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Institutional Investors' Trading Response to Stock Market Anomalies: Evidence from Korea

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Abstract: This study examines whether institutions are sophisticated investors that exploit stock characteristics known to predict future returns in Korea, using data from 2000 to 2018. We analyze the institutional demand, measured as a change in institutional ownership, for stocks with eight well-known anomalies as well as the future abnormal returns of institutional trading. We find that, generally, institutions do not trade consistently with stock anomaly predictions because they are reluctant to hold both highly overvalued and highly undervalued stocks. Although they use a few anomalies, they use these characteristics passively to avoid stocks known to underperform rather than to pick stocks known to outperform. Furthermore, the positive returns on long-legs are concentrated on stocks sold by institutions, while the negative returns on short-legs are concentrated on stocks bought by them. Our finding casts doubt on the widely-accepted notion that institutions are skilled investors and that institutional arbitrage trading corrects any mispricing in the market. To the contrary, institutions' loss-averse trading behaviors cause or magnify mispricing.

Keywords: anomaly; institutional investor; institutional ownership; Korean stock market; loss aversion

1. Introduction

The trading behavior of institutional investors is a central concern in recent finance studies, not only because institutional trading has been increasing in international markets [1,2] but also because institutions are widely argued to be more informed and sophisticated and equipped with advanced techniques [3–7]. However, the empirical evidence regarding whether institutional investors are skilled is mixed. Initial studies focused on the mutual fund industry. While Kacperczyk et al. [8], Mamaysky et al. [9], and Kacperczyk and Seru [10] found evidence that some mutual fund managers are skilled enough to outperform, Jensen [11], Gruber [12], and Wermers [13] found no evidence that active funds outperform market average returns after taking fees into account, arguing that institutions are neither more informed nor more sophisticated. Recent studies on whether institutions use stock market anomalies found evidence that conflicts with commonly held notions. Lewellen [14] argued that institutional investors use anomalies to hold a market portfolio rather than gaining a return on investment. Edelen et al. [15] also insisted that institutional investors do not use anomalies but rather buy short-leg overvalued stocks and sell long-leg undervalued stocks, contrary to the anomaly hypothesis.

Our study examines whether institutional investors are skilled and exploit well-known stock anomalies. To this end, three research questions are addressed. First, do anomalies exist in the Korean stock market? Stocks with high book-to-market (BM), high momentum (MOM), low composite equity

issuance (CEI), low investment-to-asset (ITA), low total asset growth (AG), high gross profitability (GP), low idiosyncratic volatility (IVOL), and small size (SIZE) are known to have higher future returns than stocks with the opposite characteristics [16–19]. We investigate whether the eight most well-known anomaly strategies work in Korea. Second, do institutions invest in anomalies? We examine whether the institutional ownership of stocks with anomaly characteristics increases one to three months after the characteristic measurement period. If institutional investors are skilled enough to exploit the anomalies, their demand for stocks with these characteristics would change in accordance with the anomaly predictions. Third, do institutional investors earn abnormal returns from anomalies? We explore the after-formation returns of long-leg stocks (known to outperform) and short-leg stocks (known to underperform) conditional on the change in institutional ownership in order to estimate institutions' profits from anomaly portfolios. If institutions are sophisticated and informed investors, the positive (negative) abnormal returns of long- (short-) leg stocks would be concentrated on stocks heavily bought (sold) by institutions, and the negative abnormal returns of short leg stocks would be concentrated on stocks heavily sold by institutions.

Although our empirical test shows that the anomalies investigated provide economically and statistically significant abnormal returns, we find no evidence that institutional trading occurs in the same direction as the anomaly predictions. Instead, we find that institutions have preferences for and aversions to some characteristics—in general, they are reluctant to hold both highly overvalued and highly undervalued stocks. In some cases where anomalies are used, they passively use the characteristics to avoid stocks known to underperform rather than to pick stocks known to outperform. Furthermore, the positive returns on long-legs are concentrated on stocks sold by institutions, and the negative returns on short-legs are concentrated on stocks bought by them; we would observe the opposite results if institutions were sophisticated and skilled investors. Thus, our evidence conflicts with the finding that institutional investors play an important role in dissolving mispricing by conducting arbitrage trading based on their information and skills [8,20,21]. Rather, our evidence shows that institutional trading destabilizes stock prices rather than corrects mispricing, consistent with recent studies including Lewellen [14] and Edelen et al. [15]. We thus contribute to the literature by offering empirical evidence about the role of institutional investors in Korea through an out-of-sample study.

Our analysis differs from existing studies and contributes to the literature in several ways. First, the Korean stock market has an especially high share of retail trading—trading by retail investors accounts for more than 70% of the total volume in the Korean stock market. Hence, if retail investors are unskilled noise traders, it would be much easier for institutional investors to conduct arbitrage trading in such a liquid market. Therefore, Korean evidence offers an ideal way to test if institutions are skilled enough to exploit anomalies. Second, the Korean stock market provides daily information on trading volumes according to investor type, such as institutions, foreigners, and retail investors. One limitation of studies on the U.S. market is that institutional holdings data are available only at a quarterly frequency. Accordingly, studies of the U.S. market assume that all trading occurs at the end of each quarter. However, as Puckett and Yan [22] showed, this quarterly proxy cannot test for the relationship between institutional trading and anomalies in the short term, as they ignore institutions' potential short-term investment skills. While studies on the U.S. market focus on more than four quarters because of the limited available data, our study examines the anomalies within a year at a monthly frequency. Finally, while many studies [23,24] have examined the behavior and characteristics of institutional investors in the Korean stock market, our study differs from theirs in that we explore institutional trading in relation to stock return anomalies.

The rest of the paper proceeds as follows. Section 2 reviews the relevant literature. The study's data and methodology are detailed in Section 3. Section 4 presents the main results of our empirical analysis. Finally, Section 5 concludes the paper.

2. Literature Review

Previous studies on institutional investors have largely focused on whether herding occurs among them. The research has further analyzed the characteristics of stocks preferred by institutional investors and their investment strategies.

First, many studies have examined the stocks and investment strategies preferred by institutional investors in contexts similar to that of herding [1,2,4,6,20,24–31]. Grinblatt, Titman, and Wermers [25] showed that 77% of mutual funds are momentum traders who buy winners with past high returns and sell losers with past low returns. They provide evidence that mutual funds that implement a momentum strategy realize a better future performance. Nofsinger and Sias [26] suggested not only that institutional investors conduct more positive-feedback trade than private investors, but also that the herding of institutional investors has a stronger impact on stock prices than the herding of individual investors. Cai and Zheng [1] found that institutional investors buy stocks with positive returns over the past 12 months and sell stocks with negative returns. Hong and Lee [24] argued that institutional investors are driving the Korean stock market. They provided evidence that institutional investors perform better than individual investors and that institutional investors use a momentum strategy. Chuang and Susmel [27] suggested that institutional investors make more aggressive investments after gaining in bull markets and are less overconfident than individual investors. Gutierrez and Prinsky [28] showed that institutions play an important role in generating returns via momentum strategies. Griffin et al. [32] argued that institutional investors buy stocks that perform well and sell those that do not. Chen et al. [20] argued that stocks bought by institutional investors do not perform better than others but that stocks held by institutional investors perform better than stocks sold by institutional investors. Bennett, Sias, and Starks [33] found that the stocks that are attractive to institutional investors change over time—institutional investors initially prefer stocks with large market capitalization but come to prefer smaller, more risky stocks over time.

