



JPX Working Paper (Summary)

Analysis of Detail Breakdown Trading Data (Margin Transaction and Short Selling)

Jan. 28, 2021

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JPX Working Papers : <https://www.jpx.co.jp/english/corporate/research-study/working-paper/index.html>

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- Tokyo Stock Exchange, Inc. (hereinafter referred to as "TSE") is exploring the distribution of other data held in-house that could be used outside the company as a new data service.
- As part of this effort, TSE conducted a PoC on detail breakdown trading data (hereinafter "breakdown data"), which is a new type of data on the TSE market, and started distributing it outside the company from April 2020 after confirming that the data could be used outside the company.
- This paper outlines the various systems that are prerequisites for using the trading data and the characteristics of the trading data. In addition, the breakdown data was used to analyze the trading trends in the TSE cash equity market and create an estimation model for end-of-week outstanding margin transactions.

Standardized and Negotiable Margin Transactions

- There are two types of margin transactions, standardized and negotiable margin transactions.
- For standardized margin transactions, the eligible stocks and settlement periods are determined by TSE. For negotiable margin transactions, the transaction terms are determined between securities firms and investors. Securities firms use negotiable margin transactions to provide services based on various transaction terms.
- Breakdown data contains margin transaction data (including volume of new margin and closing margin trades by issue). Margin transaction means the total of standardized and negotiable margin transactions.

Standardized margin transaction

Eligible stocks and settlement periods are determined by TSE

Negotiable margin transaction

Eligible stocks and settlement periods are determined between securities firms and investors

In breakdown data, margin transaction data means the total of standardized and negotiable margin transactions.

Margin Transaction Flags

- Generally, investors make opposite trades to close margin positions.
- Investors must indicate to securities firms when making such closing margin transactions.
- Securities firms must indicate to TSE when they send a margin transaction order by adding a flag to indicate whether it is a new or closing transaction.
- Breakdown data contains data on new margin and closing margin transaction. TSE uses margin transaction flags to compile breakdown data.

New Margin Transaction

Closing Margin Transaction (Opposite)

New margin buy
Buy to create new margin buy position

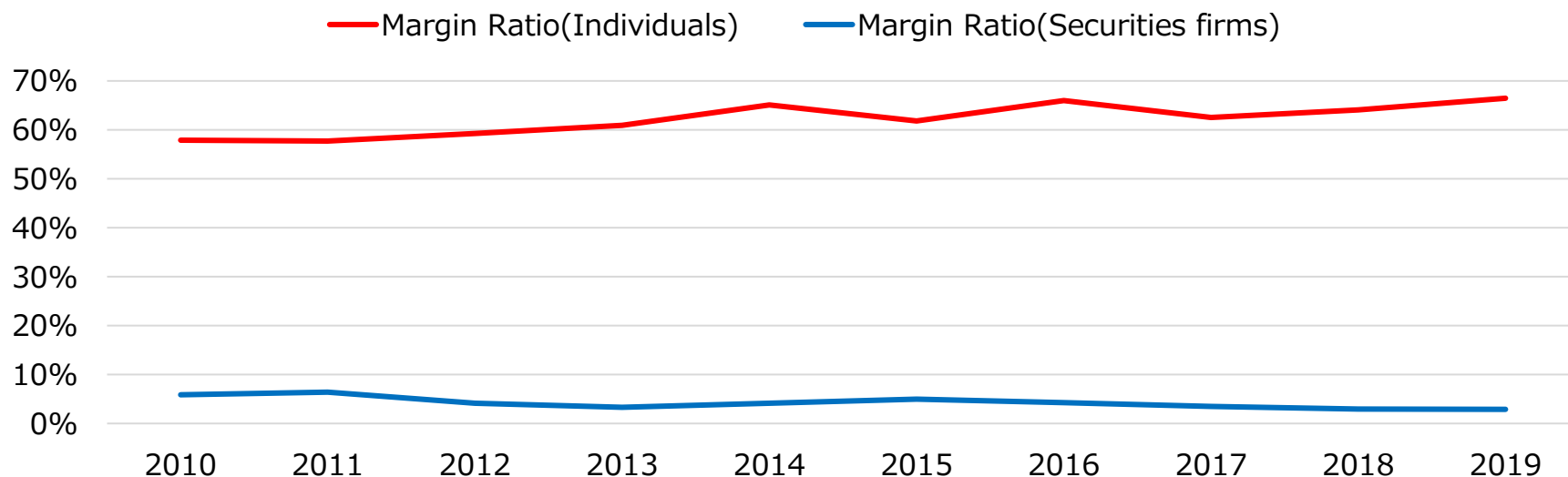
Closing margin sell
Sell to close existing margin buy position

New margin sell
Sell to create new margin sell position

Closing margin buy
Buy to close existing margin sell position

Main Users of Margin Transactions

- Margin transactions are widely used by individual (retail) investors. According to TSE statistics, more than 60% of trading value of individual investors comes from margin transactions.
- The usage ratio of margin transactions by securities firms, who normally procure funds and stocks by other methods, is less than 10%.



