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The investment behavior and performance of various investor types: a study of Finland's unique data set☆

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Abstract

Using data from Finland, this study analyzes the extent to which past returns determine the propensity to buy and sell. It also analyzes whether these differences in past-return-based behavior and differences in investor sophistication drive the performance of various investor types. We find that foreign investors tend to be momentum investors, buying past winning stocks and selling past losers. Domestic investors, particularly households, tend to be contrarians. The distinctions in behavior are consistent across a variety of past-return intervals. The portfolios of foreign investors seem to outperform the portfolios of households, even after controlling for behavior differences.

JEL classification: G10

Keywords: Investor behavior; Momentum; Performance; International stock returns

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1. Introduction

Empirical evidence that appears to strongly contradict the random walk hypothesis has recently spurred the development of what has come to be known as 'behavioral finance'. Theories of investor under- and overreaction to news (based, for example, on overconfidence and bounded rationality) are being put forth to explain return patterns such as momentum and long-horizon reversals.[1] The assumptions behind these theories of investor behavior are founded in psychological research or common sense. Clearly, however, this line of research could benefit from a more complete picture of how investors actually behave and how they differ from one another in the way they react to the same information.

A number of recent contributions have documented interesting regularities in the past-return-based behavior of investors. Grinblatt et al. (1995) find that mutual fund managers tend to pursue momentum strategies. Badrinath and Walhal (1998) find weaker evidence of this for the more general category of 13f filers. Odean (1998) finds that the investors at a U.S. discount brokerage house are reluctant to realize losses, and presents evidence which can also be interpreted as being consistent with contrarian behavior. Brennan and Cao (1997) present a theoretical model and empirical evidence that supports the view that foreign investors should pursue momentum strategies and achieve inferior performance because they are *less* informed than domestic investors. Froot et al. (2000) and Choe et al. (1999) find that foreign investors tend to be momentum investors, the latter paper focusing on short past-return horizons.

A simultaneous analysis of the investment behavior and performance of all investor categories has been impossible until now because of data limitations. Different research methods, different data frequencies, different horizons for past returns, and different institutional arrangements unavoidably blur the comparison of the results and make it difficult to identify general patterns behind the behavior and performance of isolated investor categories.

This paper analyzes a unique data set that portrays the behavior and performance of all sides of a stock market. This data set records stock investments in Finland. With only negligible and rare exceptions it categorizes in amazing detail the holdings and transactions of the universe of participants in the markets for Finnish stocks.

The paper is primarily focused on which investor groups exhibit momentum (the tendency to buy past winners and sell past losers) and which have the opposite, contrarian behavior. It finds that behavioral patterns with respect to past returns are consistent across many classifications of investors. In particular, investor groups who tend to buy winning stocks and sell losing stocks (or vice

[1] See, for example, Barberis et al. (1998), Daniel et al. (1998), and Hong and Stein (1999).

versa) seem to do so for a wide variety of past-return horizons that define winners and losers. The behavioral patterns observed are typically extremely strong. This suggests that the behavior is common to a large proportion of investors in the category, as opposed to being a statistical anomaly driven by chance.

The analysis of this data set also demonstrates that momentum behavior (with respect to both near-term and intermediate-term past returns) is correlated with investor performance, and that both momentum behavior and performance appear to be associated with the level of sophistication of the investor. Specifically, in the two-year period for which we have detailed transaction data, foreign investors, often professionally managed funds or investment banking houses, pursue momentum strategies and achieve superior performance. The association between behavior and performance does not seem to be generated by momentum in stock returns. After removing momentum investing's contribution to performance, we find that the momentum-adjusted performance of foreigners is highly significant.

The data also show that most classes of domestic investors in Finland pursue contrarian strategies with respect to both near-term and intermediate-term past returns. Some classes of domestic investors, such as Finnish households, also exhibit significantly negative performance. However, the association between the contrarian behavior of investors and poor performance is not a causal relationship. When we adjust performance for the impact of contrarian behavior, Finnish households still exhibit inferior performance.

Our analysis can partly shed light on whether the superior returns generated by trading on past returns is due to time-varying risk or behavioral tendencies. Suppose, for example, that investors who are generally perceived as sophisticated follow momentum strategies and exhibit superior performance (either because of momentum or other superior investment traits that they possess). Further suppose that investors who are generally perceived as naive follow (less profitable) contrarian strategies and exhibit inferior performance. This would be consistent with momentum being a behaviorally driven anomaly in which 'smart' investors take advantage of 'naive' investors in equilibrium.

The inverse relation between the behavior and performance of foreign and domestic investors could have been deduced from an adding-up constraint — each buy transaction coincides with a sell transaction. Hence if the buy exhibits momentum behavior, the sell exhibits contrarian behavior. This property aggregates over groups of transactions as well. For this reason, when institutional investors follow momentum strategies, the buys and sells of investors who do not belong to the institutional class must exhibit contrarian behavior, and vice versa.

Given the rich detail in our data, however, we can learn more than what can be deduced from the adding-up constraint alone. Generally, the more sophisticated the domestic investor and the greater the wealth invested in stocks, the less

contrarian is the investment strategy. Finnish institutional investors, whose sophistication level and investment size probably lie between those of foreign investors and household investors in Finland, follow a middle ground. Their investment strategy is midway between that pursued by foreign investors and the extreme contrarian strategies pursued by Finnish household investors. The middle ground also is where the performance of these Finnish institutional investors lies.

The results, although based on only two years of data, are too strong to be altered by methodological tweaking. In part, the power of our statistical tests arises from their ability to exploit the relative independence of the daily decisions of investors to buy and sell stocks. More importantly, the highly significant results are generated by economic significance: these daily decisions predict future stock returns with surprising frequency. The performance observed in Finland appears to be much greater than what has been observed in the U.S.

The organization of the paper is as follows. Section 2 describes the data used in the paper. Section 3 studies the investment behavior of participants in the markets for Finnish stocks. Section 4 measures the performance of various classes of investors and determines the degree to which performance is generated by momentum. Section 5 concludes the paper.

2. A unique data set

This study employs the central register of shareholdings for Finnish stocks in the Finnish Central Securities Depository (FCSD), a comprehensive data source. Practically all major publicly traded Finnish companies have joined the register, and it covers 97% of the total market capitalization of Finnish stocks, 200 billion FIM (5 FIM $\approx$ 1 U.S. \$) as of the beginning of 1995 (the beginning of our sample period).

2.1. Details of the register data

The register reports the shareholdings in FCSD stocks of *all* Finnish investors, both retail and institutional. The database is, to our knowledge, the first comprehensive panel on institutional holdings in the world, and does not suffer from potential representativeness problems inherent in survey data or data from a single securities firm. Since the electronic records represent official certificates of ownership, the data also are very reliable.