However, Haan and Kakes [29] analyzed institutional investors' investment strategies by classifying them into three categories: pension funds, life insurers, and non-life insurers. They insisted that institutional investors have used a contrarian investment strategy which buys losers and sells winners in the German market. Odean [30] also argued that institutional investors use a contrarian strategy. While testing the disposition effect, he found that brokerage houses that believe that current loser stocks will improve sell the winner. Cohen et al. [5] argued that institutional investors buy stocks when there is a positive cash-flow issue and vice versa, while institutional investors do not follow a momentum strategy; they sell stocks if the price goes up, even without a cash-flow issue.

Badrinath and Wahal [4] found that institutional investors use different strategies when buying and selling stocks: When buying stocks, they use a momentum strategy; when selling stocks, they use a contrarian strategy. The strategy used also depends on the type of institutional investor involved.

Second, most studies focused on "herding" among institutional investors. Herding occurs when a group of investors prefer the same stock with the same characteristics and follow each other over a certain period [34]. Some studies argued that herding occurs among institutional investors [26,34–37]. Scharfstein and Stein [35] analyzed the forces driving herding in investments, finding that, since managers value their reputation in the labor market, they tend to mimic other managers' investment decisions instead of using private information. Hirshleifer, Subrahmanyam, and Titman [36] insisted that herding occurs because investors obtain information at the same time; investors neglect stocks with different characteristics and focus on stocks with the same characteristics. Trueman [13] argued that herding occurs because analysts publish forecasts that resemble other analysts' previous announcements. Sias [34] found a positive correlation between institutional investors' demand in one quarter and the previous quarter. He also detected herding in which institutional investors prefer the same stocks. However, some studies argued that herding does not exist [13,38].

Third, a number of studies analyzed the role and investment strategy of institutional investors in the Korean market. Kim and Ko [39] argued that institutional investors prefer low turnover and large capitalization. Jun and Choe [40] found short-term herding behavior in which institutional investors

mimic the previous day and trade the next day in the same direction. Kim [41] argued that institutional investors tend to conduct feedback trading and realize positive returns. Yoo and Jang [42] insisted that returns are higher via trading by institutional investors than via trading by foreigners.

Finally, the research has analyzed the investment tendency of institutional investors in terms of anomalies. In their analysis of the day-of-the-week anomaly, Sias and Starks [43] argued that institutional investors contribute more to these anomalies than individual investors do. Edelen et al. [15] analyzed whether institutional investors use anomaly-based investment strategies. An analysis of seven well-known anomalies found that institutions tend to purchase overvalued stocks and sell undervalued stocks. Thus, the authors insisted that institutional investors do not earn significant excess returns.

3. Methodology

3.1. Raw Data

We analyzed common stocks listed on the Korea Composite Stock Price Index (KOSPI) and traded on the Korea Exchange (KRX) from 2000 to 2018. All the data needed to measure the anomaly characteristic variables, stock returns, and trading volume (or amount) for institutional investors were obtained from FnGuide. Institutional trading is defined as the trading volume or amount of institutions, including financial investment, insurance, investment trusts, privately placed funds, banks, other financial companies, and pension funds based on the KRX classification. The sample period started in 2000 due to the availability of the institutional trading information. Stocks in our sample were required to have a positive book-to-market ratio and a closing price higher than 1000 Korean won. The exclusion of penny stocks in our analysis is common in the literature (e.g., Edelen et al. [15]). The purpose of this requirement is to control for the effect of microcaps which are thinly traded and highly illiquid. By excluding penny stocks, we could guarantee that our findings were not driven by microcaps. Finally, monthly trading volumes were computed by aggregating daily trading volumes.

3.2. Variable Definitions

We used two proxies for change in institutional ownership in terms of the number of shares traded (or volume) and the amount of money traded. First, for stock i, $\Delta\#\text{INS}_{i,t}$ measures the change in institutional ownership during a given portfolio-formation period (t) in terms of the number of shares traded:

$$\Delta\#\text{INS}_{i,t} \equiv \frac{\#\text{Buy}_{i,t} - \#\text{Sell}_{i,t}}{\text{No.Shares}_{i,t}} \quad (1)$$

where No.Shares is the number of shares outstanding, and #Buy (#Sell) is the number of shares bought (sold) by institutional investors during a portfolio-formation period. Since the numerator of Δ#INS is the number of shares net-bought by institutions, it can measure the change in institutional ownership regardless of the initial ownership level. We normalized the measure by the total number of shares outstanding in order to compare across stocks.

Another proxy was constructed in a similar way, but it differed in that the amount of trading money was used:

$$\Delta\$\text{INS}_{i,t} \equiv \frac{\$\text{Buy}_{i,t} - \$\text{Sell}_{i,t}}{\text{Mkt.Cap}_{i,t}} \quad (2)$$

where Mkt.Cap is the market capitalization of a stock at the beginning of the portfolio-formation period, and $Buy and $Sell are the trading amounts of a stock bought and sold (respectively) by institutional investors during the portfolio-formation period. This proxy was normalized by the market capitalization for comparison. Unlike [44,45], which measured institutional ownership as the number of shares institutions are holding at a given point of time, Edelen et al. [15] measured this in terms of a change or flow variable during a given period. We also computed change variables for institutional ownership to examine the trading behavior of institutional investors.

Next, we explored eight anomalies to examine whether the stock market anomalies discussed in the literature work in the Korean stock market. The variables used to conduct anomaly-based investments were measured as follows.

Value effect (BM) indicates that higher returns could be obtained by investing in value stocks rather than in growth stocks. Studies have found that the strategy of buying stocks with high book-to-market value and selling stocks with low book-to-market values generates high returns [46–49]. A momentum effect was reported by Jegadeesh and Titman [50]. This strategy of buying stocks that performed well in the past and selling stocks that performed poorly in the past obtains significant positive returns [50–52]. A composite equity issuance effect was argued by Daniel and Titman [53]. In this anomaly, a strongly negative relation was observed between a firm's composite issuance and future returns. Firms that issue stocks underperform those that do not. The investment-to-assets phenomenon is a negative relationship between firms' capital investment and stock returns. Titman, Wei, and Xie [54] argued that firms that have increased their capital investment obtain negative risk-adjusted returns. In the asset growth effect, firms that increase their total assets earn lower subsequent returns. Cooper, Gulen, and Schill [55] argued that this phenomenon is attributable to investors' overreactions to changes in future business forecasts implied by asset growth. In the gross profitability premium, returns on high-profit stocks are higher than returns on low-profit stocks. Novy-Marx [18] showed that a statistically significant return can be obtained by buying stocks with higher GP and selling stocks with lower GP based on profitability calculated from the ratio of gross profit to total assets. Idiosyncratic volatility was reported by Ang et al. [56,57]; this anomaly suggests that returns on stocks with low idiosyncratic volatility are higher than on stocks with high idiosyncratic volatility. Finally, a size effect was reported by Banz [58], whereby smaller firms obtain higher returns than larger firms do [46].