Margin ratio = Trading value of margin transactions (new/close, buy/sell) ÷ Total trading value ÷ 2

Loans for margin transactions

- Securities firms need to procure funds and stocks for their customer's margin transactions. Securities firms can use loans for margin transactions to procure funds and stocks from Japan Securities Finance Co., Ltd. (JSF).

Standardized and loan margin transaction issues

- TSE selects issues eligible for standardized margin transactions and loans for margin transactions based on its rules. *
- Securities firms can procure funds and stocks for margin transactions and loans for margin transactions, and funds for standardized margin transactions from JSF.
- Many issues that see no margin selling are standardized margin transaction issues.

Standardized margin transaction issues
Securities firms can raise funds from JSF
= Investors can buy on margin

Loan margin transaction issues
Securities firms can raise funds and stocks from JSF
= Investors can buy and sell on margin

*List of issues eligible for standardized margin transactions and loans for margin transactions
<https://www.jpx.co.jp/english/listing/others/margin/index.html>

- If there is excessive use of margin transactions and this affects the stock price, TSE will implement a measure to regulate the use of margin transactions by raising the margin required for new margin transactions.
- TSE has disclosed the criteria for implementing and lifting the measure.*
- Since one of the implementation criteria is the margin transaction ratio, the breakdown data can be used to calculate this ratio to improve the predictability of the measure.

Criteria for implementation of primary measure

If an issue subject to daily publication falls under any of the criteria specified in the following (1) to (4), the Exchange shall implement the measure to raise the security deposit ratio, etc. for new margin sales and purchases on and after the next business day when the Exchange confirms that the stock falls under the criteria.

- (1) Criteria for outstanding margin transactions
- (2) Criteria for margin transaction ratio
- (3) Criteria for turnover ratio
- (4) Exception

*Guidelines Concerning Measure to Raise the Security Deposit Ratio, etc.

<https://www.jpx.co.jp/english/markets/equities/margin-reg/index.html>

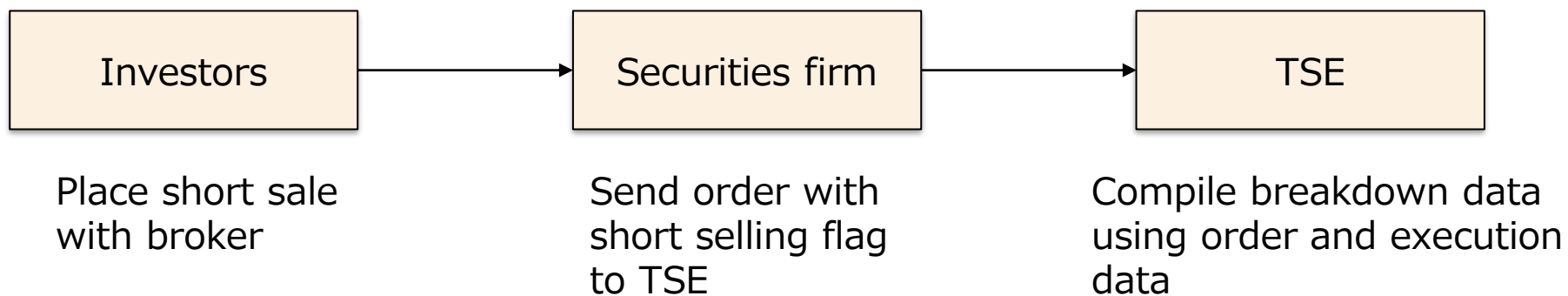
Short Selling and Margin Selling

- Selling is categorized into long selling or short selling.
- Short selling consists of margin and non-margin short selling.

Selling	Long selling	Sale of securities that are owned by the seller	
	Short selling	Short selling other than margin trading	Sale of securities borrowed through negotiations or agreements with shareholders
		Short selling on margin	Sale of securities that the seller has borrowed from securities firms

Short Selling Flags

- Investors must indicate to securities firms when making a short selling order.
- Securities firms must indicate to TSE when they send such customer orders by adding a flag to indicate that it is a short sale.
- Breakdown data contains data on selling, which consists of long selling and short selling. TSE uses short selling flags to compile data.



