

# DISPOSITION EFFECT AND CONTRARIAN/MOMENTUM BEHAVIOR OF STOCK TRADERS

Hsiang-Hsi Liu<sup>a</sup>, Pi-Hsia Hung<sup>b</sup> and Tzu-Hu Huang<sup>b</sup>

## ABSTRACT

*This research examines stock traders' disposition effects and contrarian/momentum behavior in the Taiwan Stock Exchange (TWSE). Specifically, we first investigate disposition effects across all trader types and then examine the relationships between disposition effects, trader types, and order characteristics. Next, we explore contrarian and/or momentum behavior and analyze the relationships among the contrarian/momentum behavior, investor type, and order characteristics. Finally, the links among trader types, order characteristics, and investment performance are detected. This chapter yields the following findings. (1) Individual investors exhibit the strongest disposition effects compared to other investors. (2) Foreign investors, investment trusts, and individual investors tend to use large orders to sell loser stocks. (3) Investment trusts are inclined to be momentum traders, while individual investors tend to perform contrarian strategies. (4) Institutional aggressive and large orders perform better than individuals' orders. (5) The performance of foreign investors' selling decisions is better than that of retail investors.*

**Keywords:** Behavioral finance; contrarian versus momentum; investor types; loss aversion; order aggressiveness; order size

**JEL Classification:** D02; G11; G41

---

<sup>a</sup>National Taipei University, Taiwan

<sup>b</sup>National Chi Nan University, Taiwan. Corresponding email: [phhung@ncnu.edu.tw](mailto:phhung@ncnu.edu.tw).

## 1. INTRODUCTION

Stock traders tend to sell winners too early and hold losers for too long in a trading pattern, which is called the disposition effect (Andrikogiannopoulou & Papakonstantinou, 2020; Barberis & Xiong, 2009; Feng & Seasholes, 2005; Grinblatt & Keloharju, 2001; Odean, 1998, 1999; Shapira & Venezia, 2001; Shefrin & Statman, 1985). In other words, investors are less willing to recognize losses, but are more willing to realize gains. A contrarian strategy is an investment style that goes against prevailing market trends by buying losing stocks and then selling winning stocks. The momentum strategy, however, does the opposite. Although most existing studies confirm disposition effects and contrarian/momentum behaviors, the relationships among disposition effects, contrarian/momentum behaviors, and order characteristics are so far unclear. This study considers various trader types and order characteristics and reexamines stock traders' disposition effects and contrarian/momentum behavior in the Taiwan Stock Exchange (TWSE).

TWSE is a pure order-driven market that is very different from other developed markets such as New York Stock Exchange (NYSE) and National Association of Securities Dealers Automated Quotation (NASDAQ). Individuals account for a much larger proportion of market participants. We believe that different components of stock traders exude different impacts on the disposition effect and contrarian/momentum behaviors. Moreover, traders play a more important role in determining the settled price in an order-driven market than in a quote-driven market such as NASDAQ. TWSE provides a particularly sufficient opportunity to analyze stock traders' disposition effects and contrarian/momentum behavior across different types of institutional and individual transactions.

This study specifically aims to provide information about the following research objectives. (1) We first investigate the disposition effects across all trader types. (2) If there is indeed a disposition effect, we then study the relationships among this effect, investor types, and order characteristics. (3) We continue to explore contrarian/momentum behaviors and further analyze the relationships among contrarian/momentum behaviors, investor types and order characteristics. (4) Finally, the links among trader types, order characteristics, and investment performance are detected. Basically, this research deepens the understanding of various traders' trading behaviors and clearly links the disposition effect and contrarian/momentum behavior with order aggressiveness and order size, providing a new perspective on previous results in the literature. Our empirical results also provide investors with practical references to stock investment decisions.

## 2. LITERATURE REVIEW

The so-called disposition effect is a well-recognized trading behavioral phenomenon that has been studied in the related literature over the past few decades. Shefrin and Statman (1985) point out that traders are reluctant to sell losers

(equity positions that have a paper loss), but they are more willing to sell winners. Odean (1998) and Frazzini (2006) find that traders usually hold losers too long and sell winners too early. Grinblatt and Keloharju (2001) also present that Finnish investors do not like to realize the losses. Leal et al. (2010) note strong evidence for the disposition effect in the Portugal stock market, and the disposition effect is stronger in a bull market than in a bear market. Kadous et al. (2014) document that lower self-regard (and/or higher confidence) investors will hold losing investments longer than higher self-regard (and/or lower confidence). Heimer (2016) examines the relationships between the social interaction and disposition effect, indicating that individuals will have a more significant disposition effect if they contact the social interactions. Komai et al. (2018) reveal that individuals are disposition investors, and so they are willing to realize capital gains but reluctant to recognize losses.

As for the links between trader types and disposition effects, Grinblatt and Keloharju (2000) find that both momentum and contrarian phenomena occur in the Finland stock exchange. They present that foreign investors likely use momentum strategies, while domestic investors tend to be contrarian traders. Locke and Mann (2005) state that individual investors have some disposition effects because of their irrational behavior. Their evidence shows that individuals tend to hold losers and sell winners because individuals do not want to realize losses. Jin and Scherbina (2011) show that new mutual fund managers will sell off momentum losers they have inherited in their portfolio(s), while the previous manager does not want to admit prior mistakes. Moreover, selling loser stocks provides fund managers with a fiscal incentive for tax mitigation. Ben-David and Hirshleifer (2012) find that the probability of selling winner stocks is higher than that of selling losers. Kalunda and Mbaluka (2012) show that individual investors have disposition effects and tend to sell assets that have gained value and keep assets that have lost value. Junior et al. (2013) offer that investing experience influences the disposition effect, showing that investors who have more investing experience will have a lower disposition effect. Chang et al. (2016) confirm that individuals who have a stronger disposition effect toward nondelegated assets (e.g., personal stocks), because they do not want to recognize a mistake or a wrong decision.

Regarding the causes of disposition effects or contrarian behaviors, there have not been sufficient explanations so far in the literature, such as portfolio rebalancing or information stories, that are able to fully explain the disposition effects. Lo and MacKinlay (1990) illustrate that a contrarian investment will bring more profit than a momentum strategy. They explain that a profitable contrarian portfolio mainly comes from price overreaction. Linnainmaa (2010) shows that the disposition effect and contrarian behavior easily appear for individual investors in the Finland stock market and mainly due to the use of limit orders. An alternative view based on more comprehensive explanations comes from the prospect theory. For example, Hens and Vlcek (2011) point out the prospect-theory-based explanation of the disposition effect, whereas the traditional financial theory cannot completely explain the disposition effect. Li and Yang (2013) build a general equilibrium model to explore the implications of

the prospect theory for the disposition effect. They find that the prospect theory indeed helps to explain the disposition effects and the momentum behaviors.

The existing literature on contrarian/momentum behaviors is inconclusive. [Kaniel et al. \(2008\)](#) prove that individual investors are likely to buy stocks with losses in the previous month and sell stocks receiving a higher return in the previous month. [Haan and Kakes \(2011\)](#) observe contrarian investment in the Netherlands and find pension funds have a contrarian behavior when the market is turbulent. [Ramiah et al. \(2011\)](#) find that contrarian investments have better performance for dually traded stocks than just for domestic company stocks in the Hong Kong stock market. [Kubińska et al. \(2012\)](#) show that contrarian traders are easier to exhibit the disposition effect than momentum traders. [Andrei and Cujean \(2017\)](#) propose that if information flow is at an increasing rate and word-of-mouth communication is a mechanism, then there will be short-term momentum and long-term reversal. [Fischbacher et al. \(2017\)](#) further present that automatic selling devices (using stop-loss and take-gain options) can reduce or even eliminate investors' disposition effects. Recently, [Lin et al. \(2020\)](#) test the momentum effect of the corporate bond market by using a comprehensive dataset containing bonds with different characteristics and provisions. They find that the momentum effect is more pronounced for callable and lower-rated bonds. The bond momentum effect prevails over time and remains strong even after corporate bond markets become more transparent and liquid with establishment of trace.

To sum up, although most existing studies confirm disposition effects and contrarian/momentum behavior, the relationships between disposition effects, contrarian/momentum behavior, and order characteristics are so far unclear. Unlike other studies, this research takes account of order characteristics and further reexamines stock traders' disposition effects and contrarian/momentum behaviors.

### 3. DATA SOURCES

Our study obtains three history trading files from the TWSE Corporation, including order, transaction, and market quote data. TWSE adopts an electronic limit order system to execute all traders' orders on the basis of specified priority rules. During our sample period, all orders are processed and executed in this trading system in order of price and time priority. Buy orders with higher prices take precedence over those with lower prices; in contrast, sell orders with lower prices are prioritized to be executed over those with higher prices. In addition, for orders with the same prices, an earlier order must be executed in full before a later order at the same price. Buy and sell orders interact to set the executed price and share quantity by applicable automatching rules. TWSE provides us with a particularly appropriate opportunity to analyze stock traders' disposition effects and contrarian/momentum behavior across trader types (foreign investors, investment trusts, other institutions, and individuals).

We employ the combined order, transaction, and market quote information in TWSE from July 2009 to May 2015, for a total of 5 years and 11 months with 815 listed firms. Preferred stocks, call/put warrants, closed-end funds, and Taiwan Depository Receipts (TDRs) are excluded. Starting from July 2009, due to the enforcement regulations of Taiwan's personal data protection, TWSE began to not disclose intraday information of dealers.<sup>1</sup> Market participants in this dataset can be divided into four categories: foreign investors, investment trusts, other institutions, and individual investors. Our sample period starts from then. Since June 2015, TWSE's daily price limit policy went from originally 7% to currently 10%. To stave off any contamination from a major policy change, our sample period ends at May 2015. Moreover, to avoid excessive market noises on intraday trading, we construct daily buy and sell portfolios of various stocks and trader types, spanning a long enough observable time, to examine stock traders' disposition effects and contrarian/momentum behaviors in TWSE.

