10*	0.00	−0.05	0.09
	(-1.66)	(-0.01)	(-0.79)	(1.42)
HML	−0.19**	−0.06	−0.14	0.05
	(-2.40)	(-0.70)	(-1.57)	(0.47)
Panel B: Japanese Market				
	SS		*MT*	
	Top 50% (*MT*)	Bottom 50% (*MT*)	Top 50% (*SS*)	Bottom 50% (*SS*)
Low	0.02	0.03	−0.10	0.06
	(0.26)	(0.52)	(-1.17)	(0.78)
2	0.10	−0.00	−0.03	−0.02
	(1.42)	(-0.01)	(-0.45)	(-0.26)
3	−0.01	−0.02	−0.04	0.03
	(-0.17)	(-0.26)	(-0.61)	(0.40)
4	−0.02	−0.04	−0.03	0.02
	(-0.34)	(-0.62)	(-0.47)	(0.24)
High	−0.05	−0.15**	0.02	0.06
	(-0.66)	(-2.07)	(0.27)	(0.70)
HML	−0.06	−0.18***	0.12	−0.00
	(-1.14)	(-3.65)	(1.47)	(-0.05)
Panel C: Taiwanese Market				
	SS		*MT*	
	Top 50% (*MT*)	Bottom 50% (*MT*)	Top 50% (*SS*)	Bottom 50% (*SS*)
Low	0.03	0.03	−0.04	0.18***
	(0.52)	(0.65)	(-0.73)	(2.95)
2	0.03	0.04	−0.10**	−0.00
	(0.56)	(0.99)	(-2.04)	(-0.05)
3	0.04	0.11**	−0.10**	−0.03
	(0.90)	(2.57)	(-2.33)	(-0.65)
4	0.04	−0.03	−0.00	0.05
	(0.74)	(-0.81)	(-0.09)	(1.19)
High	−0.09**	−0.17***	0.08	0.08
	(-2.03)	(-3.14)	(1.46)	(1.35)
HML	−0.12	−0.20***	0.11	−0.10
	(-1.63)	(-2.62)	(1.61)	(-1.23)

This table presents the time-series regression alphas from Fama-French three-factor model of portfolios sorted by short selling (*SS*) and margin trading (*MT*), controlling for the other variable. *SS* (*MT*) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. At the beginning of each week, we first sort stocks into a top 50% and a bottom 50% group by *MT* (*SS*), and then sort stocks into quintile portfolios by *SS* (*MT*) within each group. The weekly percentage returns of portfolios are value-weighted in each market. Reported in parentheses are Newey and West (1987) *t*-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from July 2010 to December 2019 for Chinese A-share market, January 2003 to June 2016 for Japanese market, and January 1999 to December 2019 for Taiwanese market.

Table IA.2
Short-Selling and Margin-Trading-Sorted Portfolios: Controlling for Other Predictors in Three Markets

Panel A: Chinese A-share market												
	SS						*MT*					
	Low	2	3	4	High	HML	Low	2	3	4	High	HML
Size	0.02	−0.06	−0.06	−0.08**	−0.11***	−0.13***	0.03	−0.04	−0.06	−0.04	−0.11***	−0.14***
	(0.53)	(-1.47)	(-1.54)	(-2.16)	(-3.05)	(-3.10)	(0.75)	(-1.02)	(-1.61)	(-1.29)	(-3.04)	(-3.13)

(*continued on next page*)

Table IA.2 (*continued*)