Trigger rule

- The price restrictions are not always applied. It is triggered when the traded price drops by 10% or more from the base price of the issue.
- When the price restriction is applied, short selling is prohibited at a price lower than the last price when the stock price is rising and at a price lower than or equal to the last price when the stock price is falling.

Price restriction flags

- When a securities company places a short-selling order with TSE when the issue is subject to short-selling price restriction, it must attach a short sale flag to indicate whether the order is subject to price restriction or not (i.e., an order that is legally exempted from application of the price restriction).
- Breakdown data contains data on short selling orders with price restriction and without price restriction. TSE uses short selling flags to compile breakdown data.

Outline of Trading Breakdown Detail Data Service

- “Internal Use Service” and “ External Distribution Service” will be provided.
 - Internal Use Service...For investors and securities companies
(For internal use by investors and securities firms)
 - External Distribution Service...For information vendors
(For re-distribution to customers)
- The internal use service processes data mechanically and provides historical data over a longer period with more detailed data items.
- The external distribution service data aggregates data to a certain extent, assuming that users will directly view and make judgment based on the data.

Data Contents	Data (CSV file) on daily trading value and trading volume by issue subdivided using order flag information	
Delivery Method	Data (1 file per day) is delivered via FTP at 18:00 on the same day	
Assumed User	Investors, securities firms	Information vendors
Historical Data	From Jan. 2010	From Apr. 2015
Data Items (columns)	20	16

For details, please refer to the service overview.

<https://www.jpx.co.jp/english/markets/paid-info-equities/reference/07.html>

Data Layout for Internal Use Service

- A csv file containing 20 columns with headers.
- The first two columns contain the trade date and securities code. From the third column onward, the data indicate "① execution value/volume_②sell/buy_③margin transaction flag_④short selling flag" as described in the table below.
- For example, "va_1_0_0" indicates "trading value_sell_non-margin transaction_non-short selling" (i.e., long selling value).

date	code	va_1_0_0	va_1_0_5	va_1_0_7	va_1_2_5	va_1_2_7	va_1_4_0	va_3_0_0	va_3_2_0	va_3_4_0	vo_1_0_0	vo_1_0_5	vo_1_0_7	vo_1_2_5	vo_1_2_7	vo_1_4_0	vo_3_0_0	vo_3_2_0	vo_3_4_0	
20180111	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Trade date (YYYYMMDD)
Securities code (4-digit)

Breakdown of execution value

Breakdown of execution volume

Header	Meaning	Value	Remarks
①	Either execution value or execution volume	va: Execution value (JPY) vo: Execution volume (shares)	<ul style="list-style-type: none"> • Columns 3 to 11 show the breakdown of execution value, and columns 12 to 20 show the breakdown of execution volume.
②	Either sell or buy	1: Sell 3: Buy	<ul style="list-style-type: none"> • The total sell execution value (volume) matches the total buy execution value (volume).
③	Margin flag	2: New margin transaction 4: Closing margin transaction 0: Non-margin transaction	<ul style="list-style-type: none"> • New margin transaction means those that create a new position. • Closing margin transaction means those made to close an existing margin position. • Non-margin transaction means those that are not margin transactions.
④	Short selling flag	5: Short selling (with price restriction) 7: Short selling (without price restriction) 0: Non-short selling	<ul style="list-style-type: none"> • Short selling (without price restriction) means those legally exempted from such price restriction. As such, other short sales come under short selling (with price restriction). • Non-short selling means long selling and long buying.

Data Layout for External Distribution Service

- A csv file containing 16 columns with headers.
- The first two columns contain the trade date and securities code. The data contained in the third column onward are described below.

date	code	va_LongSell	va_ShortSellwoMargin	va_MarginSell_New	va_MarginSell_Close	va_LongBuy	va_MarginBuy_New	va_MarginBuy_Close	vo_LongSell	vo_ShortSellwoMargin	vo_MarginSell_New	vo_MarginSell_Close	vo_LongBuy	vo_MarginBuy_New	vo_MarginBuy_Close
20140107	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Trade date (YYYYMMDD)
Securities code (4-digit)