Table 1 summarizes how we measured the variables and constructed the long-leg (predicted to outperform) and the short-leg (predicted to underperform) for each anomaly.

Table 1. Summary of anomaly characteristics.

Anomaly	Variable	Description	Long-leg (Undervalued, Outperform)	Short-leg (Overvalued, Underperform)
Value	BM	Book equity minus preferred capital at the end of fiscal year t-1, divided by market capitalization at the end of calendar year t-1	High (value)	Low (growth)
Momentum	MOM	Intermediate-term momentum, measured by cumulative return over past 6 to 12 months	High (winner)	Low (loser)
Composite Equity Issuance	CEI	The amount of equity that a firm issued over a year	Low	High
Investment-to-Assets	ITA	Changes in assets scaled by the lagged book value of assets	Low	High
Asset Growth	AG	Growth rate of total assets	Low	High
Gross Profitability Premium	GP	Gross profit divided by total Asset	High	Low
Idiosyncratic Volatility	IVOL	Standard deviation of daily residual returns with respect to the Fama-French 3 factor model over past 12 months	Low (defensive)	High (offensive)
Size	SIZE	Market capitalization as measured by closing prices multiply share of outstanding	Low (small)	High (big)

3.3. Investigation Windows

One difficulty with investigating trading behaviors is that it is not clear how long it takes for investors to complete their portfolio construction and how long they hold their portfolios. Thus, it was essential to make an assumption about their investment procedure. We defined three periods—the anomaly measurement period, portfolio formation period, and holding period—and assumed that institutions invest in anomaly portfolios throughout the three periods as follows.

First, institutional investors observe anomaly characteristics known to predict future returns during the anomaly-measurement period (L months). This period can range from one month to 12 months depending on the anomalies. For example, it takes 12 months to observe the accounting information-based variables at an annual frequency.

Once an anomaly ranking variable is measured, institutional investors start to buy stocks in the long-leg and sell stocks in the short-leg on the basis of the ranking of the variable. We assumed that it takes M months to finish constructing the portfolio. This period was defined as the "portfolio-formation period." We examined whether institutional investors tend to buy stocks in the long-leg, known to have higher future returns, and sell stocks in the short-leg, known to have lower future returns, according to the empirical evidence.

Finally, the investors hold their portfolios for N months, which was defined as the performance-measurement period. We evaluated the anomaly portfolio performance as well as institutional investors' performance during this period. Since we could not determine precisely how many months each period contains, we considered periods comprising a variety of months in our empirical tests. At the end of the holding period, portfolios are rebalanced according to the procedure above.

To summarize, we assumed that an investment in anomalies follows the following procedure: anomaly characteristics are measured during the anomaly-measurement period, anomaly portfolios are constructed during the portfolio-formation period, and the portfolios are held during the performance-measurement or portfolio-holding period.

4. Empirical Results

4.1. Do Anomalies Exist in the Korean Stock Market?

We started by examining if anomalies, known to predict future returns in the U.S. market, are also effective in the Korean stock market during the sample period of 2000 to 2018. We are not the first to study the Korean stock market anomalies. For example, Sehgal et al. [59] examined if anomalies, some of which overlap our analysis, are effective in six emerging markets, including South Korea. Nevertheless, our study differs in some aspects. First, our main focus was on the institutional behavior regarding anomalies, not on the anomaly return itself. This section plays a role as an intermediate step for our main analysis because it is necessary to check if anomaly strategies are profitable in our sample. Second, we used a more reliable database provide by FnGuide, a local data provider for the Korean stock market. Since Sehgal et al. [59] analyzed several emerging market, they used the Thomson Reuters database. As Ince and Porter [60] insisted, the Thomson Reuters database has a data quality issue and the data should be handled with particular care. As a result, they covered a part of the entire KOSPI stocks; we covered 980 companies, while only 500 stocks were included in the sample of Sehgal et al. [59]. Finally, we analyzed a relatively recent period, 2000–2018, while they analyzed the 1994–2010 period. Recently, it has been shown that anomaly investing strategies have suffered from much lower profits than ever reported in the literature. Therefore, the analysis including the sample after 2010 is more than replication.

The investing procedure proceeds through the anomaly-measurement, portfolio-formation, and portfolio-holding periods, as detailed in Section 3.3. According to the anomaly strategy prescription, we constructed quintile long-short portfolios that buy stocks with a characteristic predicting higher future returns and sell stocks with a characteristic predicting lower future returns. For example, for BM, stocks are sorted into five groups, and the long-leg buys stocks in the highest quintile and the short-leg sells stocks in the lowest quintile stocks, since high book-to-market stocks are known to outperform low book-to-market stocks. Next, skipping the one- or three-month formation period ($M = 1, 3$) during which the portfolios are constructed, we measured monthly average returns on long-short portfolios for a holding period of one, three, six, nine, and twelve months (i.e., $N = 1, 3, 6, 9, 12$).

Table 2 shows the results. Each column presents the monthly average returns (%) on various anomalies and the associated Newey–West *t*-statistics in parentheses for each holding period. Panels A and B show the results for the one- and three-month formation periods, respectively. The results in Table 2 show that most of the anomalies that we investigated are effective in the Korean stock market. Specifically, the monthly average returns range from 0.44% to 1.45% for M = 1 and N = 1 (relatively short-term investments), suggesting that investments in anomalies produce economically large and statistically significant profits in Korea. While anomaly returns generally become less significant in the statistical sense for longer holding periods, the returns on the BM and AG portfolios are very persistent for as long as 12 months; the high book-to-market stocks and low asset growth stocks earn higher future returns for up to one year. Although we find that most of the anomalies are highly significant, the two exceptions are the MOM and CEI portfolios. CEI has positive but insignificant returns and is only marginally significant (5% or 10%) for the three-month formation with long-term investment over six months. Given that the formation period is three months, the abnormal return to portfolios held for more than six months suggests that it takes at least nine months for stocks with a small amount of composite equity issuance to earn returns that are marginally higher than those for stocks with a large amount of composite equity issuance. MOM is highly significant for only relatively short-term investments.

Table 2. Anomaly returns: monthly average returns of long-short portfolios.