Another virtue of this data set is that it reports institutional holdings and stock trades on a daily basis. Studies of the holdings of U.S. mutual funds, as exemplified by Grinblatt and Titman (1993), and U.S. pension funds, as exemplified by Lakonishok et al. (1992), have been able to analyze quarterly data at best.

Our data consist of each owner's stock exchange trades from December 27, 1994 through December 30, 1996. The trades, which are electronically stamped on the date of trade execution, cover all publicly quoted companies represented in the Book Entry System. The recorded stock trades can occur on many stock exchanges throughout the world. For example, Nokia, by far the largest Finnish company, has trading of similar magnitude on both the Helsinki Stock Exchange and the New York Stock Exchange. It also trades on four other national stock exchanges. Differences in settlement conventions across exchanges have no effect on our analysis since we employ the transaction dates in our analysis. A minor exception to this is our classification of the size of Finnish household investors. This classification is obtained by computing the market value of each Finnish investor's stockholdings as of a January 1, 1995 record date. Because the three-trading-day settlement lag on the Helsinki Stock Exchange is conventional, the holdings of record on January 1, 1995 largely represent Finnish stocks owned as of December 27, 1994. (To the extent that a Finnish investor purchased a stock in late 1994 with an unusual settlement period, we could be estimating the market value of that stock on a date prior to or even after December 27, 1994, but this will result in only a negligible misclassification of the size of the investor's stockholdings.)

The Book Entry System entails compulsory registration of holdings for Finnish individuals (referred to as households) and institutions. Foreigners are partially exempt from registration as they can opt for registration in a nominee name. This means that their stockholdings are combined into a larger pool of nominee-registered holdings and cannot be separated from each other by scientific investigation. As will be apparent shortly, this will have no effect on our results, but it makes it impossible to separate foreign investors into subcategories such as institutions versus individuals or small investors versus large investors.

While the database includes comprehensive data on direct shareholdings, it does not cover indirect shareholdings through financial institutions. We do not consider households' indirect ownership through mutual funds. Hence, mutual fund investments have an identification number that belongs to the fund itself (although mutual funds are not nearly as popular in Finland as they are in the U.S.).[2] However, shares held in street name at brokerage houses are identified with a number belonging to the individual brokerage account. The data aggregate holdings across brokerage accounts for the same investor, whether the shares are held in street name or not. In addition, American Depository Receipts (ADRs), such as those in Nokia, are transparent veils that pass through to the final investor as if the holding were in the actual Finnish stock without the bank

[2] In 1992, 22% of U.S. households invested in mutual funds (Poterba and Samick, 1995), whereas in the beginning of 1997, less than 1% of the Finnish population invested in mutual funds.

intermediary. However, in contrast to the Finnish brokerage accounts, virtually all holders of ADRs do not report the detail required of Finnish domestic investors, including their distinct identity.

For computational tractability and to ensure that illiquidity does not affect our analysis, we focus only on the trades in the 16 largest Finnish stocks listed on the Helsinki Stock Exchange that did not merge in 1995 or 1996.[3] These stocks account for 52% of the market capitalization of the Finnish stock market. They are listed in Table 1, along with their market capitalizations as of the beginning of 1995 and summary data of their returns over the 24 months studied.

Three pairs of these 16 stocks belong to the same firm because the firm has two classes of shares, differing with respect to voting rights. Many Finnish companies have two share classes. A greater number of votes per share is generally attached to one of the share classes, and the share class with fewer votes is usually more liquid. This makes the stocks imperfect substitutes for each other and, as reported in Ilmanen and Keloharju (1999), gives rise to different owner clienteles. Further supporting evidence of this 'clientele effect' will be presented shortly. Therefore, we consider share classes with different voting power as separate stocks.

2.2. Return data

The return data in Table 1, as well as the return data used throughout the paper, are based on closing prices from the Helsinki Stock Exchange with the usual adjustments for splits, stock dividends, and cash dividends. The Helsinki Stock Exchange return data are generated by the prices from the last trade executed on the Helsinki exchange, even if a stock traded at a later time on a different exchange, as is typically the case when the stock is listed on the later-closing New York Stock Exchange. As we will see, the nonsynchronicity of market closings has no effect on our results.

While Table 1's return data are from 1995–1996, the main time period for our analysis, we employ return data from the first half of 1997 in our analysis of performance. In addition to the average monthly returns and standard deviations of monthly returns, Table 1 also reports risk premiums relative to the one-month Finnish markka Helsinki interbank offered rate, HELIBOR, a proxy for the risk-free return.

[3] Two large banks that merged into one bank, as well as two large paper companies that merged into one, are excluded from the sample. This avoids the difficulty of calculating post-merger momentum measures and decreases the possibility that the buys and sells are affected by merger speculation. One company is excluded because its return data do not go back far enough in time to generate the computations needed for this paper.

Table 1
Descriptive statistics of returns of the 16 largest Finnish stocks

The table reports market capitalization, average monthly return, average risk premium (in excess of the one-month Finnish markka Helsinki interbank offered rate) along with the corresponding standard deviations for the two return measures for 16 Finnish share classes. These are the share classes with the largest market capitalization on the Helsinki Stock Exchange at January 1, 1995 that did not merge in the subsequent 502 trading days. These 16 share classes include three pairs of dually listed share classes and ten other stocks. Reported, as well, are the means and standard deviations of the equal- and market cap-weighted portfolios of the 16 stocks listed above. The return data are based on closing prices from the Helsinki Stock Exchange

Share class	Market value Jan 1, 1995 (Mill. FIM)	Mean monthly raw return 1995–1996	Mean monthly return over riskless rate 1995–1996	Std. dev. of monthly raw return 1995–1996
Nokia A	27,109	0.027	0.023	0.133
Nokia K	25,235	0.027	0.023	0.131
Outokumpu	10,834	0.000	− 0.004	0.090
Rautaruukki	4569	0.010	0.006	0.088
Enso R	4414	0.003	− 0.001	0.084
Enso A	4322	0.002	− 0.001	0.086
Metsa-Serla B	4167	− 0.001	− 0.005	0.104
Valmet	3834	0.025	0.021	0.097
Kesko V	3260	0.011	0.007	0.070
Finnair	2701	− 0.003	− 0.006	0.086
Kone B	2700	0.003	− 0.001	0.089
Huhtamaki I	2671	0.018	0.015	0.097
Stockmann A	2006	0.011	0.007	0.063
Partek	1980	0.010	0.006	0.081
Huhtamaki K	1946	0.017	0.013	0.097
Cultor I	1943	0.031	0.027	0.063
Totals	103,690			

Equally weighted portfolio of 16 stocks		
Mean	Mean	Std. dev.
0.12	0.008	0.091
Value-weighted portofolio of 16 stocks		
Mean	Mean	Std. dev.
0.017	0.014	0.110

2.3. The power problem

Table 1 summarizes the data across stocks by reporting equal- and value-weighted averages of the 16 means and standard deviations for both raw returns

and returns in excess of HELIBOR (the risk premium). It is noteworthy that the standard deviations of the one-month value-weighted returns are about twice the standard deviation of the value-weighted U.S. index. This suggests that any results about momentum or performance will have to be very strong to overcome the noise in the return data. For example, only one stock, Cultor I, has a risk premium that is more than twice its standard error (the standard errors are approximately one-fifth of the monthly standard deviations). No other stock has either a return or a risk premium that significantly differs from zero.