Breakdown of execution value

Breakdown of execution volume

Header	Contents	Unit	
date	Trade date (YYYYMMDD)		
code	Securities code (4-digit number)		
va_LongSell	Execution value of long selling	JPY	
va_ShortSellwoMargin	Execution value of short selling (excluding new margin sell)		
va_MarginSell_New	Execution value of new margin selling (sell orders that create new margin sell positions)		
va_MarginSell_Close	Execution value of closing margin selling (sell orders that close existing margin buy positions)		
va_LongBuy	Execution value of long buying		
va_MarginBuy_New	Execution value of new margin buying (buy orders that create new margin buy positions)		
va_MarginBuy_Close	Closing margin buying (buy orders that close existing margin sell positions)		
vo_LongSell	Execution volume of long selling		shares
vo_ShortSellwoMargin	Execution volume of short selling (excluding new margin selling)		
vo_MarginSell_New	Execution volume of new margin selling (sell orders that create new margin sell positions)		
vo_MarginSell_Close	Closing margin selling (sell orders that close existing margin buy positions) execution volume		
vo_LongBuy	Execution volume of long buying		
vo_MarginBuy_New	Execution volume of new margin buying (buy orders that create new margin buy positions)		
vo_MarginBuy_Close	Execution volume of closing margin buying (buy orders that close existing margin sell positions)		

- Data analysis was conducted using breakdown data.
- The data was analyzed to determine the general characteristics of the data and understand certain characteristics in terms of the trading rules.
- The dataset
 - Data: Detail Breakdown Trading Data (Internal Use)
 - Period: January 2015 to December 2019
 - Issues: All available issues (TSE 1st Section, 2nd Section, JASDAQ Growth, JASDAQ Standard, Mothers, and REIT)
 - Although the data has trading value and trading volume information, the results from these two datasets are almost the same. Therefore, the following pages show only the results of the analysis based on trading volume.
- Understanding the box plot
 - The line in the middle of each box shows the median price.
 - The top and bottom of each box show respectively the third quartile (75%) and the first quartile (25%).
 - The whisker above each box shows the range up to the "third quartile+1.5*IQR" and the one below shows that down to "the first quartile-1.5*IQR".
 - IQR means inter quartile range defined as "the third quartile – the first quartile".
 - The points above and below the whiskers are outliers and are shown as ○.

- Analysis 1: Short Selling Ratio by Section
 - The TSE 1st Section and REIT market have short selling ratios of around 30%, and the other markets see ratios below 20%.
- Analysis 2: Short Selling Ratio vs Price Change
 - Regardless of a price gain/loss, the short selling ratio tends to be higher when the absolute price change is larger, and lower when the absolute price change is smaller.
- Analysis 3: Margin Transaction Ratio by Section
 - Margin buy volume is larger than margin sell volume.
 - The TSE 1st Section and REIT market see lower margin buy ratios.
- Analysis 4: Estimation of Outstanding Margin Volume using Breakdown Data
 - Outstanding margin buy volume can be estimated with a relatively high degree of accuracy.
 - The error of estimation was larger in issues with smaller market cap and higher margin sell ratio.

Analysis 1: Short Selling Ratio by Market

- The median of the daily short sell ratio (ratio of short sell order volume to sell order volume) for each issue was calculated, and the figures for each market were compiled.
- Figures for short sell orders with price restriction (“_PR”) and short sell orders without price restriction (“_woPR”) were separately calculated.
- The median of the short sell ratio was about 30% in TSE 1st Section and REITs.
- For other markets, the ratio was 20% or lower.
- The ratios for without price restriction (“_woPR”) was almost zero, except TSE 1st Section and REITs.
- With institutional investors holding a large portion of TSE 1st Section and REIT issues and a large supply of stocks for borrowing/lending contributes to these markets seeing high short selling ratios.