Panel A: Chinese A-share market												
	SS						*MT*					
	Low	2	3	4	High	HML	Low	2	3	4	High	HML
BM	0.06	0.04	−0.01	−0.05	−0.03	−0.09	0.06	0.00	−0.04	−0.02	0.01	−0.05
	(1.46)	(0.83)	(-0.21)	(-1.30)	(-0.59)	(-1.57)	(1.21)	(0.12)	(-1.13)	(-0.52)	(0.18)	(-0.88)
$Ret^{-52,-5}$	0.02	0.00	0.01	−0.03	−0.07	−0.09	0.03	0.00	−0.03	−0.06	−0.05	−0.08
	(0.45)	(0.09)	(0.23)	(-0.97)	(-1.45)	(-1.52)	(0.74)	(0.11)	(-0.69)	(-1.72)	(-1.22)	(-1.34)
$Ret^{-4,-1}$	0.10***	0.05	0.03	0.05	−0.02	−0.13**	0.05	0.05	0.01	0.08**	−0.01	−0.06
	(2.86)	(1.19)	(0.58)	(1.39)	(-0.57)	(-2.22)	(0.97)	(1.21)	(0.21)	(2.16)	(-0.21)	(-0.87)
Ivol	0.05	−0.00	−0.02	0.00	−0.05	−0.10	0.05	0.01	−0.05	0.03	−0.03	−0.08
	(1.18)	(-0.08)	(-0.54)	(0.04)	(-1.09)	(-1.60)	(1.01)	(0.37)	(-1.34)	(0.77)	(-0.74)	(-1.32)
Panel B: Japanese market												
	SS						*MT*					
	Low	2	3	4	High	HML	Low	2	3	4	High	HML
Size	−0.00	0.05	−0.01	−0.04	−0.09	−0.09***	0.06	−0.01	−0.01	0.04	0.12**	0.06**
	(-0.03)	(0.93)	(-0.23)	(-0.69)	(-1.53)	(-3.29)	(1.01)	(-0.16)	(-0.17)	(0.59)	(2.00)	(2.09)
BM	0.03	0.02	0.03	−0.02	−0.09	−0.12***	0.03	−0.01	0.00	0.06	0.11*	0.08*
	(0.48)	(0.27)	(0.46)	(-0.33)	(-1.48)	(-3.63)	(0.47)	(-0.18)	(0.05)	(0.91)	(1.81)	(1.75)
$Ret^{-52,-5}$	0.04	0.02	0.00	−0.02	−0.09	−0.13***	0.02	−0.05	−0.02	0.02	0.15**	0.13***
	(0.61)	(0.33)	(0.05)	(-0.36)	(-1.48)	(-3.76)	(0.23)	(-0.77)	(-0.38)	(0.34)	(2.31)	(2.67)
$Ret^{-4,-1}$	0.04	0.02	0.03	−0.00	−0.06	−0.10***	0.01	−0.02	0.00	0.01	0.14**	0.13**
	(0.77)	(0.41)	(0.41)	(-0.07)	(-0.91)	(-3.04)	(0.21)	(-0.35)	(0.05)	(0.14)	(2.22)	(2.52)
Ivol	−0.01	0.04	−0.00	−0.02	−0.11	−0.10***	0.04	−0.08	−0.04	−0.01	0.12*	0.08
	(-0.11)	(0.61)	(-0.03)	(-0.31)	(-1.63)	(-2.80)	(0.69)	(-1.13)	(-0.59)	(-0.10)	(1.72)	(1.40)
Panel C: Taiwanese market												
	SS						*MT*					
	Low	2	3	4	High	HML	Low	2	3	4	High	HML
Size	−0.08**	−0.02	0.00	−0.05**	−0.16***	−0.08*	0.05**	−0.02	−0.08***	−0.07***	0.02	−0.03
	(-2.35)	(-0.79)	(-0.02)	(-2.11)	(-4.76)	(-1.79)	(2.18)	(-1.12)	(-3.95)	(-2.83)	(0.74)	(-0.80)
BM	0.00	0.04	0.02	−0.06**	−0.13***	−0.13**	0.10***	−0.05*	−0.03	0.01	0.04	−0.06
	(0.05)	(1.18)	(0.67)	(-2.09)	(-3.51)	(-2.42)	(2.62)	(-1.81)	(-0.99)	(0.35)	(1.00)	(-1.14)
$Ret^{-52,-5}$	−0.02	0.00	0.03	−0.09***	−0.17***	−0.15**	0.04	−0.07**	−0.11***	0.00	0.05	0.01
	(-0.36)	(0.03)	(1.08)	(-2.80)	(-3.95)	(-2.47)	(0.92)	(-2.37)	(-3.54)	(0.09)	(1.31)	(0.27)
$Ret^{-4,-1}$	0.00	0.05	0.07**	−0.06*	−0.16***	−0.16***	0.06	−0.08***	−0.07**	0.03	0.03	−0.03
	(0.08)	(1.54)	(2.45)	(-1.83)	(-3.79)	(-2.72)	(1.43)	(-2.72)	(-2.34)	(0.92)	(0.73)	(-0.53)
Ivol	0.00	−0.03	0.01	−0.11***	−0.12***	−0.12*	0.03	−0.06*	−0.12***	−0.02	0.09**	0.06
	(0.05)	(-0.85)	(0.27)	(-3.04)	(-2.87)	(-1.94)	(0.73)	(-1.87)	(-3.56)	(-0.68)	(2.29)	(1.00)

This table presents the time-series regression alphas from Fama-French three-factor model of portfolios sorted by short selling (*SS*) and margin trading (*MT*), controlling for five prominent return predictors in the literature. *SS* (*MT*) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. Other return predictors include logarithm of market value (*Size*), book-to-market ratio (*BM*), past 52-week excluding the most recent 4-week cumulative return ($Ret^{-52,-5}$), past 4-week cumulative return ($Ret^{-4,-1}$), and idiosyncratic volatility w.r.t the Fama-French three-factor model estimated over the past 52 weeks (*Ivol*). At the beginning of each week, we sequentially sort stocks into three groups according to one predictor and then into quintiles by *SS* (*MT*). In each *SS* (*MT*) quintile, we calculate the average return across three predictor groups and estimate the time-series regression alpha. The weekly percentage returns of portfolios are value-weighted in each market. Reported in parentheses are Newey and West (1987) *t*-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from July 2010 to December 2019 for Chinese A-share market, January 2003 to June 2016 for Japanese market, and January 1999 to December 2019 for Taiwanese market.