The lack of statistically significant risk premiums suggests that any statistically significant performance results are unlikely to be due to some investor classes buying stocks with high risk premiums and selling stocks with low risk premiums. This is true even if the performance analysis makes no attempt to account for the effect of risk on average returns.

2.4. Investor aggregation and summary statistics

Investors are aggregated into six investor types, listed along the top of Table 2, along with the fraction of buy volume in each of the 16 stocks. These categories of investors are based on a classification system established by the European Union (categories with negligible value to their shareholdings are not reported in our analysis). We further break up the 'household category', the individuals who invest in the stock market directly, into three investor subcategories based on the market capitalization of each investor's portfolio as of January 1, 1995. After sorting across all household investors, breakpoints are set so that each of the aggregated portfolios for the three household categories has approximately the same market capitalization.

Note that foreign investors have the largest share of buy volume in all but one of the stocks. This is doubly true for companies listed on multiple stock exchanges, like Nokia. Partly, this is attributable to the larger volumes that foreigners tend to execute with each buy or sell decision. However, it is also an artifact of the data. Trades that take place between foreign institutional investors via a market-making broker are subject to double counting. The first buy volume occurs when the foreign broker acquires the stock in its inventory for the institutional client. The second occurs when the broker or market maker sells the stock directly to the foreign institution. Intraday market making in a Finnish stock listed on the New York Stock Exchange also adds to this double-counting phenomenon.

The double counting applies to sell volume proportions as well, but, in either case, does not affect our results, which are based on buy–sell ratios. Specifically, for each trading day t and for each of the 16 stocks, as well as each of the nine categories — the eight investor types plus the aggregated household category — we record the number of shares purchased divided by the sum of the number of shares purchased and the number of shares sold. This will be referred to as the

Table 2
Daily fraction of buy volume attributable to each share and investor class

The table reports, for each of the 16 Finnish share classes (i.e., stocks) analyzed in the paper, the average of the daily fractions of buy volume attributable to each of the nine investor classes analyzed, computed from all trading days in 1995 and 1996. The buy volume comes from trading on all the world markets on which the stock is traded

Stock	Mean fraction of aggregate buy volume								
	Investor category								
	Households				Nonprofit institutions	General government	Finance & insurance institutions	Non-financial corp.	Foreign investors
	All combined	Small portfolio	Medium portfolio	Large portfolio					
Nokia A	0.009	0.004	0.003	0.001	0.001	0.003	0.047	0.054	0.886
Nokia K	0.011	0.004	0.005	0.002	0.004	0.021	0.082	0.063	0.819
Outokumpu	0.008	0.003	0.003	0.002	0.003	0.027	0.057	0.040	0.864
Rautaruukki	0.082	0.032	0.036	0.014	0.029	0.067	0.154	0.149	0.519
Enso R	0.041	0.016	0.016	0.009	0.017	0.018	0.108	0.112	0.704
Enso A	0.184	0.079	0.076	0.029	0.033	0.042	0.202	0.191	0.348
Metsa-Serla B	0.039	0.018	0.016	0.005	0.006	0.019	0.088	0.082	0.766
Valmet	0.024	0.011	0.009	0.003	0.012	0.020	0.088	0.048	0.808
Kesko V	0.059	0.032	0.020	0.007	0.011	0.055	0.134	0.192	0.548
Finnair	0.063	0.025	0.028	0.010	0.018	0.053	0.131	0.107	0.628
Kone B	0.052	0.026	0.018	0.008	0.007	0.037	0.116	0.084	0.704
Huhtamaki I	0.018	0.009	0.004	0.005	0.008	0.014	0.111	0.050	0.798
Stockmann A	0.176	0.097	0.058	0.022	0.157	0.014	0.083	0.138	0.432
Partek	0.109	0.039	0.044	0.027	0.031	0.091	0.208	0.206	0.354
Huhtamaki K	0.254	0.113	0.115	0.026	0.040	0.094	0.291	0.170	0.150
Cultor I	0.038	0.021	0.008	0.008	0.009	0.017	0.171	0.092	0.673
Mean	0.073	0.033	0.029	0.011	0.024	0.037	0.130	0.111	0.625
Median	0.046	0.023	0.017	0.008	0.012	0.024	0.113	0.100	0.688

'buy ratio'. For example, assume that Category 2 contains 300 investors. If five investors in the category each purchase 100 shares of Nokia A stock on day t, while ten investors each sell 200 shares of Nokia A stock on day t, and the remainder do not trade Nokia A, then the day t buy ratio of this category for Nokia A is $0.2 = 5 \times 100/(5 \times 100 + 10 \times 200)$. (Note that since the data consist of the entire market, aggregating over all eight investor types generates a ratio of $\frac{1}{2}$ for each of the 16 stocks.)[4] For a given category, the buy ratio at date t across all stocks can be represented as a 16-element vector.

As suggested earlier, there is evidence in the literature that dual class shares have different owner clienteles. Additional evidence in support of this view is found in the contemporaneous buy ratios of each pair of dual class shares, which are largely uncorrelated with each other. For example, the contemporaneous correlations of foreign investors' buy ratios for the dual share classes are 0.00 (Enso), 0.10 (Huhtamaki), and 0.17 (Nokia). For the other two large investor categories — finance and insurance institutions and nonfinancial corporations — the correlation coefficients are even smaller. Households are the only investor category for which the clientele effects are less obvious: the three correlations are respectively 0.31, 0.18, and 0.49, perhaps because the individual households' small holdings generally make them less concerned about voting power and liquidity.

