

Who Moves Stock Prices? Monthly evidence

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February 2009

Existing evidence using US data show a simultaneous covariability between a stock's price and quarterly flows into and out of the stock by institutional investors. In this paper we use data on monthly changes in holdings by all investor groups at the Oslo Stock Exchange to show that such quarterly effects are concentrated within a month. We find a positive relation between monthly net flows into a stock by institutions and foreigners and the stock's return. We find no evidence of any effects the next month, providing evidence against the hypothesis that quarterly results are due to within-quarter feedback. Such feedback effects must be of less than one month duration. We show that offsetting net inflows by mutual funds and foreigners are net outflows by individual and nonfinancial investors. The interesting question is which of these groups are active in "pushing prices." While we can not empirically distinguish which of the various investor groups is reacting, we argue that the most reasonable story is that institutions and foreign investors are the active parties, since the prices move in the direction of these groups' trades. The lack of next-month feedback (price reversals) is consistent with prices moving toward fundamentals.

Keywords: Asset Prices, Investor Groups, Mutual Funds, Herding, Feedback.

JEL Codes: G10, G20

Introduction

Empirical evidence has accumulated of co-movements between a stock's price and flows in or out of the stock by certain investor types. The best known example is the evidence that a stock's price go up during a period when institutional investors as a group increase their holdings in the stock. There are two main hypotheses being investigated. One is that the observed behaviour is driven by informed traders moving prices toward their fundamental values. The alternative hypothesis is that the observed behaviour is a result of herding, correlated trading by certain investor groups pushing prices temporary away from fundamental values.

In our study of the Oslo Stock Exchange we find clear evidence of simultaneous movement of asset prices and movements in and out of the stock by certain types of investors. We show

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that there is a difference between the trades of financials and foreigners on the one hand and individual investors and nonfinancials on the other hand, with the trades of the former group co-varying positively with returns, and the trades of the latter group co-varying negatively.

Our study intersects several strands of empirical literature. First, there is a large literature on trading of mutual funds, starting with Lakonishok, Shleifer, and Vishny (1992), followed by e.g. Wermers (1999), Nofsinger and Sias (1999) and Sias, Starks, and Titman (2006). This literature shows that a stock's price moves simultaneously with movement in and out of the stock by institutional investors. The price follows the direction of trade by institutions: When institutions are buying, the stock price is going up in the same period. Most of this literature relies on quarterly observations of institutional holdings, since this is the interval at which institutions have to report. Secondly, we relate to a literature on the effects of foreign investors on a stock market, in particular analyzing the impact of foreign investors on information production, such as Kang and Stulz (1997), Dahlquist and Robertsson (2001) and Covrig, Lau, and Ng (2006). The third strand of literature we contribute to analyzes the trading behaviour of individual investors, much of it behaviorally based, arguing that (some) individuals tend to trade less rationally than other investor types (Barber and Odean (2000) is a prominent example).

Our paper contributes to all of these literatures, primarily due to our data on the complete holdings of all owners at the Oslo Stock Exchange over a 18 year period, most of the time with monthly observations. The fact that we have monthly observations rather than the quarterly observations used in most US studies of mutual funds allow us to look more closely at the timing of trading, and conclude that the quarterly effects found in US papers are concentrated within a month. Relative to studies of individual investors behaviour we have much more complete data, since we have access to the holdings of *all* individual investors, not merely a sample of individuals, for example the customers of one broker, used in the typical US studies.

There are thus three important ways in which we contribute to the literature. First, we show to what extent the typical US results are true in a different market, the Oslo Stock Exchange. Second, we look at *all* investors on the exchange simultaneously, we are not just looking at e.g. the group of institutional investors. Thirdly, we have this complete data at a monthly, rather than quarterly frequency. We also have the data for a relatively long time period, from 1992 to 2007.

The paper is structured as follows. Section 1 discusses the theoretical setting and gives some references to relevant empirical studies. Section 2 gives a short overview of the data sources. In section 3 we provide descriptive statistics for the ownership on the OSE and analyze the determinants of ownership by various investor types. Among the more interesting results are evidence on the composition of the portfolios of foreign and institutional investors, which we show to concentrate in larger firms with higher liquidity and lower ownership concentration. This behaviour is consistent with evidence from other markets. We show that the offsetting groups of investors are individual investors and nonfinancial (corporate) investors, which are overrepresented in smaller firms with low liquidity and concentrated ownership. Section 4 contains the most important results of the paper, documenting contemporaneous comovement between

monthly stock returns and movements in or out of the stock by different investor groups. We show that stock prices increase the same month that institutional and foreign investors increase their holdings in a stock and individuals and nonfinancials decrease their holdings. We also show that there is no lagged effect, next month returns are not affected by the previous month's change in ownership composition. In section 5 we control for differences in risk characteristics of the portfolios of the various owner types, by redoing the analysis using returns in excess of an asset pricing model, showing that the results are not sensitive to risk adjustments. Section 6 offers a short conclusion.

1 Theoretical and empirical background

This paper concerns the behaviour of different types of investors, whether investors of a particular group behave in a correlated manner, and whether such correlated behaviour by specific groups affect asset prices. Most of the relevant theoretical literature concern trading by institutional investors. Let us therefore start by using this perspective, and look at whether the trades of institutional investors are correlated, or alternatively, whether institutions “herd.” By herding we mean situations where the decisions of individuals depend on observing the actions of others. Note that this definition rules out what Bikhchandani and Sharma (2000) call “spurious herding,” that individuals move together because they observe correlated signals about fundamentals. This is of course the implication of any model of informed trading, that prices move in the direction of informed trades. If we observe the trades of a group of informed investors we will observe that prices move together with trading.