## 4. MODEL SET-UPS AND EMPIRICAL RESULTS

### 4.1 Descriptive Statistics

Table 1 reports the descriptive statistics. Panels A and B present the statistics for the full sample and subsamples by years, respectively. Panel A shows the total of

**Table 1.** Descriptive Statistics.

<i>Panel A: Full Sample</i>							
Variable	Number of Firm-day Observations	Number of Firms	Mean	Std. Dev.	Q1	Median	Q3
Market return (%)	924,707	–	0.03	0.94	–0.46	0.07	0.58
Market turnover (%)	924,707	815	0.42	0.15	0.31	0.38	0.51
Stock return (%)	924,707	815	0.03	1.98	–0.91	0.00	0.85
Turnover rate (%)	924,707	815	0.63	0.94	0.12	0.28	0.71
Book-to-market ratio	924,707	815	0.45	0.29	0.22	0.39	0.62
Market capitalization	924,707	815	28.08	71.66	3.27	6.97	16.89
<i>Panel B: Subsamples by Years</i>							
Variable	2009	2010	2011	2012	2013	2014	2015
Market return (%)	0.18	0.05	–0.10	0.03	0.04	0.03	0.04
Market turnover (%)	0.67	0.56	0.44	0.34	0.34	0.34	0.33
Stock return (%)	0.28	0.04	–0.11	0.05	0.08	0.02	–0.01
Turnover rate (%)	1.11	0.89	0.61	0.49	0.51	0.55	0.44
Book-to-market ratio	0.44	0.40	0.42	0.45	0.43	0.50	0.51
Market capitalization	27.95	28.40	28.79	27.77	29.87	26.49	27.45

815 firms over the sample period, for a total of 924,707 firm-day observations. Market return is computed by the logarithmic return of the Taiwan Stock Exchange Capitalization Weighted Stock Index (TAIEX) and is expressed as a percentage. Stock return is calculated as the logarithmic return, expressed as a percentage. The mean and standard deviation of daily market returns are 0.03% and 0.94%, while those of daily stock returns are 0.03% and 1.98%, respectively. Market turnover is measured by the average of the daily turnover rates of all common stocks listed on the TWSE and expressed as a percentage. Turnover rate for individual stocks is computed by the average number of shares traded divided by the number of shares outstanding on the trading day and expressed as a percentage. The mean daily market turnover rate is 0.42%. The book-to-market ratio is calculated as the average of the book value at the end of the previous year divided by the market capitalization on the trading day. The average book-to-market ratio is 0.45%. Market capitalization is computed as the average closing price multiplied by shares outstanding on the trading day (in NT\$ billion). The market capitalization is NT\$28.08 billion with a high standard deviation of NT\$71.66 billion, indicating that firm sizes disperse widely. Panel B of Table 1 lists the subsample statistics year by year. In 2009, the average market return and turnover are 0.18% and 0.67%, respectively, while the average stock return and turnover rate are 0.28% and 1.11%, respectively. Both stock returns and turnover rates are larger in 2009 than those in other years. This is because the previous year belonged to the financial crisis period of 2007–2008 and stock trading situation is sluggish. Stock returns and trading volume bounce back quickly immediately following the financial crisis period. The book-to-market ratio and market capitalization are stable and similar to those in the full sample.

Table 2 presents the descriptive statistics of buy and sell orders. Buy traders place orders to fill in the market at the highest bid prices; sell traders provide certain securities to the market at the lowest ask prices. Buy and sell sides stand in

**Table 2.** Descriptive Statistics of Buy and Sell Orders.

Variable	Number of Observations	Mean	Std. Dev.	Q1	Median	Q3
<i>Panel A: Buy Orders</i>						
Number of orders	925,008	513.80	753.57	67.00	205.00	605.00
Order aggressiveness (%)	925,008	1.10	0.88	0.59	1.01	1.47
Number of shares traded (lots)	925,008	2,664.74	4,600.28	242.00	819.00	2,714.00
Value of trades (NT\$ billion)	925,008	74.02	160.45	0.12	8.54	57.78
<i>Panel B: Sell Orders</i>						
Number of orders	916,861	543.42	773.85	74.00	225.00	655.00
Order aggressiveness (%)	916,861	0.73	0.70	0.27	0.65	1.07
Number of shares traded (lots)	916,861	2,653.44	4,577.75	246.00	822.00	2,705.00
Value of trades (NT\$ billion)	916,861	73.73	159.63	0.12	8.67	57.81

an opposite direction and have different forces affecting the settlement price. Thus, it is appropriate to separate buy and sell orders when discussing the disposition effect and contrarian/momentum behavior. We mix all types of investors and divide all orders into buy and sell orders in Panels A and B, respectively. Panel A (B) presents per stock per day's buy orders for total of 925,008 (916,861) observations. The average daily number of buy (sell) orders is 513.80 (543.42). The number of orders indicates the average number of buy or sell orders submitted by all investors for each stock per day. The mean of daily buy (sell) order aggressiveness is 1.10% (0.73%). Order aggressiveness denotes the average volume-weighted aggressiveness of all investors for each stock per day and expressed as a percentage. Specifically, we first calculate the order-level buy (sell) aggressiveness as the difference of the order price minus the prevailing midpoint of the best bid and ask quotes (and multiplied by minus one), divided by the midpoint quote expressed as a percentage. It means that the higher the value is, the more aggressive the order will be, regardless of order directions. We then compute the average volume-weighted aggressiveness for all investors for each order direction and each stock on a daily basis.

The average daily buy (sell) number of shares traded is 2,664.74 (2,653.44) lots (1 lot = 1,000 shares). The number of shares traded is measured by the average number of shares (in lots) executed by all investors for each stock per day. The mean of daily buy (sell) value of trades is NT\$74.02 (NT\$73.73) billion. The value of trades is computed as the average value of the sum of executed prices multiplied by shares executed by all investors for each stock per day (in NT\$ million).

Table 3 further shows the descriptive statistics of buy and sell orders across trader types. We first divide all orders into buy and sell orders and then separate them into different trader types: foreign investors, investment trusts, other institutions, and individuals. We calculate the number of orders, order aggressiveness, number of shares traded, and values of trades sorted by each category. Focusing on the number of orders, individuals account for the largest proportion of orders, followed by foreign investors. Investment trusts make up the lowest percentage of orders in TWSE. In terms of order aggressiveness, although investment trusts account for the smallest proportion of orders, they are the most aggressive traders, followed by foreign investors and then other institutions. Individuals are the most passive traders, even though they are the dominant participants in TWSE. In brief, each trader type has its own trading characteristics.

#### 4.2 Disposition Effects Across Trader Types

This section investigates disposition effects across different trader types by applying the logit model as follows:

$$\begin{aligned} \text{Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = & \beta_0 + \beta_{j1} \text{ModLoss}_{i(-k, -1)} + \beta_{j2} \text{ExtLoss}_{i(-k, -1)} \\ & + \beta_{j3} \text{Size}_{i,t-1} + \beta_{j4} \text{Risk}_{i,t-1} + \beta_{j5} \text{BM}_{i,t-1} \\ & + \beta_{j6} \text{Turn}_{i,t-1} + \text{FE}. \end{aligned} \quad (1)$$

**Table 3.** Descriptive Statistics of Trader Orders.

Variable	Buy Orders			Sell Orders		
	Number of Observations	Mean	Std. Dev.	Number of Obs.	Mean	Std. Dev.
<i>Panel A: Foreign Investors</i>						
Number of orders	741,425	111.63	257.00	726,041	107.61	253.89
Order aggressiveness (%)	741,425	1.30	1.78	726,041	1.34	1.85
Number of shares traded (lots)	741,425	542.91	1,718.09	726,041	527.54	1,703.84
Value of trades (NT\$ million)	741,425	17.09	63.24	726,041	16.59	62.74
<i>Panel B: Investment Trusts</i>						
Number of orders	161,016	33.93	67.85	183,584	31.95	63.76
Order aggressiveness (%)	161,016	2.79	3.12	183,584	2.96	3.17
Number of shares traded (lots)	161,016	318.06	758.76	183,584	296.66	695.74
Value of trades (NT\$ million)	161,016	13.85	30.75	183,584	13.08	30.01
<i>Panel C: Other Institutions</i>						
Number of orders	577,024	51.46	125.22	568,383	48.84	119.27
Order aggressiveness (%)	577,024	0.76	1.68	568,383	0.86	1.77
Number of shares traded (lots)	577,024	554.84	1,461.24	568,383	539.74	1,446.00
Value of trades (NT\$ million)	577,024	18.20	55.73	568,383	17.69	54.61
<i>Panel D: Individuals</i>						
Number of orders	923,561	410.31	589.53	916,447	392.02	577.69
Order aggressiveness (%)	923,561	0.71	0.87	916,447	1.06	0.74
Number of shares traded (lots)	923,561	1,880.07	3,160.87	916,447	1,940.34	3,222.12
Value of trades (NT\$ million)	923,561	50.10	106.57	916,447	51.90	109.23

The dependent variable is defined as the logarithm of the probability of being a short portfolio versus a long portfolio (i.e., log-odds).  $Sell_{ijt}$  is a dummy variable that equals one if trader type  $j$  sells stock  $i$  on day  $t$  and zero otherwise. In the following paragraphs, we refer to subscripts  $i$  and  $j$  as stock and trader type, respectively, and subscript  $t$  as trading day.  $Sell_{ijt}$  represents a dummy variable that equals one if trader type  $j$  sells the shares of stock  $i$  on day  $t$  and zero otherwise. A moderate loss,  $ModLoss_{i(-k, -1)}$ , is a dummy variable that equals one if the stock return drops by 10%–20% over the past  $k$ -day period from relative days  $-k$  to  $-1$  and zero otherwise;  $k = 21, 63, 126,$  and  $252$ , representing approximately one month, three months, six months, and one year, respectively. An extreme loss,  $ExtLoss_{i(-k, -1)}$ , is a dummy variable that equals one if the



stock return drops by more than 20% over the past  $k$ -day period and zero otherwise.