3. Buy–sell behavior across investor categories

3.1. The measure of investment style

We study how investment behavior relates to past returns by examining whether the buy ratio of past winning stocks exceeds the buy ratio of past losing stocks. More specifically, investment style on day t for an investor category is measured as the difference between the average of the buy ratios of the four stocks with past returns that are in the top quartile (of the 16 stocks) less the average of the buy ratios of the four stocks with past returns that rank in the lowest quartile. If this difference is positive, the buy ratio for past winning stocks exceeds the buy ratio for past losing stocks and the investor category is viewed

[4] This is not precisely true because there are a number of categories of investors that contain so few investors and have so few trades that we did not wish to report data on them in this study. Combined together, these esoteric investor categories own less than one-half of one percent of the market's capitalization. Even absent this consideration, the $\frac{1}{2}$ can only be obtained by aggregating over each investor. It cannot be obtained by averaging across categories in subsequent tables because of the way in which we aggregate in those tables. For similar reasons, we cannot obtain the aggregate household numbers from the three household categories without first disaggregating.

as momentum-oriented on day t. If it is negative, the investor category is viewed as contrarian on day t. Stocks receive an equal weight rather than a value or volume weight in the buy ratio average to prevent Nokia, by far the largest and most actively traded company, from dominating our results.

Our investigation of momentum primarily focuses on behavior generated by returns up to six months in the past. Past returns for day t are computed by analyzing the impact of the return on day $t-1$ (the columns labeled -1) as well as the returns between trading days $t-m$ and $t-n$, where the pairs $(-m, -n)$ and associated column labelings are as follows:

- $(-5, -2)$ is generally the prior week excluding the prior day,
- $(-20, -6)$ is approximately the prior month excluding the prior week,
- $(-120, -21)$ is approximately the prior half-year excluding the prior month, and
- $(-120, -1)$ is approximately the prior half-year, which combines all of the horizons together. This spectrum of horizons should give us a sufficiently complete picture of how different investor groups react to past returns. In unreported work, we find that returns more than six months in the past have very little effect on the buy ratios of the investor groups.

A category's overall degree of trend following is measured as the fraction of days for which the buy ratio difference is positive. If the fraction of days exceeds one-half, the investor category displays momentum behavior. Otherwise, the category displays contrarian behavior.

3.2. Test statistics

Test statistics for investor behavior assume that for a given investor type, each day t buy ratio difference used to compute the measure of investor behavior (and later, the measure of performance) has a mean of zero and is independent of the corresponding correlations computed at other dates. We analyze statistical significance with a binomial sign test of whether the fraction of positive buy ratio differences over all dates t is 0.5. The test is two-tailed in that when the fraction α of positive correlations exceeds 0.5, we report twice the probability that we would observe a fraction greater than α by chance. When α is less than 0.5, we report twice the probability that we would observe a fraction less than α by chance.

The binomial nonparametric test assumes an AR(1) process in the buy ratio differences. Essentially, there is a higher probability of continuations (buy ratio differences of the same sign on two consecutive days) than reversals (buy ratio differences of the opposite sign on two consecutive days). We use a closed form solution, developed in Grinblatt and Keloharju (1998), to compute the binomial probability of x positive buy ratio differences out of n observations for each

investor category, assuming that the observed fraction of continuations (versus reversals) is the true probability of continuation under the null hypothesis that $x = n/2$. The z-test statistic is

$$z = \frac{x - n/2}{n/4 + [(2p-1)^{n+1} - n(2p-1)^2 + (2p-1)(n-1)]/16(1-p)^2}$$

where p is the observed proportion of continuations.

The AR(1) adjustment to the binomial sign test controls for the possibility that some of the orders placed by different investors within a class on day t will be executed on different days. Some of the orders will be market orders and will be executed on day t. Others will be market orders placed after the close of trading and executed on day $t + 1$. Others will be limit orders executed on either day t or day $t + 1$. While limit orders for some small investors may not be executed for many days, the AR(1) assumption seems like a reasonable approximation in all cases.

The reasonableness of the AR(1) assumption is inferred by examining the residuals from an AR(1) regression for the pairings of each of the analyzed horizons with each investor category. The residuals from a regression of buy ratio differences on lagged buy ratio differences should not exhibit time-series patterns (probably first-order autocorrelation) if an AR(1) specification reasonably characterizes the time series of buy ratio differences. This seems to be the case. Specifically, consistent with our other tests, we test for such residual autocorrelation nonparametrically and find that the probability of sign reversal in consecutive residuals in this time series is virtually identical to the probability of continuation in the signs. For example, with the three largest investor categories — foreign investors, household investors, and finance and insurance institutions — the proportions of reversals in the signs of consecutive residuals are respectively 0.498, 0.542, and 0.508 for the six-month past-return horizon. None of these proportions significantly differs from 0.5 at the 5% level, suggesting that AR(1) is an adequate specification of the buy ratio difference process. The insignificance applies to all but three of 42 remaining pairings of investor categories and household subcategories with the various past-return horizons.

Moreover, for certain investor categories even the AR(1) adjustment might be unnecessary. For example, the buy ratio differences of foreign investors have first-order autocorrelations that are insignificant, irrespective of the horizon for the past return. In these cases, the autocorrelation adjustment could probably be dispensed with, further improving the strength of our results.

In our data the differences between the unadjusted and AR(1)-adjusted results are not large: the unadjusted z-values are in all specifications at least 65%, and in most specifications at least 85% of the AR(1) adjusted z-values. This gives us confidence that adjusting for more complex processes would have little effect on the results.

3.3. Main results

Table 3 highlights data on the buy ratio difference measure of trading style described above. A buy ratio difference that is positive on a given day is indicative of a momentum-driven investment strategy. A negative number indicates a contrarian strategy for the investor category. Table 3 reports the fraction of positive buy ratio differences for each time series along with the appropriate significance level. Fig. 1, a graphical representation of Table 3, reports the proportion of buy ratio differences less 0.5 for each investor category and for each of the five past-return horizons.

As can be seen from Table 3, Finnish household investors tend to be contrarians for all of the ranking periods. This is broadly consistent with Odean (1998), who shows that a sample of U.S. individual investors tends to cash in on winners and hold on to losers. Cashing in on winners is consistent with a contrarian investment strategy. The frequency of contrarian behavior in Finland seems to be inversely related to a rough (and admittedly ad hoc) ranking of the sophistication of the investor types. At the six-month past-return horizon, households have buy ratio differences that are positive on only 16% of the trading days. These results are extremely significant: the unreported AR(1)-adjusted z-values are below -10. For the 84% that constitute the remaining days, these investor categories exhibit negative buy ratio differences, buying losers and selling winners. As the size of the household investor increases (as measured by portfolio size), the frequency of contrarianism seems to diminish. For the largest households, presumably more sophisticated than the smaller households, contrarian buy ratio differences are observed on only about 66% of the trading days with the six-month past-return rankings.

Institutional investors generally take larger positions than individuals, have more resources to expend on research, and in many cases, view investment as a full-time career. Consequently, it is reasonable to view institutions as more sophisticated than individuals. Government investors and nonprofit institutions, seemingly more sophisticated than households, but perhaps less sophisticated than the other two classes of Finnish institutional investors, are less contrarian than household investors but more contrarian than nonfinancial corporations and finance and insurance institutions. The government and nonprofit categories of investors exhibit contrarian buy ratio differences 56–69% of the time depending on the past-return horizon used for the stock rankings.