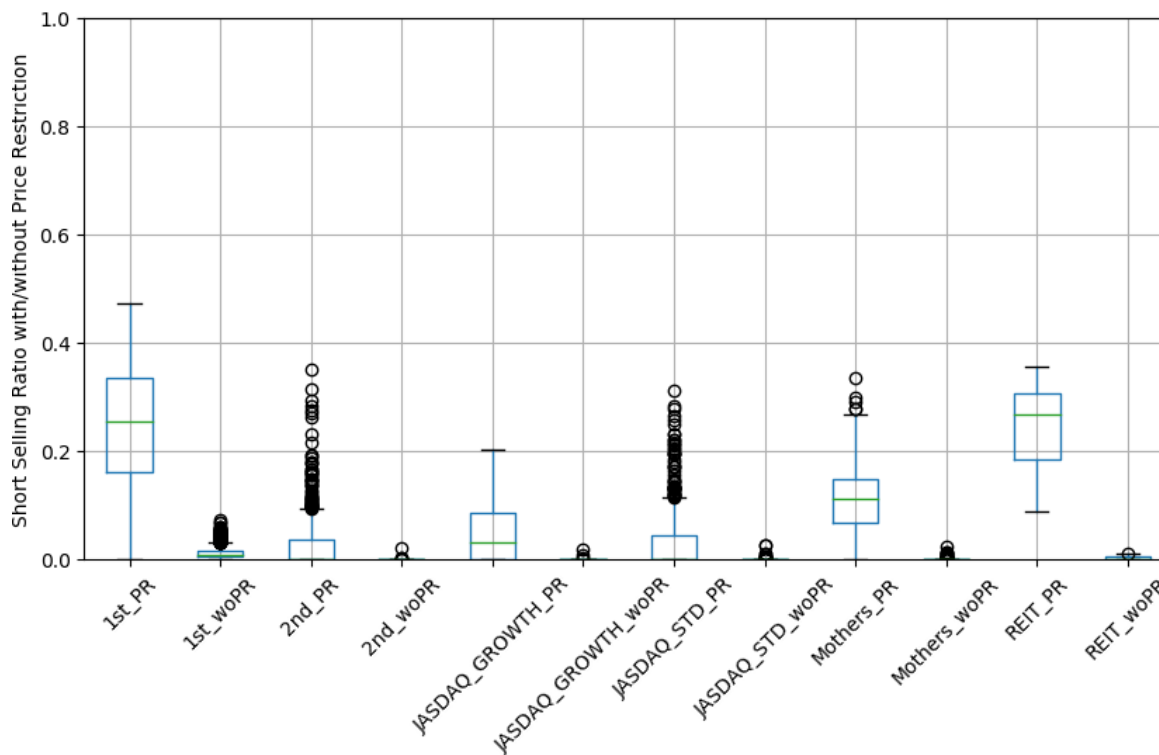


Fig. Short Selling Ratio with/without Price Restrictions

Analysis 2: Short Selling Ratio and Price Change

- The correlation coefficient for each issue between the short selling ratio and the price change was calculated based on price changes classified into positive (“pos”), negative (“neg”), and both (“all”).
- The correlation coefficient was positive for positive price changes and negative for negative price changes. Regardless of whether it was a price gain or loss, a larger absolute price change coupled with a higher short selling ratio and a smaller absolute price change with a lower ratio.
- Since the balance of demand and supply shifts when a large price change occurs, the higher short selling ratio is thought to be the result of more short selling executed with market makers such as HFT.