Table IA.3
Fama-Macbeth Regressions

Panel A: one-week return			
	(1)	(2)	(3)
SS	−0.03**		−0.03*
	(-2.07)		(-1.95)
MT		−0.00	−0.00
		(-1.54)	(-1.34)
Size	−0.04***	−0.04***	−0.04***
	(-3.11)	(-2.95)	(-2.95)
BM	0.07**	0.07**	0.07**
	(2.38)	(2.24)	(2.28)
β_{MKT}	0.13**	0.13**	0.13**
	(2.39)	(2.42)	(2.38)
β_{SMB}	−0.07**	−0.08**	−0.08**
	(-2.42)	(-2.43)	(-2.45)

(*continued on next page*)

Table IA.3 (*continued*)

Panel A: one-week return			
	(1)	(2)	(3)
β_{HML}	−0.05	−0.05	−0.05
	(-1.34)	(-1.35)	(-1.36)
Ivol	−0.02**	−0.02*	−0.02*
	(-1.97)	(-1.90)	(-1.87)
$Ret^{-4,-1}$	−0.00	−0.00	−0.00
	(-0.81)	(-0.74)	(-0.72)
$Ret^{-52,-5}$	0.00	0.00*	0.00*
	(1.64)	(1.71)	(1.70)
Amihud	0.16	0.15	0.15
	(0.79)	(0.74)	(0.78)
Turnover	−0.21	−0.20	−0.20
	(-0.88)	(-0.85)	(-0.86)
Obs	2,957,826	2,957,826	2,957,826
Adj. R^2	0.14	0.14	0.14
Panel B: Cumulative two-week return			
	(1)	(2)	(3)
SS	−0.03*		−0.03*
	(-1.75)		(-1.72)
MT		−0.00	−0.00
		(-0.22)	(-0.00)
Size	−0.09***	−0.09***	−0.09***
	(-3.69)	(-3.66)	(-3.60)
BM	0.13**	0.12**	0.12**
	(2.39)	(2.27)	(2.28)
β_{MKT}	0.24**	0.25**	0.24**
	(2.37)	(2.44)	(2.38)
β_{SMB}	−0.13**	−0.13**	−0.13**
	(-2.38)	(-2.40)	(-2.39)
β_{HML}	−0.08	−0.07	−0.08
	(-1.12)	(-1.11)	(-1.13)
Ivol	−0.04**	−0.04**	−0.04**
	(-2.13)	(-2.08)	(-2.09)
$Ret^{-4,-1}$	−0.00	−0.00	−0.00
	(-1.22)	(-1.20)	(-1.19)
$Ret^{-52,-5}$	0.00	0.00	0.00
	(1.54)	(1.62)	(1.59)
Amihud	0.32	0.29	0.32*
	(1.63)	(1.56)	(1.72)
Turnover	−0.53	−0.53	−0.53
	(-1.22)	(-1.21)	(-1.21)
Obs	2,979,665	2,979,665	2,979,665
Adj. R^2	0.14	0.14	0.14
Panel C: Cumulative three-week return			
	(1)	(2)	(3)
SS	−0.02		−0.02
	(-0.86)		(-0.91)
MT		0.00	0.00
		(1.24)	(1.36)
Size	−0.14***	−0.14***	−0.14***
	(-4.15)	(-4.13)	(-4.09)
BM	0.19**	0.19**	0.19**
	(2.52)	(2.46)	(2.44)
β_{MKT}	0.31**	0.32**	0.32**
	(2.13)	(2.21)	(2.15)
β_{SMB}	−0.19***	−0.20***	−0.19***
	(-2.59)	(-2.63)	(-2.60)
β_{HML}	−0.09	−0.09	−0.09
	(-0.95)	(-0.95)	(-0.96)
Ivol	−0.04	−0.04	−0.04
	(-1.22)	(-1.22)	(-1.19)
$Ret^{-4,-1}$	−0.00	−0.00	−0.00
	(-0.83)	(-0.79)	(-0.76)
$Ret^{-52,-5}$	0.00	0.00	0.00
	(1.47)	(1.51)	(1.51)
Amihud	0.29**	0.31**	0.30***
	(2.52)	(2.58)	(2.59)

(*continued on next page*)

Table IA.3 (*continued*)