The finance and insurance institutions, as well as the nonfinancial corporations, are perhaps the most sophisticated of the domestic investor categories but are only marginally contrarian. They do not exhibit statistically significant contrarian behavior with respect to returns that are more than one week in the past. However, they do tend to buy past losers and sell past winners when winners are defined by the prior day or the prior week. Also, they are contrarians with respect to the full past six-month horizon.

Table 3
Analysis of momentum and contrarian behavior of the investor categories using unadjusted buy ratio differences

For 1995–1996, the table reports the fraction of positive daily buy ratio differences for nine categories of investors, along with the significance level of a two-tailed binomial sign test that the fraction of positive differences is one-half. Each daily buy ratio [(buy volume)/(buy volume + sell volume)] for the 16 share classes in Table 1 is grouped with the buy ratios of stocks in the same momentum class and averaged. Each day's buy ratio difference is generated by subtracting the average buy ratio for stocks with past returns in the loser quartile from the average buy ratio of stocks with past returns in the winner quartile. The past returns used for ranking a stock are based on various prior return intervals relative to day t. These return intervals are given as the column heads. The column labeled '-1' has winner/loser rankings based on the return from the trading day prior to day t, while those labeled '$-m..-n$' are based on the returns cumulated from m trading days prior to day t until n trading days prior to day t. In the absence of momentum or contrarian behavior, the average buy ratio difference should be zero and the fraction of measured positive buy ratio differences should be one-half. The binomial sign test assumes that the buy ratio differences follow a first-order autoregressive process in which the probability of two consecutive buy ratio differences of the same sign is given by the sample proportion. Zero buy ratio differences are dropped as sample points from this calculation.

Investor category	Proportion of positive buy ratio differences					Binomial test p-value				
	Past performance period (days)					Past performance period (days)				
	-1	$-5..-2$	$-20..-6$	$-120..-21$	$-120..-1$	-1	$-5..-2$	$-20..-6$	$-120..-21$	$-120..-1$
Households — all investors combined	0.409	0.353	0.299	0.233	0.159	0.000	0.000	0.000	0.000	0.000
Households — small portfolio size	0.425	0.351	0.323	0.265	0.175	0.001	0.000	0.000	0.000	0.000
Households — medium portfolio size	0.397	0.367	0.322	0.325	0.235	0.000	0.000	0.000	0.000	0.000
Households — large portfolio size	0.464	0.398	0.404	0.385	0.342	0.154	0.000	0.000	0.000	0.000
Nonprofit institutions	0.436	0.392	0.420	0.420	0.311	0.018	0.000	0.006	0.008	0.000
General government	0.373	0.441	0.403	0.406	0.369	0.000	0.046	0.002	0.004	0.000
Finance and insurance institutions	0.422	0.434	0.506	0.470	0.390	0.000	0.005	0.793	0.219	0.000
Nonfinancial corporations	0.386	0.398	0.518	0.468	0.452	0.000	0.000	0.426	0.151	0.035
Foreign investors	0.593	0.608	0.572	0.576	0.647	0.000	0.000	0.002	0.001	0.000

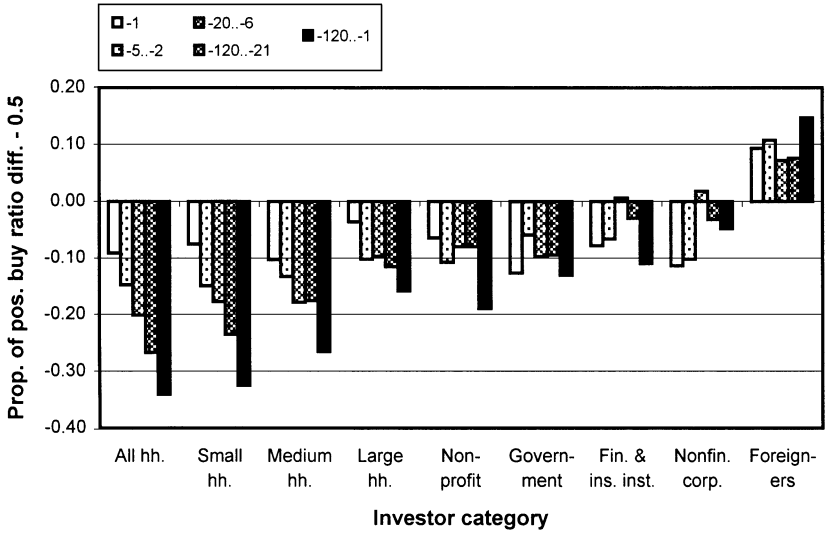

Fig. 1. Analysis of momentum and contrarian behavior of the investor categories using unadjusted buy ratio differences. The figure, a graphical representation of Table 3, graphs the proportion of buy ratio differences less 0.5 for each investor category and for each of the five past-return horizons. Each grouping of bar figures represents one investor category and each bar in the graph represents a horizon. The legends for the horizons are at the right. " -1" is the trading day prior to day t, while those labeled " $-m..-n$" are the returns cumulated from m trading days prior to day t until n trading days prior to day t.

All of the Finnish investor categories are probably less sophisticated than the foreign investors. Foreign investors tend to be well capitalized foreign financial institutions with a long history of successful investment in other stock markets. This category is generally composed of mutual funds, hedge funds, and foreign investment banks. Foreign investors alone tend to be momentum investors over all horizons. This is dramatically illustrated in Fig. 1, which shows that the proportions of positive buy ratio differences exceeds 0.5 only for the foreign investors.

In addition to analyzing which investors exhibit momentum behavior and which exhibit contrarian behavior, we also examine the symmetry and beta risk of the investment strategies followed by each category. In unreported work, we analyze whether investor categories exhibiting momentum behavior tend to buy winners more than they sell losers, and vice versa for the contrarian investor categories. The results for all investor categories appear fairly symmetric.

To assess whether overall market movements affect purchases and sales, we compute the correlation between the day t buy ratio differences, based on the six-month past return, and the day t market returns. Only the foreigners' correlation is significant. The significant correlation appears to be driven by

Nokia A and K shares, which have a combined market value of more than one-fourth of the market capitalization of the Helsinki Stock Exchange at the beginning of the sample period. The positive relation for foreigners between the buy ratio differences and market returns disappears when we exclude Nokia from the analysis.

3.4. The horizon for momentum and contrarian investing

The 'term structure of behavior' also yields interesting results. As Fig. 1 highlights, the tendency to be momentum oriented or contrarian oriented is generally quite large across both recent short past-return horizons as well as more distant and longer past-return horizons. With two exceptions out of 45, this tendency is also consistent in sign. The exceptions occur for the finance and insurance institutions and the nonfinancial corporations (the contrarian investor types that exhibit the least amount of contrarian behavior). The consistency across these horizons could indicate that momentum or contrarian behavior represents a fundamental attitude towards past returns as a determinant of buys and sells.