	Holding Periods (Months) *N*				
***N*=□**	**1**	**3**	**6**	**9**	**12**
Panel A: one month formation period (M = 1)					
BM	1.45 ***	1.47 ***	1.48 ***	1.30 ***	1.07 ***
□	(4.86)	(5.02)	(4.78)	(4.64)	(3.43)
MOM	0.81 ***	0.58 **	0.20	0.07	0.13
□	(3.41)	(2.54)	(0.85)	(0.28)	(0.57)
CEI	0.17	0.05	0.20	0.12	0.18
□	(1.22)	(0.40)	(1.52)	(1.02)	(1.57)
ITA	0.44 ***	0.43 ***	0.45 ***	0.33 **	0.13
□	(2.92)	(2.94)	(2.91)	(2.16)	(1.14)
AG	0.60 ***	0.55 ***	0.59 ***	0.41 **	0.31 ***
□	(3.83)	(3.26)	(3.34)	(2.50)	(2.60)
GP	0.59 **	0.57 **	0.61 **	0.61 **	0.64 **
□	(2.50)	(2.37)	(2.38)	(2.48)	(2.58)
IVOL	0.58 **	0.53 **	0.48 *	0.54 **	0.51 *
□	(2.56)	(2.03)	(1.79)	(1.99)	(1.77)
SIZE	1.29 ***	1.20 ***	1.17 ***	0.97 ***	0.90 **
□	(3.29)	(3.13)	(2.86)	(2.70)	(2.48)
Panel B: three month formation period (M = 3)					
BM	1.45 ***	1.42 ***	1.20 ***	1.24 ***	1.14 ***
□	(5.00)	(4.79)	(4.28)	(4.36)	(3.85)
MOM	0.31	−0.02	−0.44*	0.01	−0.01
□	(1.19)	(−0.06)	(−1.77)	(0.04)	(−0.04)
CEI	0.14	0.07	0.30 **	0.27 **	0.23 *
□	(1.22)	(0.63)	(2.43)	(2.12)	(1.87)
ITA	0.43 ***	0.33 *	0.08	0.10	0.12
□	(2.66)	(1.94)	(0.65)	(0.84)	(0.98)
AG	0.57 ***	0.43 **	0.34 ***	0.25 *	0.31 ***
□	(3.51)	(2.42)	(2.71)	(1.90)	(2.65)
GP	0.65 ***	0.61 **	0.57 **	0.70 ***	0.61 **
□	(2.67)	(2.49)	(2.40)	(2.76)	(2.50)
IVOL	0.51 *	0.49 *	0.51 *	0.67 **	0.49
□	(1.96)	(1.82)	(1.81)	(2.53)	(1.62)
SIZE	1.03 ***	1.14 ***	1.13 ***	0.88 **	0.93 ***
□	(2.62)	(2.73)	(2.69)	(2.49)	(2.67)

Note: The sample period covers 2000 to 2018. Average returns are in percent. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

Table 3 repeats Table 2 but computes risk-adjusted returns relative to the Fama–French three factor model using the following regression:

$$R_{i,t} = \alpha_i + b_i MKT + s_i SMB + h_i HML + \varepsilon_{i,t} \quad (3)$$

where $R_{i,t}$ is the return on anomaly i in month t, and MKT, SMB, and HML are the three factors suggested by Fama and French [47]. The intercept α_i (risk-adjusted returns) is reported with the 12 lag Newey–West t-statistics. Consistent with Table 2, most of the anomaly returns are significant, both economically and statistically, even after risk factors are controlled for. One exception is that the significance of the MOM portfolio returns disappears after risk-factor adjustment. This implies that the positive abnormal returns to MOM are attributable to the risks embedded in the portfolio.

Table 3. Risk-adjusted returns of long-short anomaly portfolios.

	Holding Periods (Months) *N*				
***N*=□**	**1**	**3**	**6**	**9**	**12**
Panel A: one month formation period (M = 1)					
BM	0.57 ***	0.62 ***	0.54 ***	0.49 ***	0.33
□	(3.41)	(3.70)	(3.23)	(2.73)	(1.55)
MOM	0.81 ***	0.68 ***	0.28	0.23	0.22
□	(3.78)	(3.01)	(1.16)	(1.01)	(1.03)
CEI	0.17	0.12	0.18	0.15	0.25 *
□	(1.16)	(0.85)	(1.07)	(1.32)	(1.84)
ITA	0.35 **	0.33 **	0.35 **	0.24 *	0.09
□	(2.53)	(2.41)	(2.42)	(1.66)	(0.81)
AG	0.44 ***	0.39 ***	0.43 ***	0.27 *	0.22 *
□	(3.06)	(2.69)	(2.75)	(1.80)	(1.72)
GP	0.79 ***	0.77 ***	0.85 ***	0.84 ***	0.90 ***
□	(3.46)	(3.30)	(3.56)	(3.55)	(3.67)
IVOL	0.58 ***	0.52 **	0.45 **	0.43 **	0.43 *
□	(3.01)	(2.47)	(2.02)	(2.12)	(1.83)
SIZE	0.93 ***	0.85 ***	0.72 ***	0.64 ***	0.61 ***
□	(4.04)	(3.90)	(3.83)	(3.51)	(3.79)
Panel B: three month formation period (M = 3)					
BM	0.63 ***	0.54 ***	0.36 **	0.50 ***	0.38 *
□	(3.38)	(3.03)	(2.00)	(2.77)	(1.94)
MOM	0.43	0.16	−0.19	0.19	0.13
□	(1.56)	(0.61)	(−0.80)	(0.84)	(0.53)
CEI	0.17	0.14	0.32 ***	0.16	0.25 **
□	(1.34)	(1.31)	(2.68)	(1.17)	(2.08)
ITA	0.35 **	0.21	0.04	0.06	0.07
□	(2.26)	(1.43)	(0.33)	(0.45)	(0.68)
AG	0.41 ***	0.24	0.20	0.11	0.20
□	(3.02)	(1.59)	(1.56)	(0.94)	(1.60)
GP	0.85 ***	0.83 ***	0.79 ***	0.94 ***	0.85 ***
□	(3.68)	(3.59)	(3.39)	(4.01)	(3.51)
IVOL	0.52 ***	0.42 **	0.44 *	0.54 ***	0.35
□	(2.61)	(2.16)	(1.94)	(2.70)	(1.53)
SIZE	0.64 ***	0.65 ***	0.66 ***	0.61 ***	0.62 ***
□	(3.33)	(3.51)	(3.38)	(3.90)	(3.51)

Note: The sample period covers 2000 to 2018. Risk-adjusted average returns are measured in percent. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

To sum up, six out of the eight anomalies are very significant, even for long-term holding periods and after risk-adjustment. The two exceptions are the CEI anomaly, which produces marginally significant, positive, raw, and risk-adjusted returns only for long-term investments; and the MOM

anomaly, which has highly significant raw returns but loses significance after risks are considered. These findings suggest that anomaly portfolios can be used to generate economically and statistically meaningful profits. If institutional investors are skilled, as is commonly argued, they could use these well-known characteristics in their portfolio choices and beat the market average. We will test if this happens in the following section.