Herding behaviour concerns cases where information about other market participant's behaviour is more important than other information. The words “herding” and “fad” have a flavor of irrationality, but this does not need to be the case. In fact, most theoretical models of herding behaviour have rational actors. There are a number of reasons that rational institutional investors may look more to the behaviour of its fellow institutions in choosing investment portfolios. First, institutional investors may not want to “stand out from the crowd,” they are afraid of the reputational cost of following a different strategy from their fellow managers (Scharfstein and Stein, 1990). Second, institutional traders may make inferences from the trades of their fellow managers, believing they are better informed, and follow their trading patterns (Bikhchandani, Hirshleifer, and Welch, 1992). Finally, institutional investors may share preferences for stocks of certain characteristics, such as highly liquid stocks (Falkenstein, 1996). However, herding and fads may also be a result of irrational behaviour, see the surveys of Bikhchandani, Hirshleifer, and Welch (1998) and Hirshleifer and Teoh (2003).

While the theoretical literature on herding and related issues is large, with many different models, empirically differentiating the various models is difficult. The models tend to have similar empirical implications, that stock prices follow the trades of the group in question. In our work we will focus on one critical difference in time series behaviour. If trading by one investor group, such as institutions, tend to destabilize prices, we would expect to see temporary movements away from the equilibrium price, ie. we should observe stock increases followed by

decreases, and vice versa (Scharfstein and Stein, 1990). On the other hand, if institutional trading act to stabilize prices, we should not see any reversals of price movements following fund trading (Hirshleifer, Subrahmanyam, and Titman, 1994).

The empirical literature on herding and mutual fund trading is voluminous. Lakonishok et al. (1992) is one of the first empirical studies using data on mutual fund portfolio compositions. They find some evidence of contemporaneous covariability of mutual fund trading and returns, concentrated in small stocks. Warther (1995) argues that it is the unexpected cash flow in and out of mutual funds which is important. Using larger samples of institutional holdings, Wermers (1999) using quarterly data, and Nofsinger and Sias (1999) using annual data, both find strong evidence of a contemporaneous covariability between changes in mutual fund holdings and equity returns. Sias et al. (2006) find that quarterly returns covary with changes in institutional ownership. By decomposing quarterly returns they argue that the most likely cause of the covariability is institutional trading moving prices. Cohen, Gompers, and Vuolteenaho (2002) uses institutional trading following cash flow news to argue that institutions tend to move stocks in the “right” direction (toward fundamentals). Edelen and Warner (2001), using daily data on aggregate flows into US equity funds, find a strong concurrent relation between flows and returns. They conclude that this relation is due to flows affecting returns, and that the magnitude of the relation corresponds to estimates of price impact of institutional trading. Similar conclusions are reached by Griffin, Harris, and Topaloglu (2003) using high frequency data. Sias (2004) argues that institutions tend to herd because they infer information from each other. There is also a recent literature which intersect institutional trading with market microstructure, by utilizing high frequency data, see Cambell, Ramadorai, and Schwartz (2009) for a summary of this literature.

Most of the evidence on mutual fund trading looks at US data. There are some exceptions. Walter and Weber (2006) uses a sample of German funds. Chen and Hong (2006) uses daily data on mutual fund holdings in Taiwan. Grinblatt and Keloharju (2000) uses data from Finland which is similar to our dataset, and actually contains data of higher frequency, although only 3 years of data. Their focus is more on momentum strategies and similar feedback strategies based on actual holding periods of investors. There is also a number of investigations using data from Sweden at the level of individual households, see for example Calvent, Campbell, and Sodini (2007, 2008), but this has a different focus from the present paper.

As mentioned in the introduction, we also intersect with questions where the distinction between foreign and domestic investors is important, such as international asset pricing and the question of home bias (Lewis, 1995, 1999). Much of this literature is concerned with the level of foreign investment. In our work we are however more interested in crosssectional differences across stocks in foreign investment. This question is much less studied, to some degree due to lack of data. Notable exceptions include Kang and Stulz (1997), Choe, Kho, and Stulz (1999), Dahlquist and Robertsson (2001, 2004) and Covrig et al. (2006). These studies show that foreign investors in a stock market are predominantly financial investors, such as mutual funds. Their crosssectional choices seem to be motivated by liquidity, foreign investors tend to concentrate in

stock of large firms with liquid stock.

Finally, the third literature we intersect with is the empirical literature on trading behaviour of individual investors, which is more recent, and much of it is behaviorally based.¹ A well known starting point for this literature is the documentation that individual owners tend to trade too often (Barber and Odean, 2000). Kaniel, Saar, and Titman (2005) show that at high frequency individual traders tend to be contrarians. Similar findings is shown by Jackson (2003) using Australian data. Using data from Germany, Dorn, Huberman, and Sengmueller (2004) show evidence of of herding by individual investors. Grinblatt and Keloharju (2001) show that individuals are influenced by tax concerns. A number of recent papers considers both institutional traders and individual traders, asking who is most influential in moving prices, and who gains. Barber, Lee, Liu, and Odean (2005a) uses data from Taiwan to argue that individual traders lose to institutional traders. Barber, Odean, and Zhu (2005b) and Hvidkjaer (2006) uses US microstructure data to ask this question, but they are forced to use order size to classify trader type. Using holdings data for the US, San (2005) compares the gains from trading for individual and institutional trading and finds much less evidence that individual traders are on the losing side. Boyer and Zheng (2009) also looks at the interaction between investor groups, but they actually have access to data for all investors in the market, albeit at a quarterly frequency.