We must be cautious in drawing conclusions about the relative importance of each horizon from a cross-horizon comparison of the proportion of positive buy ratio differences. While it is fair to conclude that disproportionally large magnitudes for the more recent horizons imply that the more recent horizons are more important, the converse need not apply. Larger magnitudes for the more distant horizons, as exhibited by the household category, can simply be due to the larger return discrepancies between winning and losing stocks for the more distant horizons than for the more recent horizons. This is because the more distant horizons define winners and losers over a larger number of days.

3.5. The validity of alternative interpretations

One potential criticism of the view that foreign investors are momentum investors is that some classes of investors may be passively buying (or selling) the same stock throughout the sample period. For example, foreign investors might simply like to persistently purchase Nokia A because they are familiar with Nokia's consumer products or because of Nokia's listing on the New York Stock Exchange. If, by chance, Nokia A happens to be a 'winning stock' over a large portion of the sample period, then Table 3 could erroneously indicate that foreigners are momentum investors. The reported significance levels in Table 3, even with the AR(1) adjustment, do not properly account for the constant in the buy ratio difference generated by this alternative hypothesis.

To control for this alternative, Table 4 repeats the methodology in Table 3 by analyzing what we term 'mean-adjusted buy ratio differences'. An investor category's mean-adjusted buy ratio for a stock on a given day represents the

deviation of an investor's buy ratio for the stock on that day from the investor's typical buy ratio for that stock throughout the sample period. For purposes of computing a typical buy ratio, we average the investor category's daily buy ratios for the stock throughout the sample period excluding a window of up to 240 days around the day that is being mean-adjusted. The exclusion window is necessary to avoid having behaviorial patterns with respect to six-month past returns contaminate the mean adjustment.

To understand this exclusion window, note that a momentum investor who buys a stock on day t might be doing so in response to a high return on that stock observed anywhere between days $t-1$ and $t-120$. If the high return generating the winning classification occurs on day $t-120$, none of that investor's buy ratios from days $t-1$ and $t-120$ can be viewed as representing normal trading activity that is unaffected by momentum. Similarly, if the high return generating the large day t buy ratio occurs on day $t-1$, all of the buy ratios over the subsequent 120 days would also be pushed higher and thus could not be used to determine normal buying activity in that stock.

Formally, the mean-adjusted buy ratio for investor category i, stock s, and day t is the difference between the unadjusted buy ratio for investor category i, stock s, and day t and the average buy ratio for investor category i and stock s for the period December 27, 1994 through December 30, 1996, except for the days in the sample period within the interval $[t-120, t+120]$.

The mean-adjusted buy ratio differences for past winning and losing stocks in Table 4 are similar to those in Table 3. Table 4 indicates that foreign investors tend to be momentum investors and that households tend to be contrarian. The term structure results are largely consistent across Tables 3 and 4 as well.

An alternative way of illustrating that the statistical significance levels for the patterns observed in Table 3 are not driven by repeated purchases of a favorite stock that by chance went up in value is to look at the buy ratios on a stock-by-stock basis. As a further check on the robustness of Table 3, we examine whether an investor class tends to have a higher buy ratio in a given stock on days when its past return labels the stock as a 'winner' than on days when its past return labels it a 'loser'. Although there is no rigorous statistical method for aggregating the results across stocks, household investors have higher buy ratios when the stock is a winner than when it is a loser (as measured by the full six-month past-return horizon) for only three of the 16 stocks, while foreign investors have higher buy ratios following winning periods versus losing periods for ten of the 16 stocks. For the shortest horizons, the results are even stronger. These unreported results are qualitatively consistent with the results in Tables 3 and 4.

3.6. Robustness tests

We perform three unreported robustness checks on our results. First, we measure buy ratios using the number of buy transactions and sell transactions as

Table 4
Analysis of momentum and contrarian behavior of the investor categories using mean-adjusted buy ratio differences

For 1995–1996, the table reports the fraction of positive daily 'mean-adjusted' buy ratio differences for nine categories of investors, along with the significance level of a two-tailed binomial sign test that the fraction of positive differences is one-half. Each daily buy ratio [(buy volume)/(buy volume + sell volume)] is first mean-adjusted by subtracting the average buy ratio for the stock and investor category over the whole 1995–1996 sample period excluding a window of days for day t consisting of days $t-120$ through $t+120$ inclusive. Each of the mean-adjusted buy ratios for the 16 share classes in Table 1 is grouped with the mean-adjusted buy ratios of stocks in the same momentum class and averaged. Each day's mean-adjusted buy ratio difference is generated by subtracting the average mean-adjusted buy ratio for stocks with past returns in the loser quartile from the average buy ratio of stocks with past returns in the winner quartile. The past returns used for ranking a stock are based on various contemporaneous or prior return intervals relative to day t. These return intervals are given as the column heads. The column labeled '-1' has winner/loser rankings based on the return from the trading day prior to day t, while those labeled '$-m..-n$' are based on returns cumulated from m trading days prior to day t until n trading days prior to day t. In the absence of momentum or contrarian behavior, the average mean-adjusted buy ratio difference should be zero and the fraction of measured positive mean-adjusted buy ratio differences should be one-half. The binomial sign test assumes that the mean-adjusted buy ratio differences follow a first-order autoregressive process in which the probability of two consecutive buy ratio differences of the same sign is given by the sample proportion. Zero mean-adjusted buy ratio differences are dropped as sample points from this calculation.

Investor category	Proportion of positive buy ratio differences					Binomial test p-value				
	Past performance period (days)					Past performance period (days)				
	-1	$-5..-2$	$-20..-6$	$-120..-21$	$-120..-1$	-1	$-5..-2$	$-20..-6$	$-120..-21$	$-120..-1$
Households — all investors combined	0.395	0.335	0.303	0.235	0.173	0.000	0.000	0.000	0.000	0.000
Households — small portfolio size	0.429	0.367	0.319	0.249	0.195	0.003	0.000	0.000	0.000	0.000
Households — medium portfolio size	0.384	0.349	0.304	0.315	0.231	0.000	0.000	0.000	0.000	0.000
Households — large portfolio size	0.457	0.408	0.410	0.420	0.382	0.068	0.001	0.001	0.002	0.000
Nonprofit institutions	0.446	0.429	0.464	0.445	0.388	0.029	0.006	0.160	0.043	0.000
General government	0.411	0.463	0.434	0.410	0.361	0.000	0.186	0.020	0.003	0.000
Finance and insurance institutions	0.432	0.428	0.508	0.468	0.398	0.002	0.002	0.732	0.188	0.000
Nonfinancial corporations	0.386	0.386	0.520	0.444	0.440	0.000	0.000	0.380	0.012	0.009
Foreign investors	0.573	0.592	0.566	0.568	0.643	0.001	0.000	0.005	0.004	0.000

opposed to buy volume and sell volume. Second, we test significance levels for mean buy ratio differences as well as for the average of each day's correlation and covariance between the buy ratio vector for all stocks and the vector of the cross-section of past returns. In both cases, the results are highly similar to those presented in the paper.