4.2. Do institutions Exploit Anomalies?

This section tests whether institutional investors, as a whole, consider the well-known characteristics of stocks predicting higher returns when they manage their portfolios. If they tend to buy stocks in the long-leg and sell stocks in the short-leg, then we will observe a higher net increment of institutional ownership in the long-leg relative to that in the short-leg during the formation period.

As in the anomaly test, we assumed that institutional investors construct portfolios for one or three months ($M = 1,\ 3$) on the basis of detected stock characteristics. We thus sorted stocks into quintile portfolios according to anomaly variables and computed the average change in institutional ownership, Δ#INS in terms of shares and Δ$INS in terms of trading dollar amount, for the long- and short-legs.

Table 4 reports the results. The first three columns show the results when we measure the change in institutional ownership as the number of shares net-bought by institutions, or Δ#INS. Similarly, the second three columns use the dollar amount net-bought by institutions, or Δ$INS, to measure the change in institutional ownership. These two proxies are scaled by the number of shares outstanding and market capitalization, respectively, and are then multiplied by 10,000. Thus, two proxies are free of the unit measurement and are expressed as relative changes in basis points. Columns *Long* and *Short* present the average of the change in institutional ownership in excess of a normal change, defined as the change in the middle portfolio stocks (i.e., 3rd quintile). We use the excess changes in order to see how the anomaly characteristics affect institutions' trading behavior in excess of their normal trading. Also, we focus only on the long and short legs because we are interested in institutional demand for stocks that produce anomaly profits. Readers who are interested in the plain values for all quintiles may refer to Tables A1 and A2 in the Appendix A. Column *L-S* shows the difference between Long and Short, which measures the excess increase in institutional ownership of long-leg stocks relative to short-leg stocks. Therefore, if institutions exploit an anomaly, we expect to see (statistically significant) positive values for that anomaly in *L-S*.

Several interesting points emerge from Table 4. First, we observe positive changes in institutional ownership only for four anomalies, of which three are statistically significant. Specifically, BM, MOM, GP, and IVOL anomalies have positive Δ#INS and Δ$INS for *L-S*, although BM is statistically insignificant for all cases (Δ$INS is negative for the one-month formation case). This finding suggests that institutional investors tend to buy more stocks with high past returns, high gross profitability, and low idiosyncratic volatility than those with the opposite characteristics. For one month after the characteristic observation, for example, institutional investors tend to increase winner stocks by 12.36 bps (relative to the number of shares outstanding, with a *t*-stat of 4.01) and 13.73 bps (relative to the market capitalization, with a *t*-stat of 4.61) relative to loser stocks in their portfolio. Similarly, they tend to increase high gross profit stocks by 4.84 bps (relative to the number of shares outstanding, with a t-stat of 2.27) and 6.35 bps (relative to the market capitalization, with a t-stat of 3.22) relative to the low gross profit stocks in their portfolio. Finally, defensive stocks (low IVOL) are likely to be increased by 8.78 bps (relative to the number of shares outstanding, with a *t*-stat of 2.41) and 7.45 bps (relative to the market capitalization, with a *t*-stat of 2.02) relative to the offensive stocks in their portfolio. This evidence suggests that institutions tend to follow the prescription of anomalies from MOM, GP, and IVOL.

Table 4. Excess changes in institutional ownership of anomaly portfolios (quintile).

	Δ#INS (bps)			Δ$INS(bps)		
	Long	**Short**	**L-S**	**Long**	**Short**	**L-S**
Panel A: one month formation period (M = 1)						
BM	−2.58	−4.18 **	1.60	0.51	0.69	−0.18
	(−1.19)	(−2.02)	(0.58)	(0.14)	(0.18)	(−0.07)
MOM	−0.92	−5.81 ***	4.88 **	0.68	−4.76**	5.44 ***
	(−0.49)	(−3.01)	(2.38)	(0.34)	(−2.58)	(2.89)
CEI	−5.04 *	−2.23	−2.81 *	−2.92	0.58	−3.50 **
	(−1.84)	(−0.93)	(−1.76)	(−1.04)	(0.23)	(−2.11)
ITA	−5.01 **	−4.42 **	−0.59	−5.89 ***	−3.99 ***	−1.90
	(−2.51)	(−2.21)	(−0.31)	(−3.49)	(−2.60)	(−1.06)
AG	−3.34 **	−2.19	−1.15	−6.81 *	−0.32	−6.50 *
	(−2.34)	(−1.37)	(−0.74)	(−1.80)	(−0.23)	(−1.73)
GP	1.88	−2.97	4.84 **	2.16	−4.19 **	6.35 ***
	(1.20)	(−1.59)	(2.27)	(1.45)	(−2.36)	(3.22)
IVOL	0.10	−8.21 **	8.31 **	−1.68	−8.71 ***	7.04 **
	(0.07)	(−2.43)	(2.36)	(−1.25)	(−2.67)	(1.98)
SIZE	−7.64 ***	−2.32	−5.32	−7.06 **	2.51	−9.57 ***
	(−3.71)	(−0.74)	(−1.64)	(−2.27)	(0.58)	(−2.90)
Panel B: three month formation period (M = 3)						
BM	−1.65	−3.93 *	2.28	0.14	−0.50	0.65
	(−0.82)	(−1.88)	(0.85)	(0.05)	(−0.16)	(0.23)
MOM	−0.74	−4.44 ***	3.71 **	−0.26	−3.32 **	3.06
	(−0.38)	(−2.78)	(2.03)	(−0.11)	(−2.11)	(1.56)
CEI	−5.03 **	−3.38	−1.65 *	−2.57	−0.76	−1.81 *
	(−2.05)	(−1.63)	(−1.75)	(−1.00)	(−0.36)	(−1.69)
ITA	−3.63 *	−2.75	−0.88	−5.07 ***	−2.86 **	−2.21
	(−1.84)	(−1.53)	(−0.47)	(−2.94)	(−2.00)	(−1.19)
AG	−2.14	−1.07	−1.06	−5.98	0.53	−6.51
	(−1.50)	(−0.84)	(−0.76)	(−1.49)	(0.46)	(−1.64)
GP	1.81	−2.89	4.71 **	1.95	−4.22 **	6.17 ***
	(1.13)	(−1.55)	(2.15)	(1.25)	(−2.33)	(3.00)
IVOL	0.43	−7.72 **	8.15 **	−1.22	−8.11 ***	6.88 **
	(0.37)	(−2.46)	(2.47)	(−1.13)	(−2.69)	(2.08)
SIZE	−7.40 ***	−3.42	−3.97	−6.29 *	1.74	−8.03 **
	(−3.61)	(−1.13)	(−1.24)	(−1.90)	(0.39)	(−2.44)

Note: Δ#INS and Δ$INS are scaled by the number of shares outstanding and market capitalization, respectively. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

Second, the *Long* and *Short* columns show that institutions use the prescriptions of MOM, GP, and IVOL in order to avoid the underperformance of short-leg stocks rather than to benefit from the outperformance of long-leg stocks. For example, the Δ#INS of IVOL in Panel A shows that institutions reduce their offensive (high IVOL) stocks holding, according to the IVOL anomaly prescription, by 8.76 bps during the one-month formation period, while they increase their defensive (low IVOL) stocks by only 0.03 bps during the same period. Similarly, for the GP anomaly, institutions reduce their holdings of low gross-profitable stocks (short-leg) by 2.97 bps during the one-month formation period, while they purchase high gross-profitable stocks (long-leg) by only 1.88 bps during the same period. Such a significant reduction in the institutional holdings of short-legs implies that, even when institutional trading is in accordance with anomaly predictions, their trading behavior reflects sales of stocks known to underperform more than it does the buying of stocks known to outperform.