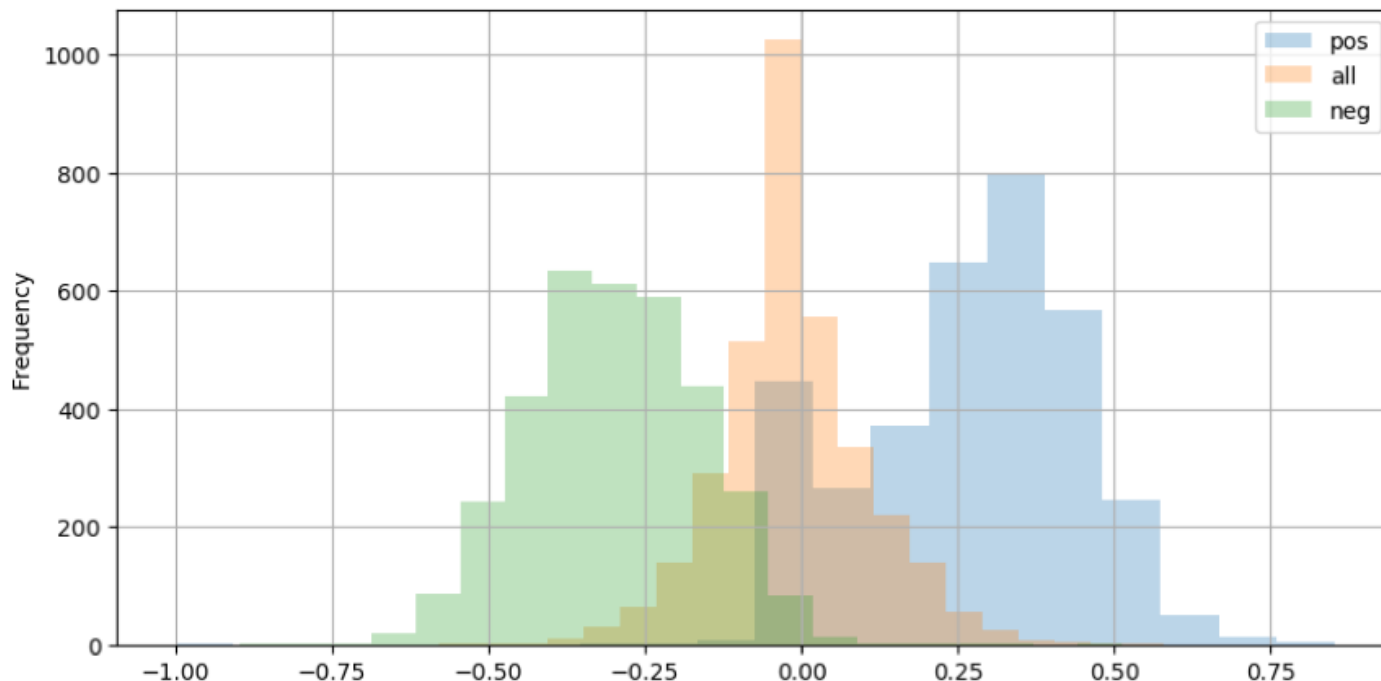


Fig. Correlation coefficient between short selling ratio and price change
(pos: only positive; neg: only negative; all: all cases)

Analysis 3: Margin Buy Ratio by Market

- The margin trading ratio (the percentage of new margin buy volume to overall buy volume) for each market was calculated.
- The margin buy ratio was around 20%.
- The ratio was lower in the TSE 1st Section and REIT market.

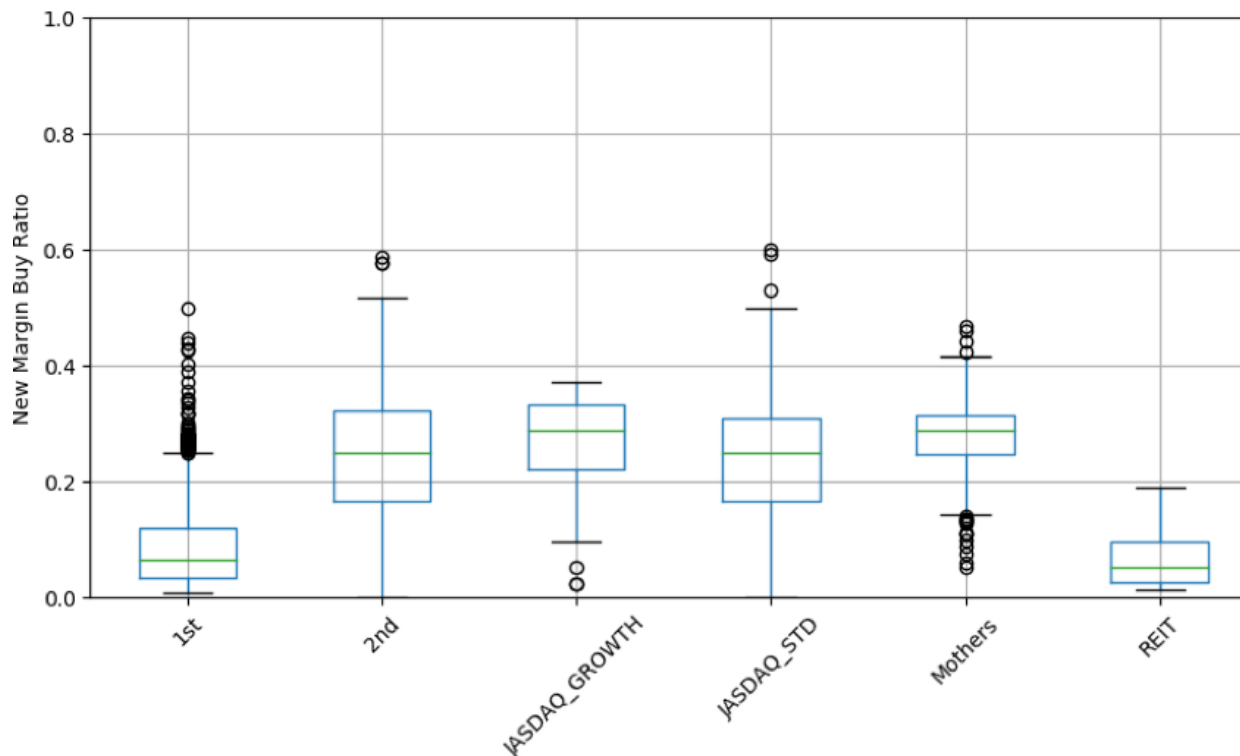


Fig. Margin Buy Ratio by Market

Analysis 3: Margin Sell Ratio by Market

- The margin sell ratio (the percentage of new margin sell volume to overall sell volume) for orders with price restriction (“_PR”) and without price restriction (“_woPR”) were separately calculated.
- The ratio was below 10%, with the TSE 1st Section and REIT markets almost zero.
- The difference between “_woPR” and “_PR” was statistically significant, with “_woPR” order more than “_PR”.
- Short selling on margin by retail investors (up to 50 times of the trading unit) is classified as short selling without price restriction, and many new margin sell orders come under this category. This was behind the difference between “_woPR” and “_PR”.