Firm characteristics are considered, including firm size, firm risk, book-to-market ratio, turnover rate, and tick-size dummies. Firm size,  $\text{Size}_{i,t-1}$ , is defined as the natural logarithm of the market capitalization of stock  $i$  on day  $t-1$ . Firm risk,  $\text{Risk}_{i,t-1}$ , is measured by the standard deviation of daily returns over the previous quarter. Higher risk correlates to divergence of investor opinions that would increase stock price variation (Chen et al., 2020). Book-to-market ratio,  $\text{BM}_{i,t-1}$ , is calculated as the ratio of the book value in the latest fiscal year to the previous-day market capitalization. Turnover rate,  $\text{Turn}_{i,t-1}$ , is the trading volume divided by the shares outstanding on the previous day expressed as a percentage. Fixed effects are represented by tick-size dummies, industry indicators, and yearly effects.<sup>2,3</sup> All fixed effects are denoted as FE.

If trader  $j$  is unwilling to submit sell orders when stock  $i$  suffers a capital loss, then  $\beta_{j1}$  and  $\beta_{j2}$  should be significantly negative; i.e., there exist disposition effects. Moreover, the absolute value of  $\beta_{j2}$  should be greater than the absolute value of  $\beta_{j1}$ . Trader type  $j$  denotes foreign investors, investment trusts, other institutions (general corporations doing industrial business), and individuals, respectively.

Table 4 reports disposition effects across trader types. Panels A–E present the empirical results for foreign investors, investment trusts, other institutions, individuals, and all investors, respectively. In Panel A the estimated coefficients on the extreme loss variables,  $\text{ExtLoss}_{i(-k,-1)}$ , are significantly negative for the past three- and six-month measurement periods, indicating that foreign investors are unwilling to sell losing stocks and continue to hold those stocks when they suffer from extreme losses. However, the estimated coefficients on the past one-month moderate and extreme losses are significantly positive, showing that foreign investors tend to sell the nearest one-month losing stocks. In brief, there is evidence of disposition effects for foreign investors toward stocks with past three- to six-month extreme losses.

Panels B and C of Table 4 present similar patterns as above. Most estimated coefficients on the moderate and extreme loss variables are significantly positive. Investment trusts and other institutions tend to sell past losers. They do not display disposition effects. Panel D of Table 4 exhibits a striking contrast with Panels B and C, in which most estimated coefficients on moderate and extreme losses are significantly negative. Individuals have strong disposition effects compared to other investors, regardless of the past return measurement intervals. Putting all investors together in Panel E, the estimated coefficients on the past six-month and one-year moderate losses and three- and six-month extreme losses are significantly negative. Overall, there exist disposition effects in TWSE, and the main results come from individuals, followed by foreign investors. Investment trusts and other institutions do not exhibit disposition effects.

Putting all investors together, we further estimate the following logit model to examine which trader's disposition effect is stronger.

**Table 4.** Disposition Effects Across Trader Types.

Independent Variable	Log Odds of Selling			
	$k = 1$ Month	$k = 3$ Months	$k = 6$ Months	$k = 1$ Year
<i>Panel A: Foreign Investors</i>				
Intercept	6.30***	6.29***	6.29***	6.31***
ModLoss $_{i(-k, -1)}$	0.03***	-0.01	-0.02***	-0.01
ExtLoss $_{i(-k, -1)}$	0.02***	-0.03***	-0.03***	0.03***
Size $_{i,t-1}$	0.02***	0.02***	0.02***	0.02***
Risk $_{i,t-1}$	-0.03***	-0.02***	-0.02***	-0.02***
BM $_{i,t-1}$	0.99***	1.00***	1.00***	0.99***
Turn $_{i,t-1}$	0.03***	0.02***	0.02***	0.03***
Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.36	0.36	0.36	0.36
Number of Observations	1,467,466	1,467,466	1,467,466	1,467,466
<i>Panel B: Investment Trusts</i>				
Intercept	5.98***	6.00***	6.01***	5.99***
ModLoss $_{i(-k, -1)}$	0.06***	0.12***	0.10***	0.06***
ExtLoss $_{i(-k, -1)}$	0.05***	0.10***	0.12***	0.04**
Size $_{i,t-1}$	-0.05***	-0.05***	-0.05***	-0.05***
Risk $_{i,t-1}$	-0.04***	-0.04***	-0.04***	-0.03***
BM $_{i,t-1}$	-0.40***	-0.42***	-0.43***	-0.42***
Turn $_{i,t-1}$	-0.12***	-0.11***	-0.11***	-0.12***
Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.14	0.14	0.14	0.14
Number of Obs.	344,600	344,600	344,600	344,600
<i>Panel C: Other Institutions</i>				
Intercept	5.95***	5.96***	5.96***	5.97***
ModLoss $_{i(-k, -1)}$	0.01	0.01*	0.00	0.01
ExtLoss $_{i(-k, -1)}$	0.02***	0.03***	0.05***	0.10***
Size $_{i,t-1}$	0.02***	0.02***	0.02***	0.02***
Risk $_{i,t-1}$	0.02***	0.02***	0.02***	0.02***
BM $_{i,t-1}$	0.53***	0.53***	0.53***	0.51***
Turn $_{i,t-1}$	0.01***	0.01***	0.01***	0.01***
Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.30	0.30	0.30	0.30
Number of Observations	1,145,407	1,145,407	1,145,407	1,145,407
<i>Panel D: Individuals</i>				
Intercept	9.68***	9.68***	9.68***	9.70***
ModLoss $_{i(-k, -1)}$	-0.02***	-0.03***	-0.04***	-0.03***
ExtLoss $_{i(-k, -1)}$	-0.05***	-0.05***	-0.05***	0.02***
Size $_{i,t-1}$	0.01***	0.01***	0.01***	0.01***
Risk $_{i,t-1}$	0.00	0.00	0.00	-0.01**

**Table 4.** (Continued)

Independent Variable	Log Odds of Selling			
	$k = 1$ Month	$k = 3$ Months	$k = 6$ Months	$k = 1$ Year
$BM_{i,t-1}$	1.13***	1.14***	1.14***	1.13***
$Turn_{i,t-1}$	0.00	0.00	0.00	0.00
Fixed Effects	Yes	Yes	Yes	Yes
$P$ -value for the $F$ -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.36	0.36	0.36	0.36
Number of Observations	1,840,008	1,840,008	1,840,008	1,840,008
<i>Panel E: All Investors</i>				
Intercept	6.75***	6.74***	6.74***	6.76***
$ModLoss_{i(-k,-1)}$	0.01**	0.00	-0.02***	-0.01***
$ExtLoss_{i(-k,-1)}$	0.00	-0.01***	-0.01**	0.04***
$Size_{i,t-1}$	0.01***	0.01***	0.01***	0.01***
$Risk_{i,t-1}$	0.00	0.00	0.00	-0.01***
$BM_{i,t-1}$	0.90***	0.90***	0.91***	0.89***
$Turn_{i,t-1}$	0.00	0.00	0.00	0.00
Fixed Effects	Yes	Yes	Yes	Yes
$P$ -value for the $F$ -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.33	0.33	0.33	0.33
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

$$\begin{aligned}
 \text{Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = & \beta_0 + \beta_{j1} \text{ModLoss}_{ij(-k,-1)} + \beta_{j2} \text{ExtLoss}_{i(-k,-1)} \\
 & + \beta_3 \text{Fore}_{it} + \beta_4 \text{Trust}_{it} + \beta_5 \text{OthInst}_{it} \\
 & + \text{ModLoss}_{i(-k,-1)} \\
 & \times (\beta_6 \text{Fore}_{it} + \beta_7 \text{Trust}_{it} + \beta_8 \text{OthInst}_{it}) \\
 & + \text{ExtLoss}_{i(-k,-1)} \\
 & \times (\beta_9 \text{Fore}_{it} + \beta_{10} \text{Trust}_{it} + \beta_{11} \text{OthInst}_{it}) \\
 & + \text{Controls} + \text{FE}, \tag{2}
 \end{aligned}$$

where  $\text{Fore}_{it}$ ,  $\text{Trust}_{it}$ , and  $\text{OthInst}_{it}$  equal one when the trader trading stock  $i$  on day  $t$  is in the foreign investor, investment trust, and other institutions groups, respectively, and zero otherwise. Individuals serve as the reference group. Control variables include firm size, firm risk, book-to-market ratio, turnover rate, and ticker dummies, denoted as Controls. If trader  $j$  is unwilling to sell losing stocks that suffer from capital (paper) losses, then the coefficients corresponding to a given interaction term of the loss dummy and trader dummy should be significantly negative.

Table 5 exhibits the empirical results of disposition effects for pooled investors. Most estimated coefficients on  $\text{ModLoss}_{ij(-k, -1)}$  and  $\text{ExtLoss}_{i(-k, -1)}$  are significantly negative. The results are consistent with our previous findings that individuals on average have disposition effects. As to the estimated coefficients on interaction terms, the estimated coefficients on  $\text{ExtLoss}_{i(-k, -1)} \times \text{Fore}_{it}$  are significantly negative from three months to one year. We find that foreign investors also have disposition effects, indicating that they are reluctant to sell losing stocks. Domestic institutions (investment trusts and other institutions) do not have disposition effects. In brief, individuals present stronger disposition effects compared with other investors in TWSE.