The issues we can consider in the present paper are driven by our available data, namely monthly observations of the complete holdings of all stock market participants on the Oslo Stock Exchange. With this data we observe changes from one month to the next, allowing us to construct various measures of movements between investor groups. The monthly frequency, and our access to data on *all* investors, not just mutual funds, is a significant improvement on the quarterly data on institutional holdings used in many of the empirical studies of US data. In our work we relate monthly changes in portfolio compositions to stock returns, and ask questions relevant at the monthly frequency. In particular, we will ask whether the quarterly comovement observed in other studies is a simultaneous movement within a month, or whether it is feedback effects of more than one month's duration. An important feature of our data is that we observe the holdings of all owners, not just the institutional owners. This mean we can look at the overall effects when one group of owners is increasing or decreasing its stake in a stock. Who takes the "slack"? While we can make some observations here, the monthly frequency of the holdings data does limit our ability to consider intra-month effects, in particular testing for causality between owner types at high frequencies, but our data is still a significant improvement on most existing data sets.²

¹This literature intersects with the literature on household finance as recently surveyed by Campbell (2006).

²The only countries with data similar to ours are Sweden and Finland. Our Norwegian data covers a longer time period than what has been used so far for these countries.

2 Data

This paper uses data from the Norwegian equity market for the period 1989 to 2007. We use two types of data. One is data on corporate ownership from the Norwegian Securities Registry (VPS). This registry was created by law, imposing that all trades in listed shares have to be electronically registered here. The only exception is that foreign investors are allowed to use a nominee account with an international securities firm, where only the aggregate holdings with the nominee are registered with the Norwegian Securities Registry. From the Securities Registry we have access to annual (1989-1992) and monthly (1993-2007) data. At each date we observe the number of stocks owned by every owner. While the data is anonymized, each owner has a unique identifier which allows us to follow the owners' holdings over time, and a sector code that allows us to distinguish between such types as mutual fund owners, financial owners (which include mutual funds), industrial (nonfinancial corporate) owners, private (individual) owners, state owners and foreign owners. It is worth emphasizing that this information is never completely revealed to the market in general. Only other owners of the same stock may (for a fee) get the owner list for that stock. Breakdowns of the fraction owned by the owner types we analyze are published on a monthly basis, but not for individual stocks, only for the aggregate market.

In addition to the data on equity ownership we use market data from the Oslo Stock Exchange Data Service (OBI). This source provides stock prices and accounting data, allowing us to construct return series and calculate accounting based firm characteristics. The number of companies on the exchange has increased from 141 in 1989 to 241 in 2007. To avoid problems due to bid ask bounce and stale observations we require the stocks used in the analysis to have a price above NOK 10 (About USD 1.50) and have actual trades a minimum of 20 days during a year. This filter removes an average of 32 stocks per year.³

3 Crosssectional determinants of investment behaviour by different owner types

Our data from the securities registry allow us to split equity owners into five mutually exclusive groups: financial, individual, foreign, nonfinancial and state owners. We are also able to identify which of the financial owners are mutual funds. Given the focus on mutual funds in the literature, we include these as a separate group. Our data on foreign ownership does not distinguish between types of foreign investors. We can therefore not distinguish between foreign financial owners and other foreign owners. However, from other sources we do know that much of the international ownership is by financial (institutional) owners.⁴

Let us first look at the ownership fractions of the various owner groups used in this study. In figure 1 we show time series plots of the average fraction of each company held by the different owner types. While there is some time series variation, the fractions have remained remarkably

³Ødegaard (2007b) provides details about asset pricing data at the Oslo Stock Exchange.

⁴We refer to Bøhren and Ødegaard (2001) for more details about the ownership structure of the OSE.

stable in the period. Financials have held an average of 17% over the period. The fraction of this which is mutual funds has increased from about 2% at the beginning of the period to close to 8% at the end. Foreign ownership has varied between a fourth and a third, with a marked increase in most recent years. This increase in foreign ownership in the last few years seem to have been at the expense of individual owners, which have seen a matching decrease in the last few years, from 25% to 15%. The fraction held by nonfinancials has been stable throughout the period.