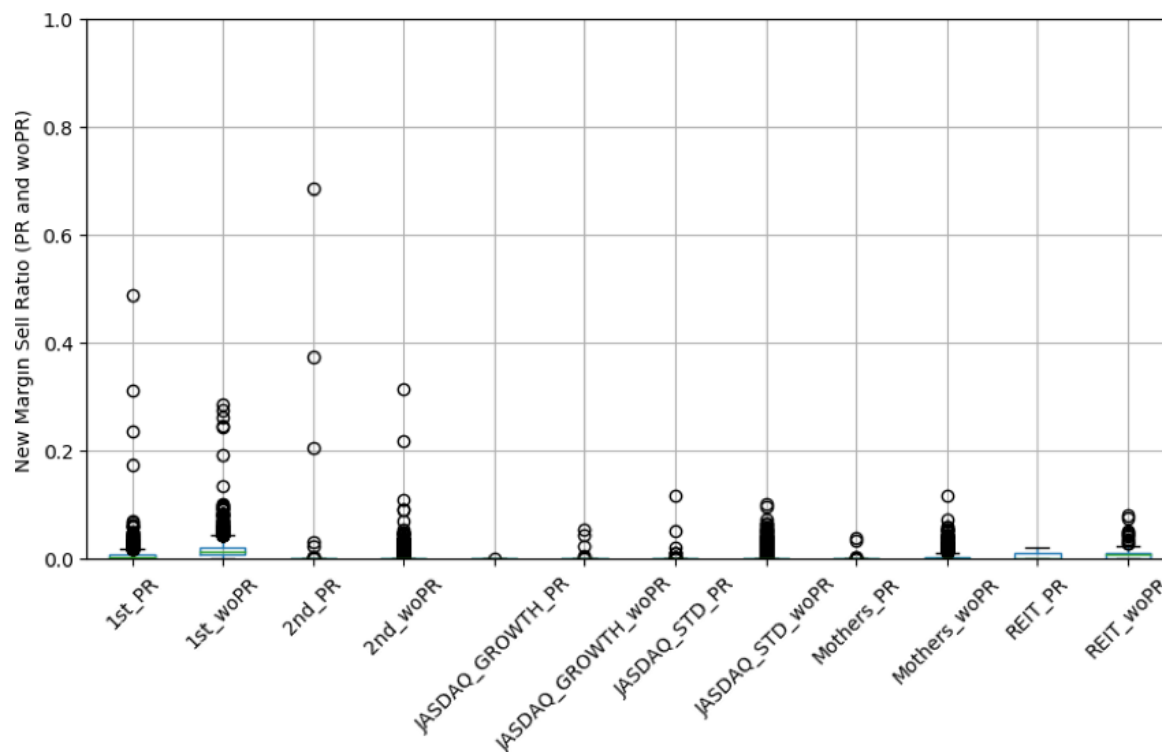


Fig. Margin Sell Ratio with/without Price Restriction by Market

Analysis 4: Estimation of Outstanding Margin Volume using Breakdown Data

- End-of-week outstanding margin volume was estimated by adding/subtracting the daily margin transaction flow to the outstanding volume from the end of the previous week. The estimated and actual outstanding volumes were compared, and the estimation error was defined as below.

$$\text{Estimation error} = \frac{\text{Outstanding Volume Estimated using Breakdown Data} - \text{Actual Outstanding Volume}}{\text{Actual Outstanding Volume}}$$

- Due to the low (almost zero) margin transaction volume and outstanding volume in markets other than the TSE 1st Section, the following analysis used only data on TSE 1st Section issues.

Table. Distribution of the Median of the Estimation Error for Outstanding Margin Buy/Sell Volume

	Median of Estimation Error for Outstanding Margin Buy	Median of Estimation Error for Outstanding Margin Sell
Mean	2.95%	12.62%
Std. Deviation	5.21%	49.78%
Min	-33.54%	0.00%
First Quartile	1.57%	3.96%
Median	2.17%	8.30%
Third Quartile	3.25%	15.30%
Max	204.15%	1978.95%

- The median of the estimation error for outstanding margin buy was 2.17% and sell was 8.30%.
- For the third quartile of outstanding buy, it was relatively small at 3.25%. We could confirm that outstanding margin buy volume can be estimated relatively precisely using breakdown data.
- However, outstanding sell volume showed a larger estimation error than outstanding buy.