Panel A: one-week return			
	(1)	(2)	(3)
Turnover	−1.13*	−1.10*	−1.11*
	(-1.95)	(-1.91)	(-1.92)
Obs	2,716,998	2,716,998	2,716,998
Adj. R^2	0.13	0.13	0.13
Panel D: Cumulative 4-week return			
	(1)	(2)	(3)
SS	−0.02		−0.02
	(-0.70)		(-0.63)
MT		0.00	0.00
		(0.48)	(0.55)
Size	−0.17***	−0.17***	−0.17***
	(-3.90)	(-3.88)	(-3.86)
BM	0.27***	0.26**	0.26**
	(2.59)	(2.53)	(2.55)
β_{MKT}	0.44**	0.45**	0.44**
	(2.32)	(2.36)	(2.33)
β_{SMB}	−0.22**	−0.22**	−0.22**
	(-2.28)	(-2.27)	(-2.28)
β_{HML}	−0.13	−0.13	−0.13
	(-1.08)	(-1.06)	(-1.08)
Ivol	−0.06	−0.06	−0.06
	(-1.64)	(-1.63)	(-1.60)
$Ret^{-4,-1}$	−0.01**	−0.01**	−0.01**
	(-2.42)	(-2.39)	(-2.37)
$Ret^{-52,-5}$	0.00	0.00	0.00
	(1.30)	(1.34)	(1.34)
Amihud	0.51**	0.50**	0.52***
	(2.50)	(2.48)	(2.75)
Turnover	−0.98	−0.96	−0.97
	(-1.34)	(-1.33)	(-1.33)
Obs	2,980,803	2,980,803	2,980,803
Adj. R^2	0.15	0.15	0.15

This table presents the results of Fama-Macbeth regressions of stock return on short-selling and margin-trading variables in the full sample. The dependent variable is stocks' one-week return in Panel A, cumulative two-week return in Panel B, cumulative three-week return in Panel C, and cumulative 4-week return in Panel D. *SS* (*MT*) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. Control variables include logarithm of market value (*Size*), book-to-market ratio (*BM*), factor loadings and idiosyncratic volatility (*Ivol*) w.r.t the Fama-French three-factor model estimated over the past 52 weeks, the Amihud illiquidity measure estimated over the past 52 weeks (*Amihud*, 10^{-8}), average turnover calculated over the previous 52 weeks (*Turnover*), past 52-week excluding the most recent 4-week cumulative return ($Ret^{-52,-5}$), and past 4-week cumulative return ($Ret^{-4,-1}$). Market dummies are included in all specifications. Reported in parentheses are Newey and West (1987) *t*-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%. The sample period is from January 1999 to December 2019.

Table IA.4
Alternative Short-Selling and Margin-Trading Measures Sorted Portfolios

	SS Ratio		MT Ratio	
	Ret^{ex}	*Alpha*	Ret^{ex}	*Alpha*
Low	0.10	0.00	0.16	0.05
	(0.94)	(0.10)	(1.51)	(1.09)
2	0.06	−0.03	0.05	−0.05
	(0.69)	(-0.76)	(0.49)	(-1.48)
3	0.14*	0.05	0.08	−0.01
	(1.65)	(1.40)	(0.88)	(-0.23)
4	0.08	−0.01	0.10	0.01
	(0.83)	(-0.26)	(1.09)	(0.35)
High	−0.04	−0.14***	0.06	−0.05
	(-0.38)	(-3.53)	(0.51)	(-1.32)
HML	−0.14***	−0.14***	−0.10*	−0.10*
	(-3.01)	(-2.97)	(-1.95)	(-1.93)

This table presents the time-series regression alphas from Fama-French three-factor model of portfolios in the full sample. At the beginning of each week, we sort stocks into quintile portfolios by short-selling ratio (*SS Ratio*) and margin-trading ratio (*MT Ratio*) relative to their peers in each market. *SS Ratio* (*MT Ratio*) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to the total number of shares outstanding. The weekly percentage returns of portfolios are first value-weighted in each market and then averaged across three markets. Reported in parentheses are Newey and West (1987) *t*-statistics adjusted for heteroskedasticity and autocorrelation. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from January 1999 to December 2019.

Table IA.5
Predictability of Leveraged Trading on Unexpected Earnings Surprises in Three Markets