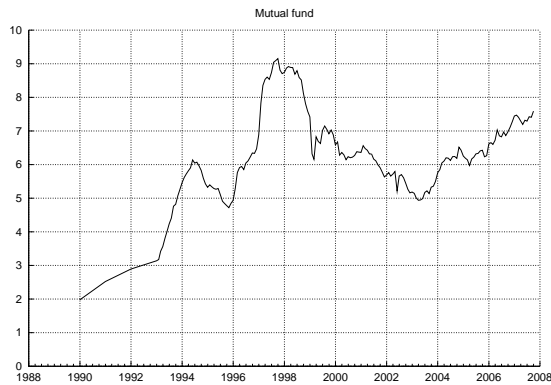
Let us discuss public (state) ownership of Norwegian companies in some more detail. As shown in the graph in the lower left of figure 1, the average public ownership is low, about 5% of the average firm is held by state owners. However, this number hides some diversity. Public ownership is of two types: One is ownership by public pension funds. Such funds behave like the typical institutional investor, focusing on returns. However, there is a second type of state ownership, where the state keeps a direct stake in a few companies viewed as important for the Norwegian economy. Essentially, this concerns four companies. Throughout the analysis period, the state held a 49% stake in Norsk Hydro, a metals and oil company. In 1993 the state took ownership of DnBNOR, the largest Norwegian bank, in the aftermath of a banking crisis. This stake has since been gradually reduced. In 2001 two very large companies were privatized and introduced on the OSE. These were Telenor, the state telecom, and Statoil, the state oil company. The effects of these privatizations are illustrated in figure 2, which shows what fraction of the value of the exchange is held by different owner types. In terms of value, the public ownership jumped from 15% to 35% in 2001, a jump purely due to these two privatizations. While the state has a large stake in the exchange, for the purposes of the present paper we will ignore it. We are concerned with the dynamics of changes in ownership. For the four large companies where the stake holds a strategic stake, this stake changes very seldom. For the other companies, where the stake is due to public pension funds, there is also little dynamics in the state ownership. In this paper we will therefore concentrate on the other owner types.

In addition to simply looking at the levels of fraction owned by the various types, we characterize further the investment behaviour of the various owner types. Doing so will give some perspectives on the results linking returns and ownership composition movements, in particular it will show the need for adjusting any returns for firm characteristics related to risk, since the riskiness of portfolios may vary across owner types if the portfolio composition is different. Our evidence on the behaviour of different investor types is however of interest in itself, since it is data which are unavailable in most stock markets.

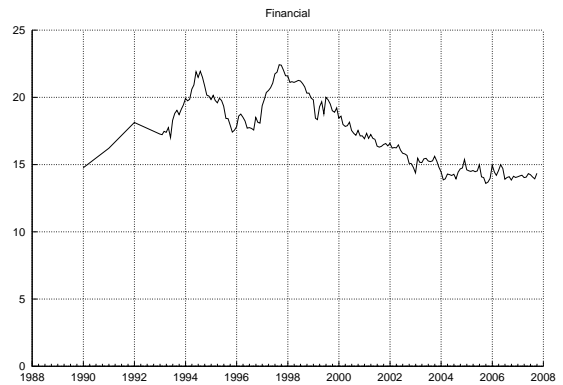
We first, in table 1, split the stocks on the exchange into quartiles by a large number of stock and company characteristics, and show the average ownership fractions for the quartiles.⁵ In panel A we split the stocks on the exchange in four groups based on firm size. We see that financial owners (including mutual funds) and foreigners tend to concentrate their holdings in larger firms. This confirms evidence in e.g. Dahlquist and Robertsson (2001) on the investment

⁵A number of companies on the Oslo Stock Exchange has dual-class equity, both voting and nonvoting equity. For these companies we aggregate the characteristics to the company level. See Ødegaard (2007a) for further details about dual-class equity.

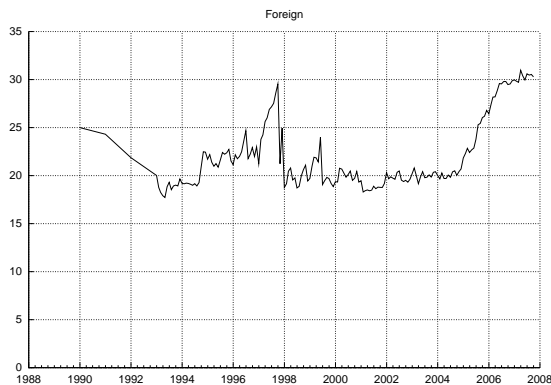
Figure 1 Average ownership fractions of different owner types at the Oslo Stock Exchange