Third, the pattern of behavior that is observed across investor categories is consistent when we divide the sample period in half and analyze the subperiods separately. The signs and significance of the pattern are largely the same in both 1995 and 1996. The interesting change in magnitudes between the two years is discussed later in the paper.

4. Performance across investor categories

In the last section we show that the degree to which an investor category exhibits momentum is monotonically related to that category's sophistication. This finding invites us to ask whether sophisticated investors pursue momentum strategies in order to achieve superior performance. First, we investigate whether there are differences in performance between the investor categories. Second, we analyze whether momentum behavior is likely to generate superior performance, both in the past and within our two-year period.

4.1. The performance measure and test statistics

We measure performance by examining whether the buy ratio of future winning stocks exceeds the buy ratio of future losing stocks. The actions of the investor who generates performance with this measure are consistent with that investor being able to forecast which stocks will outperform others over a six-month horizon. (Though not reported here, the results for three-month future horizons are essentially the same.) With two years of data, it would be inappropriate to employ the traditional method of evaluating performance based on six-month excess returns. There are too few returns of this length to generate any inferences. Hence, we instead make use of the relative independence of the daily buy–sell decisions of investors (using test statistics derived from a prewhitening of the daily buy ratio series for first-order autoregression).

We define performance on day t for an investor category as the difference between the buy ratio of the four stocks with future returns that are in the top quartile (of the 16 stocks) less the buy ratio of the four stocks with future returns that rank in the lowest quartile. If this difference is positive, the buy ratio for future winning stocks exceeds the buy ratio for future losing stocks, indicating that the investor category is a superior performer on day t.

Future returns for day t are computed by cumulating daily returns between days $t+1$ and $t+120$. Put another way, measuring performance is like

measuring momentum investing with respect to six-month returns, except the arrow of time is in reverse.

A category's overall performance is measured as the fraction of days for which the buy ratio difference (based on future winners versus losers) is positive.[5] If the fraction of days exceeds 0.5, the investor category is regarded as a superior performer. Otherwise, the category represents a nonperformer. The nonparametric test statistics, which are based on the number of positive buy ratios, are analogous to those in Table 3, and make use of the AR(1) adjustment.[6]

Priced risk is largely addressed by looking at the difference in the ratios for two portfolios of stocks with large market capitalization. It is true that a manager who consistently buys high-risk stocks and sells low-risk stocks will 'game' our performance measure and, at least asymptotically, spuriously tend to exhibit superior performance (note that such a strategy consistently tends to increase the risk of the portfolio, which is unlikely). The same is true for a strategy of buying a stock at a time when the stock is riskier than normal and selling the same stock when its risk decreases. However, it is unlikely that the cross-sectional differences in ex-ante mean returns across the 16 stocks and over time are large enough to game our statistical tests. Recall that Table 1 indicates that a typical Finnish stock has a standard deviation of about 10% over a one-month period. This is so large that it is virtually impossible to distinguish any stock's average return from the risk-free return, let alone make distinctions between the risk premiums of the 16 largest Finnish stocks that would be of sufficient size to game our tests. In short, differences across stocks in realized future returns are not determined by mean return differences tied to risk.

It follows that under the null hypothesis of no performance ability, the expected buy ratio difference for investment strategies that seek to game the absence of a risk adjustment, while above zero, is negligibly above zero. In addition, the standard deviation of the buy ratio differences under the null is likely to be large. The results that we will present shortly are quite strong — indeed, they are orders of magnitude larger than any risk-related bias that can be imagined by a skeptic, let alone any bias that exists in reality.

[5] As a robustness check, we also measure performance as the Pearson correlation between the 16-element buy ratio on day t and the 16-element vector of future returns or the 16-element vector of future return ranks. The results are largely the same, and, if anything, slightly stronger with this alternative approach.

[6] We examine the residuals from an AR(1) regression of buy ratio differences for a strategy based on the performance rankings that use returns from the future six months. The proportion of continuations in the signs of residuals is for no time period or investor category significantly different from 0.5 at the 5% level, suggesting that the AR(1) is an adequate specification of the buy ratio difference process.

To ascertain the degree to which performance is driven by momentum, we also compute the difference in buy ratios for future winning stocks and future losing stocks, where winning and losing is based on momentum-adjusted future returns rather than the raw returns per se. The momentum adjustment subtracts the return over the same six-month future period of an equally weighted portfolio of the remaining stocks in the same momentum class as the stock being analyzed before classifying future winning and losing stocks.

The specifics of the momentum-based return adjustment are as follows. If a six-month future return begins on day t, a stock's momentum class is determined by whether the stock's return from day $t-120$ to day $t-1$ (about six months) places the stock among the top four past-return performers, the bottom four past-return performers, or the middle eight performers. The momentum-adjusted return for the stock over the six-month period from t to $t+120$ is the stock's actual return from t to $t+120$ less the average of the six-month future returns (that begin on day t) of the three (or seven) alternative stocks in the momentum class portfolio to which the stock belongs on day t.

4.2. Results

Table 5 reports the fraction of positive buy ratio differences. In contrast to Table 3, winners and losers for the buy ratios are determined by top and bottom quartiles of future returns. The first column's buy ratio difference proportions are computed from rankings based on future raw returns; the second column is based on rankings of momentum-adjusted returns.

The story is parallel to that in Table 3. Foreign investors, who follow momentum strategies, have positive average performance, as exhibited by the abnormally high proportion of positive buy ratio differences. The buy ratio differences based on the raw future returns are positive 56% of the time, which is statistically significant at the 5% level. The next most sophisticated category of investor, the finance and insurance institutions, are short-run contrarians and are neutral with respect to long-term past returns. They too exhibit significant performance with positive buy ratio differences 55% of the time.

Household investors, who follow contrarian strategies, have negative average performance, as exhibited by the buy ratio differences. The unadjusted buy ratio differences for all households are positive 44–46% of the time depending on the size of their portfolios.