Third, institutional investors trade contrary to anomaly predictions regarding CEI, ITA, AG, and SIZE. The changes in institutional holdings—particularly for CEI and SIZE—are significantly and negatively associated with anomaly returns. For example, as measured by Δ$INS, institutions reduce

their holdings of small stocks by 7.06 bps (*t*-stat: −2.27) during the one-month formation period, contrary to the SIZE anomaly prediction, whereas they increase their holdings of big stocks by 2.51 bps (insignificant), resulting in a net change of −9.57 bps (*t*-stat: −2.90). This suggests that institutions are very reluctant to buy stocks with small market capitalization, despite the high future returns, and that they prefer to hold stocks with large market capitalization that are likely to underperform.

Finally, regarding the negative relation between institutional trading and anomaly prediction, such as CEI, ITA, AG, and SIZE, both long- and short-leg stocks tend to be net-sold during the formation period. For example, high ITA stocks are sold by 5.01 bps (t-stat: −2.51) contrary to the ITA anomaly prescription, while low ITA stocks—consistent with the anomaly—are sold by 4.42 (t-stat: −2.21). Institutional trading occurs contrary to the prescription because of the excessive decrease in the long-leg, which results in a net increment (*L*-*S*) of −0.59 (insignificant). Therefore, this suggests not that institutions trade contrary to anomaly predictions, but that they avoid trading stocks with extreme characteristics. Although a deep examination of the reason for such behavior is beyond our scope, a potential explanation can be considered as follows. It seems that institutions regard stocks with extreme characteristics as either highly risky or not as profitable as required. For example, institutions may be reluctant to hold small stocks because stocks with small capitalization are likely to suffer from financial distress risk and liquidity risk. Also, stocks with large capitalization may not be attractive to them because big stocks are likely to have experienced a sharp increase in price and look overvalued. Institutions having held such stocks want to reduce their holdings to realize their profits. These reasons can make institutions reluctant to buy or hold stocks with extreme characteristics.

To summarize, institutions trade somewhat contrary to anomaly predictions from CEI, ITA, AG, and SIZE because institutions try to avoid holding stocks with extreme values (too low or too high) for such characteristics. On the other hand, institutional trading is consistent with the predictions for BM, MOM, GP, and IVOL. However, the trading concentrates more on selling stock known to underperform than on buying stocks known to outperform. Therefore, there is no evidence that institutional investors actively exploit the anomalies found in the literature.

4.3. Do Institutional Investors Earn Alphas from Anomaly Portfolios?

In the previous section, we find that institutional investors do not actively exploit well-known anomaly characteristics and often behave somewhat contrary to the predictions of anomalies. This section examines whether institutional investors make alphas (risk-adjusted returns) in the long- and short-legs through their own trading behaviors.

To this end, we constructed Δ#INS-sorted quintile portfolios conditional on anomaly-sorted quintiles in a way similar to the investment process detailed earlier. Specifically, after identifying long-leg stocks on the basis of an anomaly characteristic, we sorted them again using the institutional demand variable Δ#INS during the next one-month formation period. Buy and Sell portfolios reflect the top and bottom quintiles, respectively. Similarly, short-leg stocks can be classified into Buy and Sell according to the change in institutional holding Δ#INS. This process results in four portfolios from the intersections: LongBuy, LongSell, ShortBuy, and ShortSell. For these portfolios, we computed the following-month returns (i.e., performance measurement period N =1). Finally, we estimated the Fama–French three factor alphas and Newey–West *t*-statistics, as reported in Table 5.

We find two striking points. First, all the anomalies LongSell portfolios produce positive alphas, among which five anomalies (BM, MOM, GP, IVOL, and SIZE) exhibit statistically significantly positive alphas. This indicates a very high opportunity cost in the anomaly investment sense. LongSell stocks are known to have higher future returns (currently undervalued), and yet are sold by institutions. For example, the high BM stocks (or value stocks) sold by institutions earn a monthly alpha of 0.82% with a t-statistic of 3.27, which is both economically and statistically significant. In other words, if institutions had held those stocks, they could have earned a monthly abnormal return of 0.82%. Similarly, in terms of the alpha, selling winner stocks (long-leg of MOM), selling defensive stocks

(long-leg of IVOL), and selling small stocks (long-leg of SIZE) led to an opportunity cost of 0.87%, 0.52%, and 1.17%, respectively.

Table 5. Anomaly alphas and investor trading.

	BM			**MOM**			**CEI**		
	Buy	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**
Long	−0.20	0.82 ***	−1.01 ***	−0.05	0.87 ***	−0.91 ***	−0.21	0.07	−0.27
	(−0.79)	(3.27)	(−3.28)	(−0.18)	(3.03)	(−3.70)	(−0.81)	(0.27)	(−1.03)
Short	−0.28	−0.02	−0.26	−0.48 **	−0.65 ***	0.16	−0.21	0.28	−0.49
	(−1.51)	(−0.09)	(−1.25)	(−2.54)	(−2.71)	(0.71)	(−0.86)	(1.11)	(−1.37)
L-S	0.08	0.84 **		0.44	1.51 ***		0.00	−0.21	
	(0.25)	(2.42)		(1.26)	(3.89)		(0.00)	(−0.70)	
	ITA			**AG**			**GP**		
	Buy	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**
Long	0.40	0.24	0.16	−0.09	0.15	−0.24	0.63 ***	0.82 ***	−0.20
	(1.37)	(1.04)	(0.46)	(-0.33)	(0.58)	(−0.65)	(2.64)	(4.60)	(−0.98)
Short	−0.28	0.03	−0.30	−0.52 ***	−0.01	−0.51 ***	−0.57 **	0.02	−0.59 **
	(−1.44)	(0.13)	(−1.32)	(−3.04)	(−0.06)	(−2.71)	(−2.09)	(0.08)	(−2.03)
L-S	0.67 **	0.21		0.44 **	0.16		1.20 ***	0.80 ***	
	(2.24)	(1.27)		(2.08)	(0.63)		(3.38)	(2.66)	
	IVOL			**SIZE**					
	Buy	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**			
Long	−0.06	0.52 ***	−0.57 ***	0.63 **	1.17 ***	−0.54			
	(−0.34)	(3.26)	(−2.73)	(1.98)	(4.18)	(−1.65)			
Short	−0.72 **	−0.63 *	−0.09	−0.00	0.36	−0.36			
	(−2.07)	(−1.96)	(-0.22)	(−0.01)	(1.63)	(−1.29)			
L-S	0.66 *	1.15 ***		0.64	0.81 ***				
	(1.76)	(3.17)		(1.45)	(3.42)				