Mutual funds



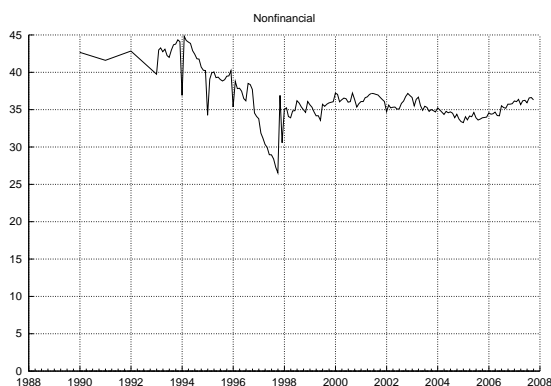
Financials



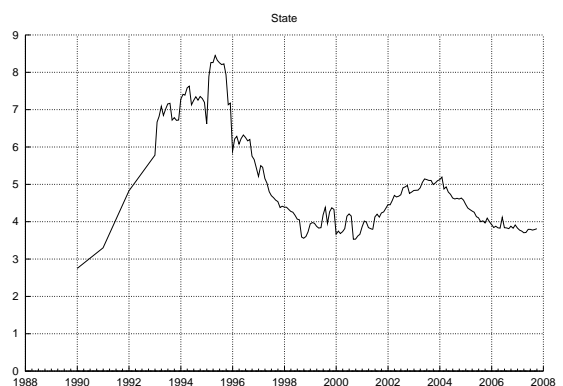
Foreign



Individual



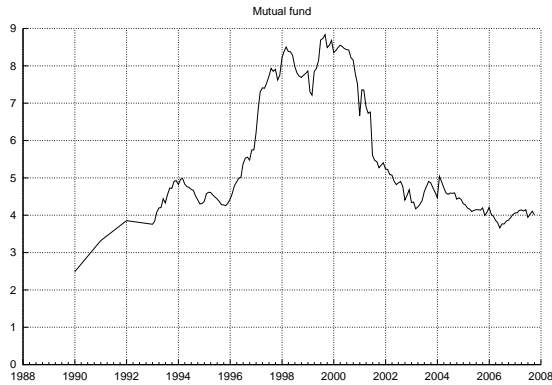
Nonfinancial



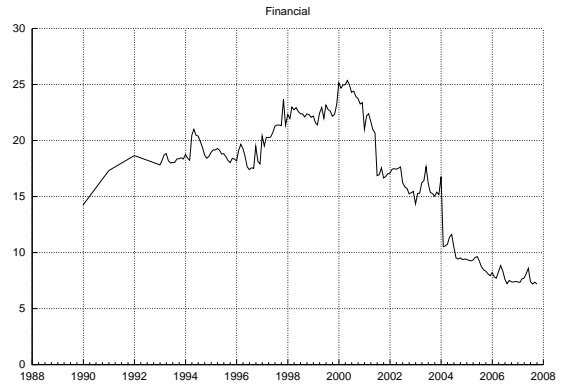
State

The figures shows percentage fractions of the outstanding equity at the stock exchange owned by the six different owner types. For each owner type we calculate what percentage of the firm's equity is owned by the given type. We then aggregate across stocks by calculating equally weighted averages. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds.

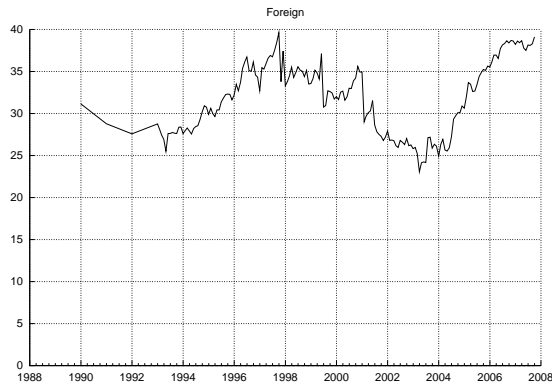
Figure 2 Fractions of OSE owned by different owner types



Mutual funds



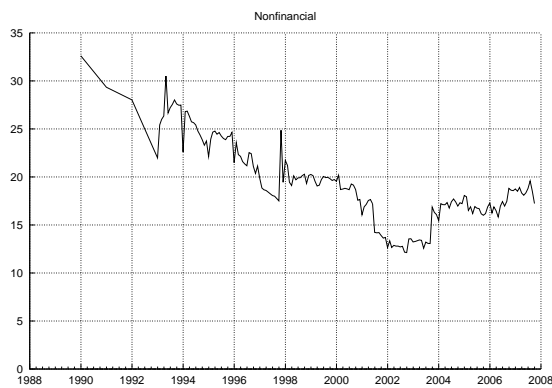
Financials



Foreign



Individual



Nonfinancial



State

The figures shows percentage fractions of the outstanding equity at the stock exchange owned by the six different owner types. For each owner type we calculate what percentage of the firm's equity is owned by the given type. We then aggregate across stocks by calculating value weighted averages, where the firm market value is used for value weighting. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds.

behaviour of foreign owners and Gompers and Metrick (2001) on the composition of the portfolios of financial owners. The state also tends to invest most in the largest firms, a result which is driven by the state's large stake in some of the largest companies on the exchange.

In Panel B of table 1 we have grouped firms by listing age, time listed on the exchange. There is no clear pattern here, except a slight over-weighting by financials in older firms.

The corporate governance characteristics of the firms on the OSE are proxied by a measure of ownership concentration. We use a Herfindahl index to measure ownership concentration.⁶ In panel C of table 1 we have grouped firms into four groups sorted by the concentration of the firm's ownership. Here the same pattern is evident as was seen for firm size. Financial and foreign owners tend to invest more in firms with less concentrated ownership. This is offset by the over-weighting of nonfinancials and individual owners in more concentrated firms.

Another important characteristic relevant for stock investment is the stock's liquidity. In panel D of table 1 we use stock turnover as a liquidity measure and group the stocks according to monthly turnover. We see that financial and foreign owners tend to focus on the more liquid stocks.

We also consider a number of characteristics relevant for stock risk. Panel E of table 1 groups firms by the volatility of the firm's stock. The clearest patterns are that financial owners as a group tend to prefer the least volatile stocks, while nonfinancial owners are more into volatility, with an overweight of volatile stocks. Panel F of table 1 groups firms by an estimate of the systematic risk of the firm's equity, measured by stock beta. The clearest pattern in this table is that individual and nonfinancial owners concentrate in the group of lowest beta stocks, while foreign owners do not seem to mind beta risk, as they are concentrated in equities with high beta. Finally, in panel G of table 1 we group firms by book/market ratio. While there are some differences across owner types they seem to be nonsystematic.

The picture that appears from this table is that financial and foreign investors tend to invest more in larger firms with less ownership concentration, lower volatility, and higher stock liquidity. These characteristics are of course correlated. Larger firms tend to have more liquid stocks and less concentrated ownership.