Panel A: Chinese A-share market			
	(1)	(2)	(3)
$ABSS_{-1}$	−38.76***		−37.32**
	(-2.65)		(-2.52)
$ABMT_{-1}$		0.90	0.86
		(1.47)	(1.39)
RET_{-1}	0.00	−0.00	0.00
	(0.40)	(-0.08)	(0.12)
$ABVOL_{-1}$	−0.13***	−0.15***	−0.14***
	(-3.97)	(-4.01)	(-3.96)
Adj. R^2	0.2%	0.2%	0.2%
Obs	17,285	17,285	17,285
Panel B: Japanese market			
	(1)	(2)	(3)
$ABSS_{-1}$	−4.82		−4.81
	(-1.61)		(-1.61)
$ABMT_{-1}$		−0.79**	−0.79**
		(-2.13)	(-2.12)
RET_{-1}	0.89***	0.89***	0.89***
	(4.03)	(4.04)	(4.03)
$ABVOL_{-1}$	0.03*	0.03**	0.03**
	(1.88)	(2.00)	(2.00)
Adj. R^2	0.1%	0.1%	0.1%
Obs	43,456	43,456	43,456
Panel C: Taiwanese market			
	(1)	(2)	(3)
$ABSS_{-1}$	−17.04***		−17.13***
	(-5.95)		(-5.97)
$ABMT_{-1}$		0.39	0.50
		(0.64)	(0.82)
RET_{-1}	0.05***	0.05***	0.05***
	(3.78)	(3.44)	(3.75)
$ABVOL_{-1}$	0.12**	0.07	0.11**
	(2.12)	(1.19)	(1.97)
Adj. R^2	0.9%	0.5%	0.8%
Obs	4429	4429	4429

This table reports the OLS regressions of standardized unexpected earnings on abnormal short-selling and margin-trading activities before earnings announcements in three markets. The dependent variable, standardized unexpected earnings (SUE), is defined as the change in the latest quarterly earnings per share from the same quarter a year ago, normalized by the standard deviation of these changes over the previous eight quarters (with a minimum requirement of six quarters). The variable $ABSS_{-1}$ ($ABMT_{-1}$) is the time-series abnormal short selling (margin trading), measured as a stock's weekly short-selling variable SS_t (weekly margin-trading variable MT_t) minus the average SS_t (MT_t) over the previous 52 weeks. The variables SS_t and MT_t are the ratio of weekly net short-selling amount and net margin-trading amount to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks, respectively. The variable RET_{-1} is the stock's return in the week prior to the announcement. The variable $ABVOL_{-1}$ is the abnormal trading volume in the week prior to the announcement, normalized by the average weekly volume over the previous year. Reported in parentheses are heteroskedasticity-robust *t*-statistics. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from July 2010 to December 2019 for Chinese A-share market, January 2003 to June 2016 for Japanese market, and January 1999 to December 2019 for Taiwanese market.

Table IA.6
Comovement of Short Selling and Margin Trading in Three Markets

Panel A: Chinese A-share market			
	N	Mean	Median
$R^2_{adj,SS}$	1068	4.43	2.85
$R^2_{adj,MT}$	1068	28.10	28.45
Difference		−23.66	−25.60
t-stat/*z*-stat		(-62.81)	(-37.06)
Panel B: Japanese market			
	N	Mean	Median
$R^2_{adj,SS}$	3287	0.90	0.00
$R^2_{adj,MT}$	3287	2.08	1.18
Difference		−1.18	−1.18
t-stat/*z*-stat		(-14.71)	(-32.16)
Panel C: Taiwanese market			
	N	Mean	Median
$R^2_{adj,SS}$	1669	1.41	0.81
$R^2_{adj,MT}$	1669	4.92	4.46
Difference		−3.51	−3.64
t-stat/*z*-stat		(-24.52)	(-29.02)

This table presents the adjusted R^2 of time-series regressions of short selling and margin trading of individual stocks on their cross-sectional averages. The regression specifications are:

$$SS_{i,t} = \lambda_{0,i} + \lambda_{1,i} SS_{m,t} + \epsilon_t, MT_{i,t} = \gamma_{0,i} + \gamma_{1,i} MT_{m,t} + \epsilon_t$$

SS (*MT*) is measured as the ratio of weekly net short-selling amount (net margin-trading amount) to average weekly trading volume over the previous 52 weeks with a required minimum of 40 weeks. $SS_{i,t}$ and $MT_{i,t}$ are the short-selling and margin-trading measures for stock *i* at week *t*. $SS_{m,t}$ and $MT_{m,t}$ are the market-wide short selling and margin trading at week *t*, measured by the cross-sectional average of $SS_{i,t}$ and $MT_{i,t}$. The average and median adjusted R^2 of *SS* and *MT* regressions of individual stocks are reported in percentage. The *t*-statistics for difference in mean and Wilcoxon-Mann-Whitney *z*-statistics for difference in median are reported in parentheses. Panels A to C report the results for the Chinese A-share market, the Japanese market, and the Taiwanese market, respectively. The sample period is from July 2010 to December 2019 for Chinese A-share market, January 2003 to June 2016 for Japanese market, and January 1999 to December 2019 for Taiwanese market.