It is important to recognize that the results for foreign investors are not driven by trades on the New York Stock Exchange that occur after the close of trading of the Helsinki Stock Exchange from which returns are taken. Skipping a week before computing the future returns that determine winning and losing stocks generates virtually identical performance numbers and significance levels, not only for the foreign investors but for the finance and insurance institutions as well. Moreover, the vast majority of our stocks trade every day and typically

Table 5
Analysis of performance of the investor categories using buy ratio differences

For 1995–1996, the table reports the fraction of positive daily buy ratio differences for nine categories of investors, along with the significance level of a two-tailed binomial sign test that the fraction of positive differences is one-half. Each daily buy ratio [(buy volume)/(buy volume + sell volume)] for the 16 share classes in Table 1 is grouped with the buy ratios of stocks in the same future performance class and averaged. Each day's buy ratio difference is generated by subtracting the average buy ratio for stocks with future six-month returns (or momentum-adjusted returns) in the loser quartile from the average buy ratio of stocks with future six-month returns (or momentum-adjusted returns) in the winner quartile. In the absence of performance, the average buy ratio difference should be zero and the fraction of measured positive differences should be one-half. The binomial sign test assumes that the buy ratio differences follow a first-order autoregressive process in which the probability of two consecutive buy ratio differences of the same sign is given by the sample proportion. Zero buy ratio differences are dropped as sample points from this calculation. The momentum adjustment substracts the return, computed over the same future ranking interval of an equally weighted portfolio of the remaining stocks in the same momentum class (top quartile, middle two quartiles, or bottom quartile) as the stock being momentum adjusted. If a buy ratio is computed for day t, the ranking for the momentum class is determined by the stock's cumulative past return from trading day $t-120$ to day $t-1$.

Investor category	Proportion of positive buy ratio differences		Binomial test p-value	
	Future performance period, days $+1..+120$		Future performance period, days $+1..+120$	
	Unadjusted performance	6-month mom. adj. performance	Unadjusted performance	6-month mom. adj. performance
Households — all investors combined	0.448	0.398	0.044	0.000
Households — small portfolio size	0.460	0.386	0.118	0.000
Households — medium portfolio size	0.438	0.435	0.011	0.008
Households — large portfolio size	0.438	0.401	0.015	0.000
Nonprofit institutions	0.452	0.436	0.133	0.031
General government	0.475	0.438	0.411	0.040
Finance and insurance institutions	0.552	0.548	0.026	0.031
Nonfinancial corporations	0.506	0.502	0.795	0.931
Foreign investors	0.556	0.568	0.022	0.005

many times a day. Hence, we do not believe that infrequent trading affects any of our results.

The momentum-adjusted performance numbers are generally either identical to or stronger than the unadjusted performance numbers.[7] This could only be the case if momentum strategies do not work, perhaps because, in any two-year period, momentum strategies may or may not produce superior returns, or perhaps because Finland, like Japan, is an anomalous case in the world financial markets, being one of the few countries where momentum does not work. As it turns out, it is the former interpretation that is correct. Momentum does not work in 1995–1996 largely because the magnitude of the negative performance generated by momentum investing in 1996 is at least as large as the magnitude of the positive performance earned in 1995.

In sum, towards the end of 1994, an investor who was sophisticated at statistical analysis would have concluded from historical observation of the prior 24 yr that the six-month ranking period/six-month holding period momentum strategy analyzed in Jegadeesh and Titman (1993) for U.S. stocks and in Rouwenhorst (1998) for 12 other countries would be successful at enhancing the performance of stock portfolios. While not reported here, the six-month/six-month momentum strategy has an average weekly return of 0.0016 from 1971–1994, equivalent to a return of about 8% per year. The nonparametric test of the significance of momentum generates a p-value of 0.9%. This p-value is derived from a standard two-tailed binomial sign test of whether the number of weeks in which the winner portfolio outperforms the loser portfolio could have been observed by chance with a null hypothesis that winners beat losers 50% of the time. Although this historical evidence is impressive, an investor would have found that following historical patterns would not have helped and (due to 1996) could even have hurt performance in 1995–1996.

Our hypothesis about sophistication and performance is partly buttressed by the timing of momentum and contrarian behavior (with respect to six-month past returns) across investor types. The domestic for-profit institutions became relatively more contrarian and the foreigners became relatively less momentum-oriented in 1996, when a momentum strategy was unprofitable, as compared with 1995. By contrast, all of the remaining less sophisticated categories had either no change in the degree of contrarianism from 1995 to 1996 (the small households) or noticeably reduced the contrarianism of their investment strategies in 1996 (the remaining five investor categories) when they should have become more contrarian.

[7] We document in unreported work that the results for momentum-adjusted returns are also fairly consistent across the subperiods of 1995 and 1996. Moreover, the performance results are robust to the use of mean-adjusted buy ratios instead of 'raw' buy ratios.

5. Summary and conclusion

The most sophisticated players in the financial markets in Finland are the foreign investors. An analysis of how their buys and sells relate to winning and losing stocks over various return intervals over the prior six months indicates that these investors pursue momentum strategies. By contrast, Finnish investors, particularly households, are contrarians, buying losers and selling winners. The degree of contrarianism appears to be inversely related to a ranking of the sophistication of the investor types. Sophistication is similarly related to performance, even after controlling for the effect of momentum behavior on future portfolio returns. However, not surprisingly, the performance differences, which require the ability to forecast return horizons, are weaker than the behavioral differences.

The pattern observed in Finland, in which the most sophisticated institutional investors tend to pursue momentum strategies and the less sophisticated investors seem to be contrarian, has been observed in the U.S. for a small subset of the financial market. However, we do not know if this behavior pattern extends to other investors in the U.S. markets.

Interestingly, the performance differences between the sophisticated and unsophisticated investors should increase rather than decrease if we take into account transaction costs. This is because the most sophisticated investors (foreign investors and Finnish finance and insurance institutions) who generate the highest performance probably have relatively smaller transaction costs than the least sophisticated investors (households) who generate the worst performance.

In contrast to studies of U.S. investors, our data set provides a comprehensive picture of the market for a set of large stocks. The ability to analyze the universe of trades in a stock market highlights the oft-ignored fact that if some groups of investors pursue trading strategies in which buys and sells are generated by past return differences across stocks, other investor groups must follow the opposite trading strategy. And if some investors are winners, others must be losers.

If the Finnish stock market in 1995 and 1996 is representative of earlier times, then the performance differences observed between its sophisticated and unsophisticated market participants would have been even larger than those observed in this paper. This is because contrarian behavior with respect to six-month past returns has generally been unprofitable in Finland, as is true for most other countries.

Our results could be part of a larger phenomenon in which unsophisticated investors, as a rule, are overly eager to cash out on winning stocks or to buy losing stocks or both, whereas sophisticated investors are patient enough to do the opposite. If it is true that unsophisticated investors react to past returns in this fashion, then they should similarly exhibit contrarian overreaction to other types of information, such as earnings announcements. Further investigation of

this market and future data from it could shed light on whether this hypothesis and other similar generalizations about behavior are true, and whether this has implications for modeling in behavioral finance.

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