#### 4.3 Disposition Effects, Trader Types, and Order Characteristics

Our previous findings confirm that there indeed exist disposition effects, especially for individuals and foreign investors. This section further examines the relationships between disposition effects, trader types, and order characteristics. The logit model is specified as:

**Table 5.** Disposition Effects for Pooled Investors.

Independent Variable	Log Odds of Selling			
	$k = 1$ Month	$k = 3$ Months	$k = 6$ Months	$k = 1$ Year
Intercept	6.81***	6.81***	6.80***	6.81***
$\text{ModLoss}_{i(-k, -1)}$	-0.02***	-0.02***	-0.02***	0.00
$\text{ExtLoss}_{i(-k, -1)}$	-0.03***	-0.02***	-0.01	0.08***
$\text{Fore}_{it}$	-0.04***	-0.03***	-0.02***	-0.02***
$\text{Trust}_{it}$	0.16***	0.15***	0.15***	0.17***
$\text{OthInst}_{it}$	-0.03***	-0.03***	-0.02***	-0.02***
$\text{ModLoss}_{i(-k, -1)} \times \text{Fore}_{it}$	0.05***	0.01	0.00	-0.01*
$\text{ExtLoss}_{i(-k, -1)} \times \text{Fore}_{it}$	0.04***	-0.02**	-0.04***	-0.06***
$\text{ModLoss}_{i(-k, -1)} \times \text{Trust}_{it}$	0.05***	0.11***	0.07***	0.02*
$\text{ExtLoss}_{i(-k, -1)} \times \text{Trust}_{it}$	-0.03*	0.00	0.03**	-0.15***
$\text{ModLoss}_{i(-k, -1)} \times \text{OthInst}_{it}$	0.02***	0.02***	0.00	-0.01
$\text{ExtLoss}_{i(-k, -1)} \times \text{OthInst}_{it}$	0.06***	0.05***	0.04***	-0.03***
$\text{Size}_{i,t-1}$	0.01***	0.01***	0.01***	0.01***
$\text{Risk}_{i,t-1}$	0.00**	0.00*	0.00*	-0.01***
$\text{BM}_{i,t-1}$	0.91***	0.91***	0.91***	0.89***
$\text{Turn}_{i,t-1}$	0.00	0.00	0.00	0.00
Fixed Effects	Yes	Yes	Yes	Yes
$P$ -value for the $F$ -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.33	0.33	0.33	0.33
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

$$\begin{aligned}
\text{Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = & \beta_0 + \beta_{j1} \text{ModLoss}_{ij(-k, -1)} + \beta_{j2} \text{ExtLoss}_{i(-k, -1)} \\
& + \beta_3 \text{Fore}_{it} + \beta_4 \text{Trust}_{it} + \beta_5 \text{OthInst}_{it} + \beta_6 \text{OdrAgg}_{ijt} \\
& + \beta_7 \text{OdrSize}_{ijt} + \text{ModLoss}_{i(-k, -1)} \times \text{Fore}_{it} \\
& \times (\beta_8 \text{OdrAgg}_{ijt} + \beta_9 \text{OdrSize}_{ijt}) + \text{ModLoss}_{i(-k, -1)} \\
& \times \text{Trust}_{it} \times (\beta_{10} \text{OdrAgg}_{ijt} + \beta_{11} \text{OdrSize}_{ijt}) \\
& + \text{ModLoss}_{i(-k, -1)} \times \text{OthInst}_{it} \\
& \times (\beta_{12} \text{OdrAgg}_{ijt} + \beta_{13} \text{OdrSize}_{ijt}) + \text{ExtLoss}_{i(-k, -1)} \\
& \times \text{Fore}_{it} \times (\beta_{14} \text{OdrAgg}_{ijt} + \beta_{15} \text{OdrSize}_{ijt}) \\
& + \text{ExtLoss}_{i(-k, -1)} \times \text{Trust}_{it} \\
& \times (\beta_{16} \text{OdrAgg}_{ijt} + \beta_{17} \text{OdrSize}_{ijt}) + \text{ExtLoss}_{i(-k, -1)} \\
& \times \text{OthInst}_{it} \times (\beta_{18} \text{OdrAgg}_{ijt} + \beta_{19} \text{OdrSize}_{ijt}) \\
& + \text{Controls} + \text{FE}. \tag{3}
\end{aligned}$$

Note that order aggressiveness,  $\text{OdrAgg}_{ijt}$ , is measured by the volume-weighted price aggressiveness in relation to the midpoint of the best bid and ask quotes. Order size,  $\text{OdrSize}_{ijt}$ , is defined as the natural logarithm of the average number of shares (in lots) plus one. If individuals are unwilling to submit sell orders when stock  $i$  suffers from capital losses, then the coefficients on the given interaction terms of the loss and trader dummies should be significantly negative.

Table 6 presents the disposition effects and order characteristics across trader types. Panels A–E present the empirical results for foreign investors, investment trusts, other institutions, individuals, and pooled investors, respectively. Panel A of Table 6 shows that all estimated coefficients on the interaction terms of moderate/extreme loss and order aggressiveness are significantly negative. This evidence indicates that foreign investors are unlikely to sell losing stocks using aggressive orders. Similarly, most estimated coefficients on the interaction terms of moderate/extreme loss and order size are significantly negative except for the one-month measurement period. The results show that foreign investors are less likely to sell losing stocks by placing larger orders.

Panel B of Table 6 shows that most estimated coefficients on the interaction terms of moderate/extreme loss and order aggressiveness are significantly negative, indicating that investment trusts are also unlikely to sell losing stocks using aggressive orders. By contrast, most estimated coefficients on the interaction terms of moderate/extreme loss and order size are significantly positive. The evidence shows that investment trusts tend to sell losing stocks using larger orders.

Quite the contrary appears as Panel C of Table 6 shows. Other institutions are prone to sell losers by submitting aggressive orders, but are unwilling to use large orders. For individuals in Panel D, they are not willing to sell losing stocks using aggressive orders, but prefer to use large orders to sell losers. Putting all investors together in Panel E, all estimated coefficients on the interaction terms related to order aggressiveness are significantly negative. The results indicate that

**Table 6.** Disposition Effects and Order Characteristics Across Trader Types.

Independent Variable	Log Odds of Selling			
	$k = 1$ Month	$k = 3$ Months	$k = 6$ Months	$k = 1$ Year
<i>Panel A: Foreign Investors</i>				
Intercept	4.37***	4.34***	4.32***	4.45***
ModLoss $_{i(-k, -1)}$	0.01	0.06***	0.19***	0.46***
ExtLoss $_{i(-k, -1)}$	0.09***	0.26***	0.41***	1.02***
OdrAgg $_{ijt}$	0.02***	0.03***	0.03***	0.02***
OdrSize $_{ijt}$	-0.11***	-0.11***	-0.10***	-0.09***
ModLoss $_{i(-k, -1)} \times$ OdrAgg $_{ijt}$	-0.02***	-0.04***	-0.04***	-0.04***
ExtLoss $_{i(-k, -1)} \times$ OdrAgg $_{ijt}$	-0.03***	-0.07***	-0.07***	-0.07***
ModLoss $_{i(-k, -1)} \times$ OdrSize $_{ijt}$	0.01***	0.00	-0.02***	-0.06***
ExtLoss $_{i(-k, -1)} \times$ OdrSize $_{ijt}$	0.00	-0.03***	-0.05***	-0.15***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.36	0.36	0.36	0.37
Number of Observations	1,467,466	1,467,466	1,467,466	1,467,466
<i>Panel B: Investment Trusts</i>				
Intercept	6.27***	5.85***	5.80***	5.78***
ModLoss $_{i(-k, -1)}$	-1.09***	-0.42***	-0.19***	0.04
ExtLoss $_{i(-k, -1)}$	-2.09***	-1.17***	-0.50***	-0.28***
OdrAgg $_{ijt}$	0.01***	0.00	0.00	0.00
OdrSize $_{ijt}$	-0.08***	-0.05***	-0.04***	-0.03***
ModLoss $_{i(-k, -1)} \times$ OdrAgg $_{ijt}$	-0.05***	-0.03***	-0.02***	-0.01***
ExtLoss $_{i(-k, -1)} \times$ OdrAgg $_{ijt}$	-0.05***	-0.01*	-0.01*	0.00
ModLoss $_{i(-k, -1)} \times$ OdrSize $_{ijt}$	0.18***	0.09***	0.05***	0.01
ExtLoss $_{i(-k, -1)} \times$ OdrSize $_{ijt}$	0.30***	0.18***	0.09***	0.05***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.17	0.15	0.14	0.14
Number of Observations	344,600	344,600	344,600	344,600
<i>Panel C: Other Institutions</i>				
Intercept	5.00***	4.99***	4.99***	5.07***
ModLoss $_{i(-k, -1)}$	0.07***	0.14***	0.20***	0.36***
ExtLoss $_{i(-k, -1)}$	0.08***	0.24***	0.51***	0.96***
OdrAgg $_{ijt}$	0.02***	0.02***	0.02***	0.02***
OdrSize $_{ijt}$	-0.06***	-0.06***	-0.06***	-0.05***
ModLoss $_{i(-k, -1)} \times$ OdrAgg $_{ijt}$	0.04***	0.02***	0.02***	0.01**
ExtLoss $_{i(-k, -1)} \times$ OdrAgg $_{ijt}$	0.04***	0.01***	0.00	0.01***
ModLoss $_{i(-k, -1)} \times$ OdrSize $_{ijt}$	-0.01***	-0.02***	-0.03***	-0.05***
ExtLoss $_{i(-k, -1)} \times$ OdrSize $_{ijt}$	-0.01***	-0.03***	-0.07***	-0.14***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.30	0.30	0.30	0.31
Number of Observations	1,145,407	1,145,407	1,145,407	1,145,407

Table 6. (Continued)