Note: Fama–French three factor alphas are presented with Newey–West t-statistics in parentheses. Buy (Sell) refers to the top (bottom) quintile by Δ#INS, and B-S refers to the difference. Long (Short) refers to the stocks known to outperform (underperform) on the basis of each anomaly characteristic. L-S represents the difference between Long and Short. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

Furthermore, the long-leg alphas of all the anomalies except ITA are concentrated on stocks sold by institutions, resulting in negative alphas for B-S. The profit concentration on long-leg stocks sold is very interesting, in that institutions are typically thought of as skilled investors that dissolve mispricing via arbitrage trading. However, our finding that LongBuy (undervalued and bought) stocks earn very small positive or even negative returns and that LongSell (undervalued and sold) stocks earn highly significant returns implies that institutional investors magnify or cause underpricing rather than dissolve it.

Second, the ShortBuy portfolios for AG, GP, and IVOL have statistically significant and negative alphas. Such short-leg stocks (i.e., stocks with high asset growth, low gross profitability, and high idiosyncratic) are known to be overvalued, and anomaly prescriptions tell investors to sell them. However, the short-leg underperformance (negative alpha) is concentrated on the buy side of institutions, suggesting that institutional buying magnifies or causes the overpricing of short-leg stocks rather than dissolves it.

Our finding is based on a rather short-term (one-month) investment. Hence, one might argue that the puzzling phenomenon we detect is due to the price impact of institutional trading pressure. However, this is unlikely. Untabulated results show that the positive alphas of LongSell and the negative alphas of ShortBuy persist with statistical significance when we extend the performance measurement period up to nine months. Thus, the well-known profit of long-leg stocks is concentrated on stocks sold by institutions even for long-term investments, and the well-known loss of short-leg stocks is concentrated on stocks bought by institutions even for long-term investments. If the price impact were the cause and institutional investors played a role as arbitrageurs, the mispricing would be dissolved in the short run; our finding indicates the opposite.

The reason that we use the dependent sorting approach is because what we want to examine is how the anomaly profits within a long or short leg are distributed over the relative institutional trading behavior. Therefore, we note that the portfolios labeled by Buy or Sell do not necessarily mean that they are actually net-bought or net-sold. One might be interested in how an independent sort method affects our result. As a robustness check, Table A3 in the Appendix A repeats the analysis in Table 5 with independent 3-by-3 sorts. The use of 3-by-3 sorts rather than 5-by-5 seeks to ensure that all portfolios have enough stocks. The result reported in Table A3 shows that the independent sorting approach does not affect our conclusion qualitatively.

5. Conclusions

We have reviewed eight well-known anomaly returns and investigated the relation between institutions' trading behavior and anomalies in the Korean stock market. The study's main results and implications can be summarized as follows.

First, seven anomalies produce very significant abnormal returns for both short- and long-term investments, and one case (CEI) is marginally significant only for long-term investment. Therefore, the anomalies can be a source of abnormal performance for sophisticated investors like institutions. Second, institutions trade in a way consistent with the predictions of the BM, MOM, GP, and IVOL anomalies (buying long-leg stocks more than short-leg stocks), in which the trading demand is concentrated on short-leg stocks. This implies that institutions use anomalies in a passive way to avoid the underperformance of short-leg stocks rather than enjoy the outperformance of long-leg stocks. Third, institutions try to avoid trading stocks with the extreme (very high or very low) characteristics of CEI, ITA, AG, and SIZE, implying that, although these anomalies are well-known in the literature, institutions are very reluctant to buy stocks with extreme characteristic values. Finally, for BM, MOM, GP, IVOL, and SIZE, long-leg abnormal returns come mostly from LongSell portfolios (long-leg stocks sold by institutions) while, for AG, GP, and IVOL, the underperformance of short-leg stocks is concentrated in ShortBuy portfolios (short-leg stocks bought by institutions).

Our findings cast doubt on the widely accepted notion that institutions are highly skilled investors and that institutional arbitrage trading corrects any mispricing in the market. Instead, we find that institutions are reluctant to buy both highly overvalued and highly undervalued stocks. Even when institutions utilize anomalies, they merely use the characteristics passively to avoid stocks known to underperform. Because of this institutional preference, mispricing is magnified rather than corrected. Our findings cannot be explained by the price impact [38]. Our evidence supports the findings of Edelen et al. [15].

Our study is limited in that we analyzed institutional investors as a group. Individual institutions may use different strategies depending on their investment objectives. In particular, the portfolio holding period may vary depending on the institutional investor's strategy [61]. Investors who do not want a quick recovery of investment funds, such as insurance and pension funds, will make relatively long-term investments. Financial investment institutions and investment trusts may make short-term investments because they are intended for direct investment. Therefore, more meaningful results could be obtained if institutional investors are classified into various groups according to their characteristics, investment period, and investment objective.

Furthermore, our study is limited in that our approach has the one-dimensional nature of the tests. Although we find that institutions do not profit from following a single anomaly, we cannot rule out the possibility that, in practice, institutions employ more sophisticated strategies such as considering a group of anomalies simultaneously. These limitations should be addressed in future studies.

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Appendix A

Table A1. Volume changes in institutional ownership (Δ#INS).