Table IA.7
Rationality and Investor Sentiment

	Sentiment = $Sentiment_{B\&W2006}$				Sentiment = $Sentiment_{Active}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disposition×*Sentiment*	−1.42***				−0.76***			
	(-3.01)				(-2.71)			
Disposition	−3.76***				−3.74***			
	(-5.30)				(-5.23)			
Experience×*Sentiment*		0.44***				0.36***		
		(4.10)				(6.72)		
Experience		1.23***				1.23***		
		(7.65)				(8.41)		
AccountAge×*Sentiment*			0.04*				0.03**	
			(1.93)				(2.13)	
AccountAge			0.04				0.05	
			(1.27)				(1.31)	
HoldStock×*Sentiment*				0.03**				0.04***
				(2.17)				(2.87)
HoldStock				0.04*				0.06**
				(1.79)				(2.31)
Sentiment	0.78***	0.85***	0.81***	0.82***	0.37***	0.45***	0.42***	0.46***
	(5.33)	(5.71)	(5.71)	(5.70)	(2.97)	(3.65)	(3.60)	(4.14)
Gender	1.18***	1.09***	1.30***	1.36***	1.18***	1.08***	1.29***	1.36***
	(3.35)	(3.22)	(3.69)	(3.79)	(3.35)	(3.19)	(3.69)	(3.81)
Age	−0.28**	−0.38***	−0.33***	−0.29**	−0.28**	−0.38***	−0.33***	−0.29**
	(-2.38)	(-3.28)	(-2.84)	(-2.50)	(-2.39)	(-3.25)	(-2.85)	(-2.48)
$Age^2/100$	0.23*	0.32**	0.28**	0.24*	0.23*	0.31**	0.28**	0.24*
	(1.84)	(2.55)	(2.26)	(1.94)	(1.84)	(2.53)	(2.26)	(1.92)
Capital	−0.72***	−0.61***	−0.66***	−0.69***	−0.73***	−0.63***	−0.67***	−0.70***

(*continued on next page*)

Table IA.7 (*continued*)

	Sentiment = $Sentiment_{B\&W2006}$				Sentiment = $Sentiment_{Active}$			
	(-7.08)	(-6.05)	(-6.49)	(-6.57)	(-7.20)	(-6.22)	(-6.61)	(-6.79)
Gain	0.20*	0.15	0.22*	0.21*	0.20*	0.14	0.21*	0.20*
	(1.74)	(1.33)	(1.81)	(1.76)	(1.67)	(1.27)	(1.77)	(1.67)
Turnover	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(224.16)	(197.73)	(257.33)	(257.20)	(151.68)	(143.83)	(193.60)	(199.34)
β	−3.87***	−3.99***	−3.95***	−3.99***	−3.69***	−3.70***	−3.72***	−3.74***
	(-5.92)	(-5.93)	(-6.17)	(-6.21)	(-5.39)	(-5.28)	(-5.53)	(-5.53)
Ivol	−3.66	−7.65	−3.24	−3.29	−5.82	−10.42	−5.60	−5.89
	(-0.57)	(-1.15)	(-0.50)	(-0.50)	(-0.87)	(-1.54)	(-0.84)	(-0.89)
Obs	65,240	65,240	65,240	65,240	65,240	65,240	65,240	65,240
Adj. R^2	0.011	0.014	0.010	0.010	0.011	0.014	0.009	0.009

This table presents the panel regressions of short-selling intensity on the behavioral bias measure, investment experience, account age, and the sentiment proxy. The dependent variable is $ShortSell_{i,t}$, which that takes the value of one when investor *i* short-sells at least one stock at month *t* and zero otherwise. *Disposition* is the disposition effect of investor *i* estimated up to month *t*, as defined in Odean (1998). *Experience* is the logarithm of number of positions ever taken by investor *i* up to month *t*. *AccountAge* is the number of years between the time when the account was opened and month *t*. *HoldStock* is the number of stocks held by investor *i* at the beginning of month *t*. The sentiment proxies include $Sentiment_{B\&W2006}$, which is the sentiment index calculated following Baker and Wurgler (2006), and $Sentiment_{Active}$, which is the ratio of the number of active investor accounts that have traded at least once at the month *t* to the total number of accounts with nonzero stock holdings by the end of month *t*. *Disposition*, *Experience*, *AccountAge*, *HoldStock*, and the sentiment proxies are demeaned before calculating the interactor variable. We include *Gender*, *Age*, $Age,^2$ *Capital*, *Gain*, *Turnover*, β, and *Ivol* from Table 8 in all specifications. We multiply all slope coefficients by 100. Reported in parentheses are *t*-statistics two-way clustered by investor and month. *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively. The sample period is from June 2012 to May 2015.