Independent Variable	Log Odds of Selling			
	$k = 1$ Month	$k = 3$ Months	$k = 6$ Months	$k = 1$ Year
<i>Panel D: Individuals</i>				
Intercept	8.35***	8.38***	8.37***	8.37***
ModLoss $_{i(-k,-1)}$	0.11***	-0.04***	-0.06***	-0.06***
ExtLoss $_{i(-k,-1)}$	0.50***	-0.04***	-0.06***	-0.02**
OdrAgg $_{ijt}$	0.83***	0.83***	0.83***	0.83***
OdrSize $_{ijt}$	-0.17***	-0.18***	-0.18***	-0.18***
ModLoss $_{i(-k,-1)} \times$ OdrAgg $_{ijt}$	-0.23***	-0.23***	-0.23***	-0.23***
ExtLoss $_{i(-k,-1)} \times$ OdrAgg $_{ijt}$	-0.67***	-0.63***	-0.63***	-0.63***
ModLoss $_{i(-k,-1)} \times$ OdrSize $_{ijt}$	0.01***	0.02***	0.02***	0.02***
ExtLoss $_{i(-k,-1)} \times$ OdrSize $_{ijt}$	0.01***	0.06***	0.06***	0.06***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.40	0.40	0.40	0.40
Number of Observations	1,840,008	1,840,008	1,840,008	1,840,008
<i>Panel E: Pooled Investors</i>				
Intercept	5.92***	5.95***	5.94***	5.94***
ModLoss $_{i(-k,-1)}$	-0.04***	-0.03***	-0.01*	0.04***
ExtLoss $_{i(-k,-1)}$	-0.04***	0.00	0.05***	0.23***
Fore $_{it}$	-0.30***	-0.26***	-0.24***	-0.20***
Trust $_{it}$	-0.29***	-0.26***	-0.22***	-0.18***
OthInst $_{it}$	-0.24***	-0.22***	-0.20***	-0.17***
OdrAgg $_{ijt}$	0.07***	0.07***	0.06***	0.06***
OdrSize $_{ijt}$	-0.08***	-0.08***	-0.07***	-0.07***
ModLoss $_{i(-k,-1)} \times$ Fore $_{it} \times$ OdrAgg $_{ijt}$	-0.07***	-0.07***	-0.07***	-0.06***
ExtLoss $_{i(-k,-1)} \times$ Fore $_{it} \times$ OdrAgg $_{ijt}$	-0.08***	-0.10***	-0.09***	-0.06***
ModLoss $_{i(-k,-1)} \times$ Trust $_{it} \times$ OdrAgg $_{ijt}$	-0.18***	-0.12***	-0.11***	-0.09***
ExtLoss $_{i(-k,-1)} \times$ Trust $_{it} \times$ OdrAgg $_{ijt}$	-0.25***	-0.17***	-0.12***	-0.12***
ModLoss $_{i(-k,-1)} \times$ OthInst $_{it} \times$ OdrAgg $_{ijt}$	-0.02***	-0.03***	-0.02***	-0.03***
ExtLoss $_{i(-k,-1)} \times$ OthInst $_{it} \times$ OdrAgg $_{ijt}$	-0.02***	-0.03***	-0.03***	-0.02***
ModLoss $_{i(-k,-1)} \times$ Fore $_{it} \times$ OdrSize $_{ijt}$	0.02***	0.01***	0.01***	-0.01***
ExtLoss $_{i(-k,-1)} \times$ Fore $_{it} \times$ OdrSize $_{ijt}$	0.02***	0.01***	-0.01***	-0.05***
ModLoss $_{i(-k,-1)} \times$ Trust $_{it} \times$ OdrSize $_{ijt}$	0.09***	0.07***	0.05***	0.03***
ExtLoss $_{i(-k,-1)} \times$ Trust $_{it} \times$ OdrSize $_{ijt}$	0.10***	0.07***	0.05***	0.01***
ModLoss $_{i(-k,-1)} \times$ OthInst $_{it} \times$ OdrSize $_{ijt}$	0.01***	0.01***	0.00	-0.01***
ExtLoss $_{i(-k,-1)} \times$ OthInst $_{it} \times$ OdrSize $_{ijt}$	0.01***	0.00***	-0.01***	-0.04***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.33	0.33	0.33	0.33
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

institutional investors are reluctant to use aggressive orders to sell past losers, regardless of the lengths of the measurement periods. Conversely, most estimated coefficients on the interaction terms related to order size are significantly positive. The evidence shows that institutional investors are willing to place large orders to sell past losers.

#### 4.4 Contrarian/Momentum Behaviors of Different Trader Types

This section investigates contrarian and/or momentum behaviors across trader types for a short-term period. We specify the logit model and model the probability of selling stocks as follows:

$$\begin{aligned} \text{Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = & \beta_0 + \beta_{j1} R_{i0} + \beta_{j2} R_{i(-1)} + \beta_{j3} R_{i(-2)} \\ & + \beta_{j4} R_{i(-3)} + \beta_{j5} R_{i(-4)} + \beta_{j6} R_{i(-5)} \\ & + \text{Controls} + \text{FE}, \end{aligned} \quad (4)$$

Where  $R_{i0}$  indicates stock  $i$ 's return on day  $t$ ; variables  $R_{i(-1)}$  to  $R_{i(-5)}$  correspond to the prior return on days  $t-1$  to  $t-5$ , respectively. Stock return is calculated by the logarithmic return, also known as a continuously compounded return. Suppose that trader  $j$  conducts contrarian behavior on stock  $i$  based on the previous day's return; then  $\beta_{j2}$  should be significantly positive. By contrast, if trader  $j$  performs momentum behavior on stock  $i$  based on the previous day's returns, then  $\beta_{j2}$  should be significantly negative.

Table 7 presents the empirical results. Most estimated coefficients on  $R_{i0}$  are significantly negative except for other institutions. On the same day, most investors are unlikely to sell stocks with upward returns. Regarding previous returns for institutional investors, most estimated coefficients are significantly negative. The results indicate that foreign investors, investment trusts, and other institutions are unlikely to sell recent winners; i.e., momentum traders. Quite the contrary, individuals act as contrarians. They prefer to sell the nearest past winners. In sum, foreign investors, investment trusts, and other institutions tend to conduct momentum behaviors, while individuals are inclined to be contrarians.

To be more convincing, we extend the past observable returns to the medium-term interval for one quarter and half a year, respectively, and estimate the following logit models:

$$\begin{aligned} \text{Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = & \beta_0 + \beta_{j1} R_{i0} + \beta_{j2} R_{i(-5, -1)} + \beta_{j3} R_{i(-21, -6)} \\ & + \beta_{j4} R_{i(-42, -22)} + \beta_{j5} R_{i(-63, -43)} + \text{Controls} + \text{FE}, \end{aligned} \quad (5)$$



**Table 7.** Contrarian/Momentum Behaviors Across Trader Types for Short-Term Periods.

Independent Variable	Log Odds of Selling				
	All Investors	Foreign Investors	Investment Trusts	Other Institutions	Individuals
Intercept	6.75***	6.30***	6.09***	5.95***	9.69***
$R_{i0} \times 100$	-1.51***	-2.72***	-10.60***	1.24***	-0.19**
$R_{i(-1)} \times 100$	0.17***	2.08***	-4.16***	-0.52***	0.22***
$R_{i(-2)} \times 100$	0.04	0.02	-0.45***	-0.10	0.22**
$R_{i(-3)} \times 100$	-0.13***	-0.34***	-0.61***	-0.28***	0.21**
$R_{i(-4)} \times 100$	-0.19***	-0.45***	-0.96***	-0.22**	0.20**
$R_{i(-5)} \times 100$	-0.06	-0.38***	0.65***	-0.26***	0.19**
$Size_{i,t-1}$	0.01***	0.01***	-0.05***	0.02***	0.01***
$Risk_{i,t-1}$	0.00	-0.02***	-0.04***	0.02***	-0.01*
$BM_{i,t-1}$	0.90***	1.00***	-0.38***	0.53***	1.13***
$Turn_{i,t-1}$	0.00	0.02***	-0.10***	0.01***	0.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.33	0.36	0.16	0.30	0.36
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481	4,797,481

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

$$\text{Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = \beta_0 + \beta_{j1} R_{i0} + \beta_{j2} R_{i(-21, -1)} + \beta_{j3} R_{i(-42, -22)} \\ + \beta_{j4} R_{i(-63, -43)} + \beta_{j5} R_{i(-126, -64)} + \text{Controls} + \text{FE.} \quad (6)$$

Panel A reports contrarian/momentum behaviors across trader types for medium-term periods. Panels A and B incorporate past returns over the previous one quarter and half a year, respectively. For individuals, the estimated coefficients on past returns are significantly positive. Basically, individuals tend to adopt contrarian strategies, showing that they have a natural tendency to sell past winners. The evidence echoes our previous findings. For investment trusts, the estimated coefficients on past returns are significantly negative. The results present that investment trusts are inclined to exhibit momentum behaviors, indicating that they are unwilling to sell past winners. With respect to foreign investors, most estimated coefficients on past returns are significantly positive except for  $R_{(-21, -6)}$ . They seem to turn out to be contrarians when the past return measurement period is extended to one quarter. Panel B of Table 8 demonstrates similar patterns with Panel A. Individuals still show the strongest contrarian intensity either for short- or medium-term periods. By contrast, investment trusts present the most vigorous momentum behaviors in both short- and medium-term

**Table 8.** Contrarian/Momentum Behaviors Across Trader Types for Medium-Term Periods.

Independent Variable	Log Odds of Selling				
	All Investors	Foreign Investors	Investment Trusts	Other Institutions	Individuals
<i>Panel A:</i> $\text{Logit}\left(\frac{P(\text{Sell}_{it}=1)}{P(\text{Sell}_{it}=0)}\right) = \beta_0 + \beta_{j1}R_{i0} + \beta_{j2}R_{i(-5,-1)} + \beta_{j3}R_{i(-21,-6)} + \beta_{j4}R_{i(-42,-22)} + \beta_{j5}R_{i(-63,-43)} + \text{FE}$					
Intercept	6.75***	6.29***	6.18***	5.94***	9.67***
$R_{i0} \times 100$	-1.48***	-2.55***	-10.84***	1.22***	-0.17**
$R_{i(-5,-1)} \times 100$	-0.03	0.16***	-1.27***	-0.28***	0.29***
$R_{i(-21,-6)} \times 100$	0.01	-0.14***	-0.52***	0.06**	0.24***
$R_{i(-42,-22)} \times 100$	0.05***	0.10***	-0.38***	0.01	0.15***
$R_{i(-63,-43)} \times 100$	0.07***	0.19***	-0.40***	-0.01	0.14***
Controls and Fixed Effects	Yes	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.33	0.36	0.16	0.30	0.36
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481	4,797,481
<i>Panel B:</i> $\text{Logit}\left(\frac{P(\text{Sell}_{it}=1)}{P(\text{Sell}_{it}=0)}\right) = \beta_0 + \beta_{j1}R_{i0} + \beta_{j2}R_{i(-21,-1)} + \beta_{j3}R_{i(-42,-22)} + \beta_{j4}R_{i(-63,-43)} + \beta_{j5}R_{i(-126,-64)} + \text{FE}$					
Intercept	6.74***	6.28***	6.18***	5.94***	9.65***
$R_{i0} \times 100$	-1.48***	-2.56***	-10.83***	1.22***	-0.17**
$R_{i(-21,-1)} \times 100$	0.01	-0.07***	-0.70***	-0.01	0.26***
$R_{i(-42,-22)} \times 100$	0.06***	0.11***	-0.37***	0.01	0.17***
$R_{i(-63,-43)} \times 100$	0.08***	0.20***	-0.40***	0.00	0.16***
$R_{i(-126,-64)} \times 100$	0.09***	0.10***	-0.03	0.00	0.15***
Controls and Fixed Effects	Yes	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.33	0.36	0.16	0.30	0.36
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481	4,797,481

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

periods. Foreign investors continue to be contrarians when the past return measurement period is extended to half a year.