	BM	MOM	CEI	ITA	AG	GP	IVOL	SIZE
Panel A: one-month formation period (M = 1)								
Long	−4.97 *	−1.81	−6.68 **	−6.48 ***	−4.98 **	−1.11	−1.54	−8.23 ***
	(−1.84)	(−0.63)	(−2.17)	(−3.00)	(−2.31)	(−0.40)	(−0.65)	(−3.93)
2	−0.27	−3.39	−2.41	−2.74	−3.04	−1.65	−0.37	−4.83 **
	(−0.11)	(−1.48)	(−1.19)	(−1.20)	(−1.31)	(−0.75)	(−0.15)	(−2.47)
3	−2.39	−0.89	−1.64	−1.47	−1.64	−2.99	−1.64	−0.60
	(−1.12)	(−0.44)	(−0.94)	(−0.57)	(−0.81)	(−1.25)	(−0.74)	(−0.21)
4	−1.56	−2.88	−1.30	−1.99	−2.37	−5.15 *	−2.39	0.55
	(−0.63)	(−1.48)	(−0.55)	(−0.82)	(−0.90)	(−1.94)	(−1.12)	(0.22)
Short	−6.57 **	−6.70 **	−3.87	−5.89 **	−3.84	−5.95 ***	−9.85 ***	−2.91
	(−2.35)	(−2.59)	(−1.46)	(−2.01)	(−1.50)	(−3.02)	(−2.65)	(−0.90)
Panel B: three-month formation period (M = 3)								
Long	−4.50 *	−2.47	−6.04 **	−6.09 ***	−4.58 **	−1.13	−1.03	−7.48 ***
	(−1.78)	(−0.88)	(−2.10)	(−2.68)	(−2.25)	(−0.40)	(−0.44)	(−3.61)
2	−0.41	−2.28	−2.50	−2.54	−2.98	−1.45	−0.81	−4.64 **
	(−0.17)	(−1.03)	(−1.15)	(−1.12)	(−1.32)	(−0.69)	(−0.34)	(−2.38)
3	−2.85	−1.73	−1.01	−2.45	−2.44	−2.94	−1.47	−0.08
	(−1.32)	(−0.83)	(−0.56)	(−0.97)	(−1.16)	(−1.29)	(−0.69)	(−0.03)
4	−0.99	−2.78	−1.71	−1.97	−2.06	−5.27 **	−3.07	−0.05
	(−0.40)	(−1.48)	(−0.84)	(−0.84)	(−0.80)	(−1.99)	(−1.44)	(−0.02)
Short	−6.78 **	−6.17 **	−4.39 *	−5.20 *	−3.52	−5.84 ***	−9.19 ***	−3.50
	(−2.45)	(−2.59)	(−1.79)	(−1.91)	(−1.50)	(−2.99)	(−2.71)	(−1.06)

Note: Δ#INS is scaled by the number of shares outstanding. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

Table A2. Dollar amount changes in institutional ownership (Δ$INS).

	BM	MOM	CEI	ITA	AG	GP	IVOL	SIZE
Panel A: one-month formation period (M = 1)								
Long	−3.10	1.73	−3.26	−4.34 *	−6.53 **	1.90	−0.24	−8.05 ***
	(−1.15)	(0.58)	(−1.01)	(−1.87)	(−2.00)	(0.67)	(−0.10)	(−3.99)
2	1.83	−4.32	−3.43	−1.02	0.00	1.18	1.94	−3.63 *
	(0.82)	(−1.46)	(−1.11)	(−0.44)	(0.00)	(0.53)	(0.83)	(−1.67)
3	−3.60	1.05	−0.33	1.55	0.28	−0.26	1.44	−0.99
	(−1.21)	(0.52)	(−0.20)	(0.67)	(0.14)	(−0.11)	(0.62)	(−0.31)
4	1.67	−0.80	0.66	0.74	−0.06	−2.39	−2.00	4.98 *
	(0.66)	(−0.40)	(0.27)	(0.29)	(−0.02)	(−0.95)	(−0.57)	(1.93)
Short	−2.91	−3.71	0.24	−2.44	−0.03	−4.45 **	−7.27 *	1.52
	(−0.96)	(−1.49)	(0.09)	(−0.87)	(−0.01)	(−2.01)	(−1.90)	(0.46)
Panel B: three-month formation period (M = 3)								
Long	−2.58	0.05	−2.32	−3.99	−6.23 *	1.92	0.27	−7.09 ***
	(−1.02)	(0.02)	(−0.79)	(−1.64)	(−1.87)	(0.67)	(0.12)	(−3.50)
2	0.59	−2.41	−3.68	−0.88	−0.03	1.20	1.48	−3.20
	(0.30)	(−1.10)	(−1.21)	(−0.37)	(−0.02)	(0.56)	(0.62)	(−1.56)
3	−2.72	0.31	0.25	1.08	−0.25	−0.04	1.50	−0.80
	(−1.19)	(0.15)	(0.14)	(0.49)	(−0.12)	(−0.02)	(0.67)	(−0.25)
4	2.22	−0.60	0.41	0.62	0.30	−2.40	−2.42	4.37 *
	(0.88)	(−0.33)	(0.20)	(0.26)	(0.11)	(−0.97)	(−0.71)	(1.79)
Short	−3.22	−3.01	−0.51	−1.78	0.28	−4.26 **	−6.61 *	0.94
	(−1.08)	(−1.25)	(−0.20)	(−0.67)	(0.12)	(−1.98)	(−1.90)	(0.28)

Note: Δ$INS is scaled by the market capitalization. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

Table A3. Anomaly alphas and investor trading: 3-by-3 independent sorts.

	BM			MOM			CEI		
	Buy	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**
Long	0.22	0.71 ***	−0.50 ***	0.30 *	0.78 ***	−0.48 ***	0.15	0.45 ***	−0.30 *
	(1.33)	(4.24)	(−2.66)	(1.68)	(4.37)	(−3.35)	(0.82)	(3.08)	(−1.72)
Short	0.00	0.20	−0.20	−0.19	0.11	−0.31 *	0.02	0.44 **	−0.42 **
	(0.01)	(1.37)	(−1.58)	(−1.14)	(0.74)	(−1.82)	(0.09)	(2.58)	(−2.40)
L-S	0.22	0.51 ***		0.49 **	0.67 ***		0.13	0.01	
	(1.20)	(3.17)		(2.25)	(2.95)		(0.82)	(0.07)	
	ITA			**AG**			**GP**		
	Buy	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**
Long	0.39 **	0.65 ***	−0.26	0.29 **	0.65 ***	−0.36 *	0.53 ***	0.65 ***	−0.12
	(2.01)	(3.58)	(−1.41)	(2.11)	(3.71)	(−1.84)	(3.30)	(4.71)	(−0.84)
Short	−0.09	0.25	−0.34 **	−0.09	0.18	−0.27	−0.22	0.21	−0.42 **
	(−0.50)	(1.62)	(−2.24)	(−0.56)	(1.17)	(−1.64)	(−1.12)	(1.43)	(−2.03)
L-S	0.48 ***	0.40 **		0.38 ***	0.47 **		0.74 ***	0.44 **	
	(2.74)	(2.25)		(3.08)	(2.30)		(4.33)	(2.39)	
	IVOL			**SIZE**					
	Buy	**Sell**	**B-S**	**Buy**	**Sell**	**B-S**			
Long	0.20	0.54 ***	−0.33 ***	0.57 ***	0.96 ***	−0.38			
	(1.57)	(4.24)	(−2.81)	(3.63)	(6.03)	(−1.59)			
Short	−0.21	0.15	−0.37 *	0.29 *	0.01	0.28 **			
	(−0.89)	(0.88)	(−1.66)	(1.91)	(0.09)	(2.47)			
L-S	0.42	0.38 **		0.28	0.94 ***				
	(1.61)	(2.09)		(1.47)	(4.29)				

Note: Fama–French three factor alphas are presented with Newey–West t-statistics in parentheses. Buy (Sell) refers to the top (bottom) quintile by Δ#INS, and B-S refers to the difference. Long (Short) refers to the stocks known to outperform (underperform) on the basis of each anomaly characteristic. L-S represents the difference between Long and Short. ***, **, and * denote 1%, 5%, and 10% statistical significance levels, respectively.

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