References

Amihud, Yakov, 2002. Illiquidity and stock returns: Cross-section and time-series effects. J. Finan. Market 5, 31–56.
Ahern, Kenneth R., Sosyura, Denis, 2014. Who writes the news? Corporate press releases during merger negotiations. J. Finance 69 (1), 241–291.
Asquith, Paul, Pathak, Parag A., Ritter, Jay R., 2005. Short interest, institutional ownership, and stock returns. J. Financ. Econ. 78 (2), 243–276.
Baker, Malcolm, Wurgler, Jeffrey, 2006. Investor sentiment and the cross-section of stock returns. J. Finan. 61 (4), 1645–1680.
Bali, Turan G., Murray, Scott, 2013. Does risk-neutral skewness predict the cross-section of equity option portfolio returns? J. Financ. Quant. Anal. 48 (4), 1145–1171.
Ball, Ray, Shivakumar, Lakshmanan, 2008. How much new information is there in earnings? J. Account. Res. 46 (5), 975–1016.
Barber, Brad, Odean, Terrance, 2008. All that glitters: the effect of attention and news on the buying behavior of individual and institutional investors. Rev. Financ. Stud. 21 (2), 785–818.
Baker, Malcolm, Jeffrey, Wurgler, 2006. Investor sentiment and the cross-section of stock returns. J. Finance 61 (4), 1645–1680.
Beaver, William H., 1968. The information content of annual earnings announcements. J. Account. Res. 67–92.
Bian, Jiangze, Da, Zhi, Dong, Lou, Zhou, Hao, 2018a. Leverage Network and Market Contagion, *PBCSF-NIFR Research Paper*.
Bian, Jiangze, He, Zhiguo, Kelly, Shu, Zhou, Hao, 2018b. Leverage-induced Fire Sales and Stock Market Crashes. National Bureau of Economic Research.
Bhojraj, Sanjeev, Bloomfield, Robert J., Tayler, William B., 2008. Margin trading, overpricing, and synchronization risk. Rev. Financ. Stud. 22 (5), 2059–2085.
Boehmer, Ekkehart, Duong, Truong X., Huszar, Zsuzsa R., 2018. Short covering trades. J. Financ. Quant. Anal. 53 (2), 723–748.
Boehmer, Ekkehart, Huszar, Zsuzsa R., Wang, Yanchu, Zhang, Xiaoyan, 2022. Can shorts predict returns? A global perspective. Rev. Financ. Stud. 35 (5), 2428–2463.
Boehmer, Ekkehart, Jones, Charles M., Zhang, Xiaoyan, 2008. Which shorts are informed? J. Finance 63 (2), 491–527.
Chakravarty, Sugato, Gulen, Huseyin, Stewart, Mayhew, 2004. Informed trading in stock and option markets. J. Finance 59 (3), 1235–1257.
Chang, Eric C., Yan, Luo, Ren, Jinjuan, 2014. Short-selling, margin-trading, and price efficiency: evidence from the Chinese market. J. Bank. Finance 48, 411–424.
Chen, Zhuo, Lu, Andrea, Zhu, Xiaoquan, 2023. Investor sentiment and the pricing of macro risks for hedge funds. PBCSF-NIFR Research Paper.
Chen, Zhuo, Liu, Bibo, Wang, Huijun, Wang, Zhengwei, Yu, Jianfeng, 2020. Investor sentiment and the pricing of characteristics-based factors. PBCSF-NIFR Research Paper.
Chowdhry, Bhagwan, Nanda, Vikram, 1998. Leverage and market stability: the role of margin rules and price limits. J. Bus. 71 (2), 179–210.
Christophe, Stephen E., Ferri, Michael G., Angel, James J., 2004. Short-selling prior to earnings announcements. J. Finance 59 (4), 1845–1876.
Cohen, Lauren, Diether, Karl B., Malloy, Christopher J., 2007. Supply and demand shifts in the shorting market. J. Finance 62 (5), 2061–2096.
Deuskar, Prachi, Kumar, Nitin, Poland, J. Allan, 2020. Signal on the margin: behavior of levered investors and future economic conditions. Rev. Finance 24 (5), 1039–1077.
Diether, Karl B., Lee, Kuan-Hui, Werner, Ingrid M., 2009. Short-sale strategies and return predictability. Rev. Financ. Stud. 22 (2), 575–607.
Dhar, Ravi, Zhu, Ning, 2006. Up close and personal: investor sophistication and the disposition effect. Manag. Sci. 52 (5), 726–740.
Edmans, Alex, Goncalves-Pinto, Luis, Groen-Xu, Moqi, Wang, Yanbo, 2018. Strategic news releases in equity vesting months. Rev. Financ. Stud. 31 (11), 4099–4141.
Engelberg, Joseph E., Reed, Adam V., Ringgenberg, Matthew C., 2012. How are shorts informed?: short sellers, news, and information processing. J. Financ. Econ. 105 (2), 260–278.
Engelberg, Joseph E., Adam, V. Reed, Ringgenberg, Matthew C., 2018. Short-selling risk. J. Finance 73 (2), 755–786.
Feng, Lei, Seasholes, Mark S., 2005. Do investor sophistication and trading experience eliminate behavioral biases in financial markets? Rev. Finance 9 (3), 305–351.
Frazzini, Andrea, Pedersen, Lasse H., 2022. Embedded leverage. Review of Asset Pricing Studies 12 (1), 1–52.
Gamble, Keith Jacks, Xu, Wei, 2017. Informed retail investors: evidence from retail short sales. J. Empir. Finance 40, 59–72.
Gao, Pengjie, Hu, Allen, Kelly, Peter, Peng, Cameron, Zhu, Ning, 2024. Asset complexity and the return gap. Rev. Finance 28 (2), 511–550.
Hansman, Christopher, Hong, Harrison, Jiang, Wenxi, Liu, Yu-Jane, Meng, Juan-Juan, 2018. Riding the Credit Boom. National Bureau of Economic Research.
Hardouvelis, Gikas A., 1990. Margin requirements, volatility, and the transitory component of stock prices. Am. Econ. Rev. 80 (4), 736–762.
Hardouvelis, Gikas A., Peristiani, Stavros, 1992. Margin requirements, speculative trading, and stock price fluctuations: the case of Japan. Q. J. Econ. 107 (4), 1333–1370.
Harvey, Campbell, Liu, Yan, Zhu, Heqing, 2016. …and the cross-section of expected returns. Rev. Financ. Stud. 29 (1), 5–68.
Heilmer, Rawley, Simsek, Alp, 2019. Should retail investors' leverage be limited? J. Financ. Econ. 132 (3), 1–21.
Hou, Kewei, Chen, Xue, Zhang, Lu, 2015. Digesting anomalies: an investment approach. Rev. Financ. Stud. 28, 650–705.