#### 4.5 Contrarian/Momentum, Trader Types, and Order Characteristics

We confirm that both contrarian and momentum behaviors do exist. Different traders have their own trading habits and preferences. This section further analyzes the links among contrarian/momentum behaviors, trader types, and order characteristics as follows:

$$\begin{aligned} \text{Logit}\left(\frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)}\right) &= \beta_0 + \beta_{j1}R_{i0} + \beta_{j2}R_{i(-21,-1)} + \beta_3\text{Fore}_{ijt} + \beta_4\text{Trust}_{ijt} \\ &\quad + \beta_5\text{OthInst}_{ijt} + \text{OdrAgg}_{ijt} \times R_{i(-21,-1)} \\ &\quad \times (\beta_6\text{Fore}_{it} + \beta_7\text{Trust}_{it} + \beta_8\text{OthInst}_{it}) + \text{OdrSize}_{ijt} \\ &\quad \times R_{i(-21,-1)} \times (\beta_9\text{Fore}_{it} + \beta_{10}\text{Trust}_{it} + \beta_{11}\text{OthInst}_{it}) \\ &\quad + \text{Controls} + \text{FE}. \end{aligned} \quad (7)$$

If contrarian (momentum) traders tend to use more aggressive or larger orders, then the coefficients corresponding to the interaction terms of past returns and trader dummies should be significantly positive (negative).

Table 9 shows the estimated results. The impacts of  $R_{i0}$  on the trader's selling probabilities are similar to those shown in Tables 7 and 8. We now focus on the interaction terms of order characteristics, previous monthly returns, and trader type dummies. In Panel A of Table 9, for professional institutions (foreign investors and investment trusts), we find that the estimated coefficients of the interaction terms corresponding to order aggressiveness (size) are significantly positive (negative). The results show that professional institutions are liable to selling past one-month winners using more aggressive or smaller orders than individuals. They actively realize profits via more aggressive (lower prices in relation to the prevailing quotes) or smaller orders to sell winners quickly. Nonprofessional institutions (other institutions) do the opposite; they are unwilling to sell past one-month winners by aggressive orders. It means that nonprofessional institutions realize profits mainly through placing more passive order prices, so that they sell past winners more patiently. We also define a dummy for individuals,  $\text{Ind}_{it}$ , that equals one when the trader is a retail investor and zero otherwise. For individuals, the estimated coefficients of the interaction terms are significantly positive, displaying that individuals are willing to sell the winners by either more aggressive or larger orders. Overall, professional institutions and individuals tend to sell past winners based on lower prices (in a more aggressive manner), while the former prefer to place smaller size orders, but individuals are apt to submit larger orders to sell past winners. Different traders have a different attitude toward selling past winners. Panel B of Table 9 exhibits an extended model and presents similar patterns with findings in Panel A.

**Table 9.** Contrarian/Momentum Behaviors, Trader Types, and Order Characteristics.

Independent Variable	All Investors	Foreign Investors	Investment Trusts	Other Institutions	Individuals
$\text{Panel A: Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = \beta_0 + \beta_{j1}R_{i0} + \beta_{j2}R_{i(-21,-1)} + \beta_3\text{Fore}_{it} + \beta_4\text{Trust}_{it}$ $+ \beta_5\text{OthInst}_{it} + \text{OdrAgg}_{ijt} \times R_{i(-21,-1)} \times (\beta_6\text{Fore}_{it}$ $+ \beta_7\text{Trust}_{it} + \beta_8\text{OthInst}_{it}) + \text{OdrSize}_{ijt} \times R_{i(-21,-1)}$ $\times (\beta_9\text{Fore}_{it} + \beta_{10}\text{Trust}_{it} + \beta_{11}\text{OthInst}_{it}) + \text{FE}$					
Intercept	6.83***	6.30***	6.18***	5.96***	9.68***
$R_{i0} \times 100$	-1.52***	-2.57***	-11.08***	1.18***	-0.25***
$R_{i(-21,-1)} \times 100$	0.03	-0.46***	7.11***	-0.51***	-1.85***
$\text{Fore}_{it}$	-0.03***				
$\text{Trust}_{it}$	0.20***				
$\text{OthInst}_{it}$	-0.02***				
$\text{OdrAgg}_{ijt} \times R_{i(-21,-1)} \times \text{Fore}_{it}$	0.28***	0.29***			
$\text{OdrSize}_{ijt} \times R_{i(-21,-1)} \times \text{Fore}_{it}$	-0.06***	-0.01			
$\text{OdrAgg}_{ijt} \times R_{i(-21,-1)} \times \text{Trust}_{it}$	1.07***		0.52***		
$\text{OdrSize}_{ijt} \times R_{i(-21,-1)} \times \text{Trust}_{it}$	-0.39***		-1.13***		
$\text{OdrAgg}_{ijt} \times R_{i(-21,-1)} \times \text{OthInst}_{it}$	-0.24***			-0.22***	
$\text{OdrSize}_{ijt} \times R_{i(-21,-1)} \times \text{OthInst}_{it}$	0.03***			0.09***	
$\text{OdrAgg}_{ijt} \times R_{i(-21,-1)} \times \text{Ind}_{it}$					0.95***
$\text{OdrSize}_{ijt} \times R_{i(-21,-1)} \times \text{Ind}_{it}$					0.11***
Controls and Fixed Effects	Yes	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo $R^2$	0.33	0.36	0.20	0.30	0.36
Number of Obs.	4,797,481	1,467,466	344,600	1,145,407	1,840,008
$\text{Panel B: Logit} \left( \frac{P(\text{Sell}_{ijt} = 1)}{P(\text{Sell}_{ijt} = 0)} \right) = \beta_0 + \beta_{j1}R_{i0} + \beta_{j2}R_{i(-63,-1)} + \beta_3\text{Fore}_{it} + \beta_4\text{Trust}_{it}$ $+ \beta_5\text{OthInst}_{it} + \text{OdrAgg}_{ijt} \times R_{i(-63,-1)} \times (\beta_6\text{Fore}_{it}$ $+ \beta_7\text{Trust}_{it} + \beta_8\text{OthInst}_{it}) + \text{OdrSize}_{ijt} \times R_{i(-63,-1)}$ $\times (\beta_9\text{Fore}_{it} + \beta_{10}\text{Trust}_{it} + \beta_{11}\text{OthInst}_{it}) + \text{FE}$					
Intercept	6.82***	6.29***	5.87***	5.99***	9.72***
$R_{i0} \times 100$	-1.50***	-2.54***	-10.95***	1.18***	-0.30***
$R_{i(-63,-1)} \times 100$	-0.04***	-0.52***	1.70***	-0.59***	-1.89***
$\text{Fore}_{it}$	-0.03***				
$\text{Trust}_{it}$	0.20***				
$\text{OthInst}_{it}$	-0.03***				

**Table 9.** (Continued)

Independent Variable	All	Foreign	Investment	Other	Individuals
	Investors	Investors	Trusts	Institutions	
$\text{OdrAgg}_{ijt} \times R_{(-63, -1)} \times \text{Fore}_{it}$	0.21***	0.23***			
$\text{OdrSize}_{ijt} \times R_{(-63, -1)} \times \text{Fore}_{it}$	-0.01***	0.04***			
$\text{OdrAgg}_{ijt} \times R_{(-63, -1)} \times \text{Trust}_{it}$	0.39***		0.21***		
$\text{OdrSize}_{ijt} \times R_{(-63, -1)} \times \text{Trust}_{it}$	-0.14***		-0.34***		
$\text{OdrAgg}_{ijt} \times R_{(-63, -1)} \times \text{OthInst}_{it}$	-0.06***			-0.04***	
$\text{OdrSize}_{ijt} \times R_{(-63, -1)} \times \text{OthInst}_{it}$	0.03***			0.08***	
$\text{OdrAgg}_{ijt} \times R_{(-63, -1)} \times \text{Ind}_{it}$					0.87***
$\text{OdrSize}_{ijt} \times R_{(-63, -1)} \times \text{Ind}_{it}$					0.11***
Controls and Fixed Effects	Yes	Yes	Yes	Yes	Yes
<i>P</i> -value for the <i>F</i> -stat.	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Pseudo <i>R</i> <sup>2</sup>	0.33	0.36	0.17	0.30	0.36
Number of Observations	4,797,481	1,467,466	344,600	1,145,407	1,840,008

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

#### 4.6 Trader Types, Order Characteristics, and Investment Performance

This section analyzes the relationships among trader types, order characteristics, and the short- and long-term investment performances as follows:

$$\begin{aligned}
 \text{Perform}_{ij(+0, +\tau)} = & \alpha + \beta_1 \text{Fore}_{it} + \beta_2 \text{Trust}_{it} + \beta_3 \text{OthInst}_{it} + \beta_4 \text{OdrAgg}_{ijt} \\
 & + \beta_5 \text{OdrSize}_{ijt} + \text{Fore}_{it} \times (\beta_6 \text{OdrAgg}_{ijt} + \beta_7 \text{OdrSize}_{ijt}) \\
 & + \text{Trust}_{it} \times (\beta_8 \text{OdrAgg}_{ijt} + \beta_9 \text{OdrSize}_{ijt}) + \text{OthInst}_{it} \\
 & \times (\beta_{10} \text{OdrAgg}_{ijt} + \beta_{11} \text{OdrSize}_{ijt}) + \beta_{12} \text{Sell}_{ijt} + \beta_{13} \text{Sell}_{ijt} \\
 & \times R_{i(-21, -1)} + \beta_{14} R_{m(+0, +\tau)} \\
 & + \text{Controls} + \text{FE} + \epsilon_{ij(+0, +\tau)}, \tag{8}
 \end{aligned}$$

where  $\text{Perform}_{ij(+0, +\tau)}$  represents trader type *j*'s investment performance over the holding period for days 0 to  $\tau$ . Following [Hung et al. \(2015\)](#), the investment performance for a specific portfolio is measured by the natural logarithm of the ratio of the portfolio's ending value to the current-day volume-weighted price expressed as a percentage. Here,  $\tau = 21$  (about one month), 63 (three months), 126 (six months), and 252 (one year), respectively.  $R_{m(+0, +\tau)}$  stands for the synchronous market return of the TAIEX. Control variables refer to the same firm-specific characteristics as above. We also control fixed effects.