To summarize and formalize the impressions in table 1 we perform a series of regressions with the ownership fraction by the various owner types as dependent variables and the various characteristics shown in table 1 as explanatory variables. The results are shown in table 2 and confirms the results in table 1. For example, mutual funds tend to invest in larger firms with lower B/M ratios, lower concentration, higher liquidity, lower stock volatility and higher beta. Most of these results are in line with findings from other markets, such as Gompers and Metrick (2001) on mutual funds and Dahlquist and Robertsson (2001) on foreign ownership.

⁶The Herfindahl index is the sum of the squared ownership fractions of the firm's owners. It has a maximum of 1 when one owner owns the whole firm, and decreases as the ownership becomes more diffuse. See Bøhren and Ødegaard (2000) and Bøhren and Ødegaard (2001) for further discussion and a comparison with other concentration measures at the OSE.

Table 1 Ownership fractions split by firm characteristics

Panel A: By Firm Size

Owner type	All firms	Firm Size Quartile			
		1 (smallest)	2	3	4
Financial	17.2	13.2	16.9	18.9	20.0
Mutual fund	6.4	3.5	6.6	7.7	7.9
Individual	21.5	34.9	24.1	18.3	9.1
Foreign	22.2	11.3	18.5	24.7	33.8
Nonfinancial	36.1	39.9	40.7	36.7	27.0
State	4.8	2.0	1.7	3.6	11.9

Panel B: By Firm Age

Owner type	All firms	Firm Age Quartile			
		1 (youngest)	2	3	4
Financial	17.2	16.9	16.9	17.5	17.7
Mutual fund	6.4	6.1	6.7	6.1	6.7
Individual	21.5	22.9	23.8	22.2	17.0
Foreign	22.2	23.3	22.8	21.4	21.0
Nonfinancial	36.1	34.7	34.9	37.0	37.7
State	4.8	3.7	3.3	4.4	8.1

Panel C: By Ownership Concentration

Owner type	All firms	Ownership Concentration Quartile			
		1 (lowest concentration)	2	3	4
Financial	17.2	20.5	20.0	14.3	13.8
Mutual fund	6.4	7.0	8.1	5.7	4.7
Individual	21.5	36.3	21.1	16.3	11.2
Foreign	22.2	17.5	24.1	22.8	24.7
Nonfinancial	36.1	25.0	33.5	45.3	41.2
State	4.8	2.6	3.2	3.0	11.0

The tables shows average ownership fractions for the six owner types. In each table we group the firms on the exchange in quartiles determined by some characteristic. In Panel A we group the firms in four groups by the outstanding value of the firm's equity. Quartile 1 contains the largest firms on the exchange, quartile 4 the smallest firms. In Panel B we group the firms in age groups. *Firm Age*: Time since the company first listed on the stock exchange. Quartile 1 contains the youngest firms, quartile 4 the oldest firms. Panel C groups the firms on the exchange by ownership concentration. *Ownership Concentration*: Measured by a Herfindahl index of owner fractions, Quartile 1 contains the firms with the lowest value of the Herfindahl index, which are the firms with least concentrated ownership. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1989:12 to 2007:6.

Table 1 (continued) Ownership fractions split by firm characteristics

Panel D: By Stock Turnover

Owner type	All firms	Liquidity Quartile			
		1 (least liquid)	2	3	4
Financial	17.2	14.2	17.7	18.9	18.7
Mutual fund	6.4	4.1	6.7	7.5	7.7
Individual	21.5	22.4	22.5	19.6	22.5
Foreign	22.2	14.2	19.5	25.6	29.4
Nonfinancial	36.1	46.2	36.6	32.0	27.7
State	4.8	4.5	5.3	5.8	3.8

Panel E: By Stock Volatility

Owner type	All firms	Volatility Quartile			
		1 (least volatile)	2	3	4
Financial	17.2	20.8	21.7	19.1	15.5
Mutual fund	6.4	6.0	8.7	7.9	5.7
Individual	21.5	24.5	16.6	18.3	21.8
Foreign	22.2	19.3	23.2	24.4	21.8
Nonfinancial	36.1	28.9	32.9	35.6	39.1
State	4.8	8.7	7.9	4.9	3.7

Panel F: By Stock Beta

Owner type	All firms	Stock Beta Quartile			
		1 (lowest beta)	2	3	4
Financial	17.2	14.2	16.7	19.7	19.0
Mutual fund	6.4	3.6	5.9	7.8	8.3
Individual	21.5	31.7	19.6	14.9	19.1
Foreign	22.2	8.0	21.4	25.9	28.4
Nonfinancial	36.1	42.9	39.0	32.8	31.4
State	4.8	4.6	5.4	8.6	4.0

Panel G: By Book/Market Ratio

Owner type	All firms	Book/Market Quartile			
		1 (lowest B/M ratio)	2	3	4
Financial	17.2	18.4	18.7	17.6	14.7
Mutual fund	6.4	7.8	6.9	7.1	4.4
Individual	21.5	23.3	19.3	18.6	27.0
Foreign	22.2	26.9	20.9	19.3	17.7
Nonfinancial	36.1	29.2	35.9	41.4	38.2
State	4.8	3.9	6.9	4.8	4.0

The tables shows average ownership fractions for the six owner types. In each table we group the firms on the exchange in quartiles determined by some firm characteristic. Panel D calculates the liquidity of a firm's stock proxied by turnover. *Stock Turnover*: Monthly Turnover as fraction of stock outstanding. Quartile 1 is the stocks with the lowest turnover, i.e. least liquid according to this liquidity measure. *Stock Volatility*: Volatility of daily stock returns, *Stock Beta*: Historical estimate of stock beta measured using three years of weekly stock returns and *Book/Market Ratio*: The latest observed Book/Market Ratio of the company. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1989:12 to 2007:6.