Hou, Kewei, Xue, Chen, Zhang, Lu, 2020. Replicating anomalies. Rev. Financ. Stud. 33 (5), 2019–2133.
Jung, Michael J., Naughton, James P., Ahmed, Tahoun, Wang, Clare, 2018. Do firms strategically disseminate? Evidence from corporate use of social media. Account. Rev. 93 (4), 225–252.
Kabir, M. Humayun, Hassan, M.Kabir, 2005. The near-collapse of LTCM, US financial stock returns, and the fed. J. Bank. Finance 29 (2), 441–460.
Karpoff, Jonathan M., Lou, Xiaoxia, 2010. Short sellers and financial misconduct. J. Finance 65 (5), 1879–1913.
Khan, Mozaffar, Lu, Hai, 2013. Do short sellers front-run insider sales? Account. Rev. 88 (5), 1743–1768.
Kothari, Sabino P., Shu, Susan, Wysocki, Peter D., 2009. Do managers withhold bad news? J. Account. Res. 47 (1), 241–276.
Massa, Massimo, Zhang, Bohui, Zhang, Hong, 2015. The invisible hand of short selling: does short selling discipline earnings management? Rev. Financ. Stud. 28 (6), 1701–1736.
Nagar, Venky, Nanda, Dhananjay, Wysocki, Peter, 2003. Discretionary disclosure and 32 stock-based incentives. J. Account. Econ. 34 (1–3), 283–309.
Newey, Whitney K., West, Kenneth D., 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 55 (3), 703–708.
Odean, Terrance, 1998. Are investors reluctant to realize their losses? J. Finance 53 (5), 1775–1798.
Piotroski, Joseph D., Wong, T.J., Zhang, Tianyu, 2015. Political incentives to suppress negative information: evidence from Chinese listed firms. J. Account. Res. 53 (2), 405–459.
Rapach, David E., Ringgenberg, Matthew C., Zhou, Guofu, 2016. Short interest and aggregate stock returns. J. Financ. Econ. 121 (1), 46–65.
Richardson, Scott, Saffi, Pedro A.C., Sigurdsson, Kari, 2017. Deleveraging risk. J. Financ. Quant. Anal. 52 (6), 2491–2522.
Ryu, Doojin, Yang, Heejin, 2018. The directional information content of options volumes. J. Futures Mark. 38 (12), 1533–1548.
Seguin, Paul J., 1990. Stock volatility and margin trading. J. Monetary Econ. 26 (1), 101–121.
Shen, Junyan, Yu, Jianfeng, Zhao, Shen, 2017. Investor sentiment and economic forces. J. Monetary Econ. 86, 1–21.
Shleifer, Andrei, Vishny, Robert, 2011. Fire sales in finance and macroeconomics. J. Econ. Perspect. 25 (1), 29–48.
Solomon, David H., 2012. Selective publicity and stock prices. J. Finance 67 (2), 599–638.
Stambaugh, Robert, F., Yu, Jianfeng, Yuan, Yu, 2012. The short of it: investor sentiment and anomalies. J. Financ. Econ. 104 (2), 288–302.
Stambaugh, Robert F., Yu, Jianfeng, Yuan, Yu, 2015. Arbitrage asymmetry and the idiosyncratic volatility puzzle. J. Finance 70 (5), 1903–1948.
Yu, Jianfeng, Yuan, Yu, 2011. Investor sentiment and the mean-variance relation. J. Financ. Econ. 100 (2), 367–381.