[Table 10](#) shows the estimated results. Panels A–E present the empirical results for foreign investors, investment trusts, other institutions, individuals, and pooled investors, respectively. In Panel A, for foreign investors, most estimated coefficients on  $\text{OdrAgg}_{ijt}$  are significantly negative, while all estimated coefficients on  $\text{OdrSize}_{ijt}$  are significantly positive. On average, large-size orders by foreign investors have better performance, but more aggressive orders do not. All estimated coefficients on  $\text{Sell}_{ijt}$  are significantly positive, indicating that, on average, foreign investors' selling does not perform good since these stocks experience

**Table 10.** Order Characteristics and Investment Performance Across Trader Types.

Independent Variable	Performance			
	1 Month	3 Months	6 Months	1 Year
<i>Panel A: Foreign Investors</i>				
Intercept	-2.17***	1.32**	10.62***	25.51***
OdrAgg <sub>ijt</sub>	-0.01***	-0.05***	-0.01	-0.05***
OdrSize <sub>ijt</sub>	0.10***	0.18***	0.22***	0.30***
Sell <sub>ijt</sub>	0.13***	0.42***	0.68***	1.46***
Sell <sub>ijt</sub> × R <sub>i(-21,-1)</sub> × 100	-1.30***	-3.98***	5.30***	5.08***
R <sub>m(0,21)</sub>	0.95***			
R <sub>m(0,63)</sub>		0.84***		
R <sub>m(0,126)</sub>			0.97***	
R <sub>m(0,252)</sub>				0.92***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
P-value for the F-stat.	<0.0001	<0.0001	<0.0001	<0.0001
Adjusted R <sup>2</sup>	0.21	0.17	0.18	0.20
Number of Observations	1,467,466	1,467,466	1,467,466	1,467,466
<i>Panel B: Investment Trusts</i>				
Intercept	-1.89***	2.06***	18.55***	34.62***
OdrAgg <sub>ijt</sub>	-0.01	-0.02*	0.00	-0.15***
OdrSize <sub>ijt</sub>	0.03***	0.02	0.05**	-0.01
Sell <sub>ijt</sub>	-0.29***	-0.58***	-0.68***	-0.91***
Sell <sub>ijt</sub> × R <sub>i(-21,-1)</sub> × 100	-0.12	1.12***	6.72***	12.69***
R <sub>m(0,21)</sub>	1.05***			
R <sub>m(0,63)</sub>		1.04***		
R <sub>m(0,126)</sub>			1.12***	
R <sub>m(0,252)</sub>				1.10***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
P-value for the F-stat.	<0.0001	<0.0001	<0.0001	<0.0001
Adjusted R <sup>2</sup>	0.28	0.24	0.22	0.23
Number of Observations	344,600	344,600	344,600	344,600
<i>Panel C: Other Institutions</i>				
Intercept	-1.50***	2.07***	12.11***	26.62***
OdrAgg <sub>ijt</sub>	-0.03***	-0.04***	-0.04***	-0.07***
OdrSize <sub>ijt</sub>	0.13***	0.18***	0.23***	0.31***
Sell <sub>ijt</sub>	-0.07***	0.01	-0.03	0.18***
Sell <sub>ijt</sub> × R <sub>i(-21,-1)</sub> × 100	-1.16***	-2.78***	5.59***	8.48***
R <sub>m(0,21)</sub>	0.98***			
R <sub>m(0,63)</sub>		0.88***		
R <sub>m(0,126)</sub>			1.00***	
R <sub>m(0,252)</sub>				0.97***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
P-value for the F-stat.	<0.0001	<0.0001	<0.0001	<0.0001
Adjusted R <sup>2</sup>	0.23	0.18	0.19	0.20

Table 10. (Continued)

Independent Variable	Performance			
	1 Month	3 Months	6 Months	1 Year
Number of Observations	1,145,407	1,145,407	1,145,407	1,145,407
Panel D: Individuals				
Intercept	-6.09***	-8.80***	-7.73***	-7.46***
OdrAgg <sub>ijt</sub>	-0.22***	-0.38***	-0.59***	-0.73***
OdrSize <sub>ijt</sub>	-0.17***	-0.57***	-1.21***	-2.24***
Sell <sub>ijt</sub>	0.05***	0.28***	0.66***	1.40***
Sell <sub>ijt</sub> × R <sub>i(-21,-1)</sub> × 100	-1.23***	-3.78***	5.58***	6.18***
R <sub>m(0,21)</sub>	0.92***			
R <sub>m(0,63)</sub>		0.80***		
R <sub>m(0,126)</sub>			0.92***	
R <sub>m(0,252)</sub>				0.87***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
P-value for the F-stat.	<0.0001	<0.0001	<0.0001	<0.0001
Adjusted R <sup>2</sup>	0.21	0.17	0.18	0.20
Number of Observations	1,840,008	1,840,008	1,840,008	1,840,008
Panel E: Pooled Investors				
Intercept	-3.23***	-1.30***	6.96***	17.95***
Fore <sub>it</sub>	-0.07***	-0.16***	-0.84***	-1.21***
Trust <sub>it</sub>	0.24***	0.34***	-0.11	-0.09
OthInst <sub>it</sub>	-0.09***	-0.16***	-0.80***	-1.74***
OdrAgg <sub>ijt</sub>	-0.15***	-0.23***	-0.29***	-0.09***
OdrSize <sub>ijt</sub>	0.03***	-0.01***	-0.14***	-0.33***
Fore <sub>it</sub> × OdrAgg <sub>ijt</sub>	0.14***	0.18***	0.29***	0.25***
Fore <sub>it</sub> × OdrSize <sub>ijt</sub>	0.01***	0.01**	0.05***	0.06***
Trust <sub>it</sub> × OdrAgg <sub>ijt</sub>	0.16***	0.21***	0.24***	0.10***
Trust <sub>it</sub> × OdrSize <sub>ijt</sub>	0.01**	0.02*	0.06***	0.12***
OthInst <sub>it</sub> × OdrAgg <sub>ijt</sub>	0.11***	0.17***	0.24***	0.09***
OthInst <sub>it</sub> × OdrSize <sub>ijt</sub>	0.02***	0.02***	0.07***	0.15***
Sell <sub>ijt</sub>	0.01	0.18***	0.38***	0.94***
Sell <sub>ijt</sub> × R <sub>i(-21,-1)</sub> × 100	-1.23***	-3.44***	5.21***	6.30***
R <sub>m(0,21)</sub>	0.96***			
R <sub>m(0,63)</sub>		0.85***		
R <sub>m(0,126)</sub>			0.97***	
R <sub>m(0,252)</sub>				0.93***
Controls and Fixed Effects	Yes	Yes	Yes	Yes
P-value for the F-stat.	<0.0001	<0.0001	<0.0001	<0.0001
Adjusted R <sup>2</sup>	0.22	0.18	0.18	0.20
Number of Observations	4,797,481	4,797,481	4,797,481	4,797,481

Note: Significance levels of 10%, 5%, and 1% are denoted by \*, \*\*, and \*\*\*, respectively.

rising stock prices right after their selling. However, the estimated coefficients on the interaction terms of the sell dummy and past return are significantly negative. The results present that the one- to three-month holding period performances are better when foreign investors sell past one-month winners. This is because past winner stocks experience negative performance right after foreign investors sell them. The evidence shows that foreign investors make the right decisions to sell and thus can avoid losses.

Panel B of [Table 10](#) presents for investment trusts that all estimated coefficients on  $Sell_{ijt}$  are significantly negative, indicating that investment trusts perform better on the sell side since stocks experience decreasing prices right after their selling, regardless of the lengths of the holding periods. However, the performance of selling past one-month winners does not perform well. In Panel C, all estimated coefficients on  $OdrAgg_{ijt}$  are significantly negative, while those on  $OdrSize_{ijt}$  are significantly positive. On average, large-size orders by other institutions have better performance, but more aggressive orders do not. Moreover, other institutions selling past one-month winners are better than buy orders over the one- to three-month holding periods.

Regarding individuals' performance, all estimated coefficients on  $OdrAgg_{ijt}$  and  $OdrSize_{ijt}$  are significantly negative. More aggressive or larger orders by individuals experience worse performance right after their trading. Although individuals account for the largest proportion of orders, stock prices may be driven by institutional investors more significantly than individuals in accordance with [Kao et al. \(2022\)](#). All estimated coefficients on  $Sell_{ijt}$  are significantly positive. On average, selling by individuals does not perform well since stock prices rise immediately after their selling for at least one year. However, the performance of selling past one-month winners is good over the one- to three-month holding periods because the estimated coefficients on the interaction terms of the sell dummy and past return are significantly negative. It means that past winner stocks that experience foreign investors selling them have negative performance, indicating that foreign investors make the right decisions to sell in order to stave off possible losses. Putting all investors together in Panel E of [Table 10](#), we find that investment trusts on average have nice performance right after their trading over the one- to three-month periods. Overall, order aggressiveness and order size negatively correlate to investment performance. However, looking at interaction terms, all institutional investors' order aggressiveness and order size positively correlate to investment performance during at least one year immediately after trading.