Table 2 Determinants of ownership fraction

Variable	Mutual Funds		Financials		Foreign		Individuals		Nonfinancials		State	
	coeff	pvalue	coeff	pvalue	coeff	pvalue	coeff	pvalue	coeff	pvalue	coeff	pvalue
constant	0.034	(0.00)	0.101	(0.00)	-1.184	(0.00)	1.310	(0.00)	1.517	(0.00)	-0.643	(0.00)
ln(Firm Size)	0.002	(0.00)	0.006	(0.00)	0.067	(0.00)	-0.048	(0.00)	-0.060	(0.00)	0.032	(0.00)
BM Ratio	-0.011	(0.00)	-0.011	(0.00)	0.003	(0.04)	0.030	(0.00)	-0.037	(0.00)	0.012	(0.00)
Herfindahl Index	-0.104	(0.00)	-0.100	(0.00)	-0.095	(0.00)	-0.312	(0.00)	0.218	(0.00)	0.283	(0.00)
Firm listing age	-0.000	(0.03)	-0.001	(0.00)	-0.007	(0.00)	-0.002	(0.00)	0.010	(0.00)	0.000	(0.22)
Monthly Turnover	-0.016	(0.00)	-0.021	(0.01)	0.198	(0.00)	-0.008	(0.36)	-0.152	(0.00)	-0.013	(0.10)
Stock Volatility	-0.009	(0.71)	-0.359	(0.00)	1.024	(0.00)	-1.069	(0.00)	0.087	(0.28)	0.184	(0.00)
Stock Beta	0.028	(0.00)	0.022	(0.00)	0.052	(0.00)	-0.047	(0.00)	-0.016	(0.00)	-0.007	(0.00)
n	12171		12171		12171		12171		12171		12171	
R^2	0.17		0.06		0.31		0.41		0.20		0.21	

The table shows the results for six separate regressions explaining ownership fraction by the various owner types. Each column holds the results for a separate OLS regression. The dependent variable is the ownership fraction by the owner type listed at the top of each column. The explanatory variables are listed along the rows. Explanatory variables are *ln(Firm Size)*: Logarithm of the firm's equity market value, *Book/Market Ratio*: The latest observed Book/Market Ratio of the company, *Ownership Concentration*: Measured by a Herfindahl index of owner fractions, *Firm Age*: Time since the company first listed on the stock exchange, *Stock Turnover*: Monthly Turnover as fraction of stock outstanding, *Stock Volatility*: Volatility of daily stock returns and *Stock Beta*: Historical estimate of stock beta measured using three years of weekly stock returns. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1989:12 to 2007:6.

4 Relations between changes in ownership and stock returns

In this section we consider the links between asset returns and changes in the aggregate portfolio composition of the various owner types, first looking at contemporaneous links (within the month) and then the lagged relation (next month).

4.1 The contemporaneous relation between stock returns and change in investor composition

We want to see whether a measure of movement in and out of a stock by a specific owner group is contemporaneously related to stock returns. To this end we construct two measures of change in ownership composition, where we make a distinction between number of traders and ownership fraction. This distinction follows e.g. Chen, Hong, and Stein (2002) and Sias et al. (2006). Their argument is that looking at number of owners is more likely to catch information, completely selling out a stock or buying a new stock is a stronger signal than a slight reduction or increase in numbers of shares held. Aggregate movements are however also informative. We therefore consider both these measures.

To calculate our first measure we consider individual owners without controlling for the stake of each owner, by measuring the net number of *new* owners. We do so by taking all owners of a given group, such as mutual funds, and find those that from one month to the next take a stake in the firm without having had a stake at the beginning of the month (new owners). From this number of fresh owners we subtract those that leave the firm the same month, i.e. had a stake at the beginning of the month, but had no stake at the end of the month. For example, if five mutual funds during a month buy into a company where they had no stake at the beginning of the month, and during the same month three mutual funds sell their stake in that company

completely, we would calculate the *Net Number of New Owners* in the company for the mutual fund group to be two.

Our second measure of change in ownership composition is to look at the change in the fraction of the company owned by a given group during a month. If for example the fraction of the company owned by mutual funds move from 15% at the beginning of the month to 16% at the end of the month, we would calculate the *Change in Ownership Fraction* for mutual funds to be +1%. We calculate these two measures of change in portfolio composition for each of the six owner groups. Table 3 provides some descriptive statistics for these two measures.

Table 3 Descriptive statistics for measures of changes in portfolio composition

Panel A: Net Number of New Owners

Owner type	mean	Q1	median	Q3
Financial	-3.18	-200	0	100
Mutual fund	3.73	-100	0	100
Individual	600.34	-1300	-100	800
Foreign	18.94	-200	0	200
Nonfinancial	35.33	-300	0	200
State	3.27	0	0	0

Panel B: Change in Ownership Fraction

Owner type	mean	Q1	median	Q3
Financial	-0.03	-0.38	0.00	0.30
Mutual fund	0.01	-0.08	0.00	0.12
Individual	-0.10	-0.23	-0.01	0.16
Foreign	0.11	-0.29	0.00	0.33
Nonfinancial	0.01	-0.35	0.00	0.33
State	-0.00	0.00	0.00	0.00

For each stock and owner type we calculate the two measures of change in ownership composition, *Net Number of New Owners* and *Change in Ownership Fraction*. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1992:12 to 2007:6. We include all stocks at the Oslo Stock Exchange satisfying price and liquidity bounds.