Analysis 4: Estimation of Outstanding Margin Volume using Breakdown Data

- The following analyzed which issues are suitable for estimating outstanding margin sell volume and which are not. The issues were divided into four categories in ascending order of estimation error for outstanding margin selling. The groups were defined as follows.
 - 1Q: Estimation Error < First Quartile (=3.96%)
 - 2Q: First Quartile (=3.96%) ≤ Estimation Error < Median (=8.30%)
 - 3Q: Median(=8.30%) ≤ Estimation Error < Third Quartile (=15.30%)
 - 4Q: Third Quartile (=15.30%) ≤ Estimation Error

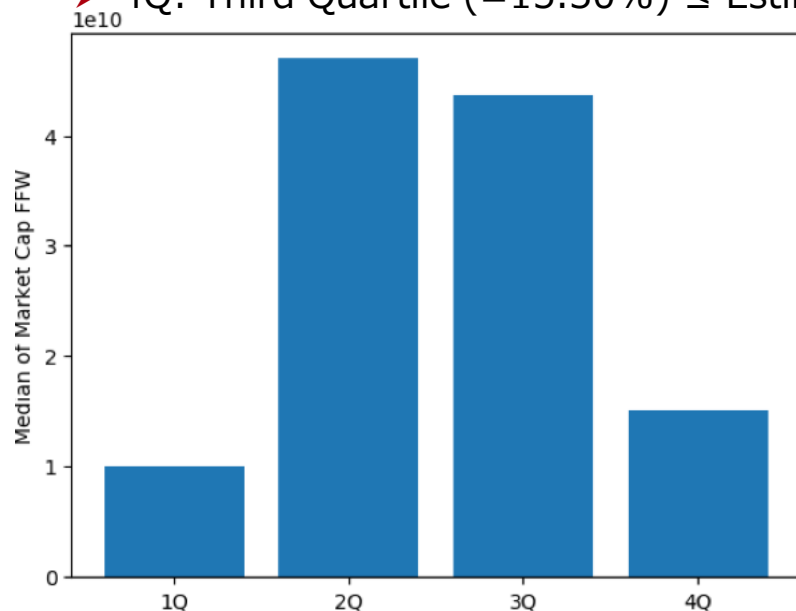


Fig. Median of Market Cap by Group

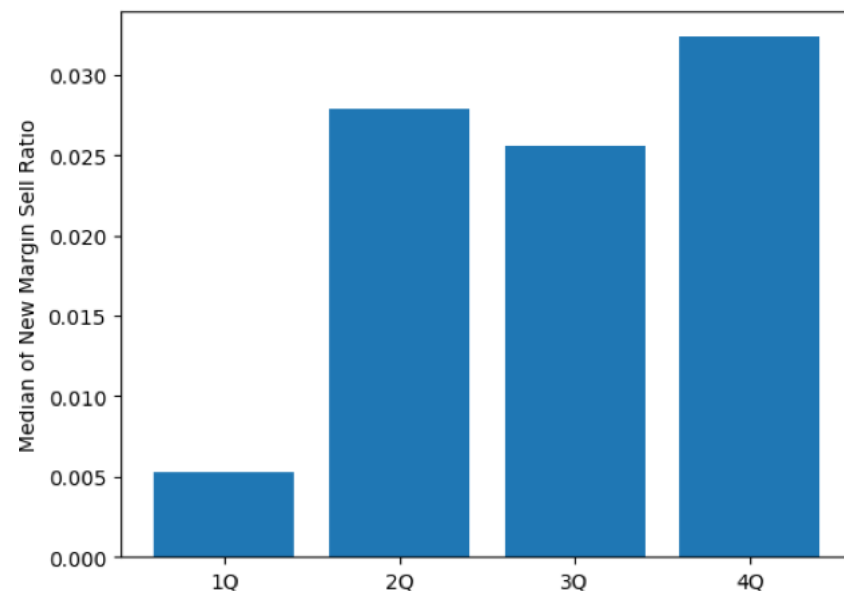


Fig. Median of New Margin Sell Ratio by Group

- Small market cap issues made up 1Q, the group with the smallest estimation error, and 4Q the group with the largest estimation error, 4Q. Large market cap issues were in 2Q and 3Q.
- 1Q issues had very small margin sell ratios whereas 4Q issues had the largest margin sell ratios.