## 5. CONCLUDING REMARKS

This research examines stock traders' disposition effects and contrarian/momentum behavior in TWSE. Our main empirical findings are as follows. Individuals present the strongest disposition effects compared with other investors. Institutional investors, especially foreign investors and investment trusts, are more reluctant to use aggressive orders to sell losers, although they on average



trade more aggressively than individuals do. Institutional investors are willing to use large orders to sell losers compared with individuals. Professional institutions and individuals tend to sell past winners based on a more aggressive manner, while the former prefer to place smaller size orders, but individuals are apt to submit larger orders to sell past winners.

Different traders have different attitudes toward selling past winners. Investment trusts on average garner better performance right after their trading over the one- to three-month periods. Institutional investors' order aggressiveness and order size positively correlate to investment performance during at least one year immediately after trading. Moreover, we find that investment trusts are inclined to conduct momentum strategies, while individuals tend to be contrarians. Specifically, investment trusts exhibit consistent momentum strategies, showing that they are unwilling to sell past winners. Foreign investors display some evidence of short-term momentum behavior, but their intensity declines along with the length of the past return measurement. They even reveal medium-term contrarian behavior instead.

Taken all together, it is worth mentioning that individuals with contrarian strategies are more likely to produce disposition effects than momentum traders. The investment performance corresponding to contrarian strategies and disposition effects is worse than that triggered by institutional investors with momentum strategies. In addition, retail investors may refer the investment styles proposed by investment trusts (e.g., stop-loss or take-gain options) in order to reduce disposition effects.

## ACKNOWLEDGMENTS

The authors would like to acknowledge the Ministry of Science and Technology, Taiwan, R.O.C., for financial support under grant MOST 110-2410-H-260 -008 -MY2. Any deficiencies, flaws, or errors remain ours alone.

## NOTES

1. The "Computer-Processed Personal Data Protection Law" was implemented in August 1995. As time went on, the design of the original legal system is no longer sufficient for practical requirements. In April 2010, the title of the law was changed to "Personal Information Protection Act." The new system has been officially implemented since October 1, 2012. TWSE changed the form of information disclosure and therefore has withheld dealers' intraday trading information since July 2009. Since then, traders only include foreign investors, investment trusts, other institutions, and individuals.

2. This chapter applies five tick-size dummies. The  $n^{\text{th}}$  tick-size dummy,  $\text{Ticker}_{n,i,t-1}$ , is a tick-size dummy variable equal to one if the previous closing price lies in  $n^{\text{th}}$  tick-size categories and zero otherwise;  $n = 1, 2, \dots, 5$ . For example,  $\text{Ticker}_{1,i,t-1} = 1$  if stock  $i$  is classified as the smallest tick size of NT\$0.01 ( $0.01 \leq \text{price} < 10$ ), otherwise  $\text{Ticker}_{1,i,t-1} = 0$ .  $\text{Ticker}_{2,i,t-1} = 1$  if stock  $i$  belongs to the tick-size group of NT\$0.05 ( $10 \leq \text{price} < 50$ ), otherwise  $\text{Ticker}_{2,i,t-1} = 0$ .  $\text{Ticker}_{5,i,t-1} = 1$  if stock  $i$  is grouped into the tick size of NT\$1.00 ( $500 \leq \text{price} < 1000$ ), otherwise  $\text{Ticker}_{5,i,t-1} = 0$ .

3. A given industry dummy equals one if stock  $i$  belongs to a specific industry. The main industries are controlled as follows: food, plastic, textile, electric machinery, electrical and cable, chemical, biotechnology and medical care, iron and steel, semiconductor, computer

and peripheral equipment, optoelectronics, communications and internet, electronic parts and components, electronic products distribution, other electronics, building material and construction, shipping and transportation, financial and insurance, trading and consumers' goods, and others. We also control fixed yearly effects.

## REFERENCES

- Andrei, D., & Cujean, J. (2017). Information percolation, momentum and reversal. *Journal of Financial Economics*, 123(3), 617–645.
- Andrikogiannopoulou, A., & Papakonstantinou, F. (2020). History-dependent risk preferences: Evidence from individual choices and implications for the disposition effect. *Review of Financial Studies*, 33(8), 3674–3718.
- Barberis, N., & Xiong, W. (2009). What drives the disposition effect? An analysis of a long-standing preference-based explanation. *The Journal of Finance*, 64(2), 751–784.
- Ben-David, I., & Hirshleifer, D. (2012). Are investors really reluctant to realize their losses? Trading responses to past returns and the disposition effect. *Review of Financial Studies*, 25(8), 2485–2532.
- Chang, T. Y., Solomon, D. H., & Westerfield, M. M. (2016). Looking for someone to blame: Delegation, cognitive dissonance, and the disposition effect. *The Journal of Finance*, 71(1), 267–302.
- Chen, L., Wang, J., Wu, C., & Zhu, H. (2020). Divergent opinion, trading information, and stock price co-movements. In *Advances in Pacific Basin business, economics and finance* (Vol. 8, pp. 1–21). Emerald Publishing Limited.
- Feng, L., & Seasholes, M. S. (2005). Do investor sophistication and trading experience eliminate behavioral biases in financial markets? *Review of Finance*, 9(3), 305–351.
- Fischbacher, U., Hoffmann, G., & Schudy, S. (2017). The causal effect of stop-loss and take-gain orders on the disposition effect. *Review of Financial Studies*, 30(6), 2110–2129.
- Frazzini, A. (2006). The disposition effect and under-reaction to news. *The Journal of Finance*, 61(4), 2017–2046.
- Grinblatt, M., & Keloharju, M. (2000). The investment behavior and performance of various investor types: A study of Finland's unique data set. *Journal of Financial Economics*, 55(1), 43–67.
- Grinblatt, M., & Keloharju, M. (2001). What makes investors trade? *The Journal of Finance*, 56(2), 589–616.
- Haan, L. de, & Kakes, J. (2011). Momentum or contrarian investment strategies: Evidence from Dutch institutional investors. *Journal of Banking & Finance*, 35(9), 2245–2251.
- Heimer, R. Z. (2016). Peer pressure: Social interaction and the disposition effect. *Review of Financial Studies*, 29(11), 3177–3209.
- Hens, T., & Vlcek, M. (2011). Does prospect theory explain the disposition effect? *The Journal of Behavioral Finance*, 12(3), 141–157.
- Hung, Pi-H., Chen, An-S., & Wu, Y.-L. (2015). Order aggressiveness, price impact, and investment performance in a pure order-driven stock market. *Asia-Pacific Journal of Financial Studies*, 44(4), 635–660.
- Jin, L., & Scherbina, A. (2011). Inheriting losers. *Review of Financial Studies*, 24(3), 786–820.
- Junior, N. C. Da, Goulart, M., Cupertino, C., Macedo, J., Jr., & Da Silva, S. (2013). The disposition effect and investor experience. *Journal of Banking & Finance*, 37(5), 1669–1675.
- Kadous, K., Tayler, W. B., Thayer, J. M., & Young, D. (2014). Individual characteristics and the disposition effect: The opposing effects of confidence and self-regard. *The Journal of Behavioral Finance*, 15(3), 235–250.
- Kalunda, E., & Mbaluka, P. (2012). Test of endowment and disposition effects under prospect theory on decision-making process of individual investors at the Nairobi Securities Exchange, Kenya. *Research Journal of Finance and Accounting*, 3(6), 157–172.
- Kaniel, R., Saar, G., & Titman, S. (2008). Individual investor trading and stock returns. *The Journal of Finance*, 63(1), 273–310.

- Kao, L., Chen, A., & Chen, C.-H. (2022). A direct test of attention theory through an examination of retail investor behavior: Evidence from Taiwanese I.P.O. subscriptions. In *Advances in Pacific Basin business, economics and finance* (Vol. 10, pp. 111–123). Emerald Publishing Limited.
- Komai, H., Koyano, R., & Miyakawa, D. (2018). Contrarian trades and disposition effect: Evidence from online trade data. In *Asian Finance Association (AsianFA) 2018 Conference*. SSRN. <https://ssrn.com/abstract=3109297>
- Kubińska, E., Markiewicz, Ł., & Tyszka, T. (2012). Disposition effect among contrarian and momentum investors. *The Journal of Behavioral Finance*, 13(3), 214–225.
- Leal, C. C., Rocha Armada, M. J., & Duque, J. L. C. (2010). Are all individual investors equally prone to the disposition effect all the time? New evidence from a small market. *Frontiers in Finance and Economics*, 7(2), 38–68.
- Linnainmaa, J. T. (2010). Do limit orders alter inferences about investor performance and behavior? *The Journal of Finance*, 65(4), 1473–1506.
- Lin, H., Tao, X. S., Wang, J., & Wu, C. (2020). Further evidence of momentum in corporate bond returns. In *Advances in Pacific Basin business, economics and finance* (Vol. 8, pp. 65–97). Emerald Publishing Limited.
- Li, Y., & Yang, L. (2013). Prospect theory, the disposition effect, and asset prices. *Journal of Financial Economics*, 107(3), 715–739.
- Locke, P. R., & Mann, S. C. (2005). Professional trader discipline and trade disposition. *Journal of Financial Economics*, 76(2), 401–444.
- Lo, A. W., & MacKinlay, A. C. (1990). When are contrarian profits due to stock market over-reaction. *Review of Financial Studies*, 3(2), 175–205.
- Odean, T. (1998). Are investors reluctant to realize their losses? *The Journal of Finance*, 53(5), 1775–1798.
- Odean, T. (1999). Do investors trade too much? *The American Economic Review*, 89(5), 1279–1298.
- Ramiah, V., Cheng, Ka Y., Orriols, J., Naughton, T., & Hallahan, T. (2011). Contrarian investment strategies work better for dually-traded stocks: Evidence from Hong Kong. *Pacific-Basin Finance Journal*, 19(1), 140–156.
- Shapira, Z., & Venezia, I. (2001). Patterns of behavior of professionally managed and independent investors. *Journal of Banking & Finance*, 25(8), 1573–1587.
- Shefrin, H., & Statman, M. (1985). The disposition to sell winners too early and ride losers too long: Theory and evidence. *The Journal of Finance*, 40(3), 777–790.