To investigate differences in stock returns, for each type of owner we sort the stocks into eight portfolios using the measure of change in portfolio composition as sorting criterion. We then calculate the realized returns of these portfolios.⁷ By sorting into portfolios we focus on crosssectional differences, each time we compare the changes across all stocks available at the same time. Using portfolios has the added benefit of controlling for aggregate movements into or out of the market. For example, if mutual funds as a group increase their total investment in the OSE by one billion NOK from one month to the next, this should affect all stocks, not the relative ranking of which stocks are most “popular.” By using the relative ranking we do not need to adjust for the time series evolution of total investment by each group, which we would otherwise need to.

⁷We have done these calculations also grouping the stocks into six or ten portfolios. The same pattern emerges.

Table 4 summarizes the results. A clear pattern emerges. For both mutual fund owners and foreign owners, portfolio 8, the portfolio of stocks where these owners increased their holdings the most, has significantly higher returns. If we first look at mutual funds, in panel A of the table, where we look at changes in number of owners, portfolio 8 has a return of 4.04% per month, 2.98% more than the portfolio with the lowest net increase (highest decrease) in number of mutual fund owners. In annual terms this is a 36% return differential.

Turning to foreign owners, the measure using number of owners is problematic for foreigners. Since much of the foreign ownership is in nominee accounts⁸ where we only observe the total for each nominee, not the different owners for each nominee, it is difficult to argue that changes in number of international owners are particularly meaningful. For the case of foreign firms we therefore instead focus on changes in ownership fraction. Here we see that the portfolio of stocks with the highest net inflow of international owners (portfolio 8) has a monthly return of 3.69%, which is 1.79% higher than the return of the portfolio with the lowest inflow (largest outflow) of international owners (portfolio 1). Hence, we see that returns covary positively with portfolio increases by institutional and international owners. Prices increase when these owners increase their stake. Since most of the trading by foreign investors is by institutional investors, it is not unnatural that these groups have similar effects.

If we now turn to two other groups, individual and nonfinancial owners, we see a pattern opposite of the results for institutional and foreign owners. It is the portfolio of stocks where these owners reduce their ownership the most which has the highest return. Given the results for institutional and international owners, this is in some sense to be expected. If one group decreases its stake, the “slack” has to be taken up by some other investor group. Here it looks like it is individual and nonfinancial investors which take up the slack. The interesting question is which group(s) of owners are most important for changing the price. Considering the evidence from other markets, such as the US evidence, where the trading of institutional investors is argued to push prices, we hypothesize that our findings are most consistent with institutional and foreign investors pushing the price. If we want to argue that the results for individual and nonfinancial investors are caused by the active trading decisions of these owners, we would then look at explaining that the portfolio where these investors are selling the most is the portfolio with the highest increase in price, which is certainly hard to reconcile with a story of informed investors moving prices towards fundamentals, although it may be consistent with a “fad” story where institutional and foreign investors trade to offset “stupid” trades by individual and nonfinancial investors. However, a more likely story is that the results are driven by the institutional trades, be they domestic and foreign, and the pattern for individual and nonfinancial owners is more a result of the total supply of stocks being constant. If these owner types are less sensitive with regard to prices, they will end up with higher ownership fractions in the stocks where the institutions are “getting out.” Vice versa, when institutions are buying, individuals and nonfinancials end up supplying stocks to the institutions due to their lower price sensitivity.

⁸In 1997 about half of the foreign ownership was in nominee accounts. See Bøhren and Ødegaard (2000).

Table 4 Same month returns of portfolios sorted on changes in ownership compositionPanel A: Portfolios sorted by *Net Number of New Owners*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	State
1	1.06	2.31	3.64	1.92	4.51	2.15
2	0.96	1.26	2.04	1.64	2.05	1.03
3	1.09	0.94	1.51	1.13	0.96	1.31
4	0.72	1.20	0.89	0.98	0.59	1.20
5	1.07	0.97	0.45	1.34	1.12	1.17
6	1.48	1.64	1.23	1.81	1.20	1.20
7	2.84	2.33	2.12	2.68	2.00	1.22
8	4.04	3.20	1.76	2.32	1.27	1.77
Difference extreme portfolios (pvalue)	-2.98 [0.00]	-0.89 [0.06]	1.88 [0.00]	-0.40 [0.39]	3.24 [0.00]	0.38 [0.40]

Panel B: Portfolios sorted by *Change in Ownership Fraction*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	State
1	3.03	3.29	4.32	1.96	4.09	2.77
2	1.62	1.59	2.56	1.38	2.36	1.72
3	0.79	1.00	1.39	0.96	1.57	1.58
4	1.02	0.38	0.75	0.95	0.60	1.68
5	1.40	0.63	0.45	0.87	0.93	1.54
6	0.79	1.36	0.63	1.27	0.85	1.13
7	1.84	1.91	1.14	2.74	1.04	1.62
8	3.30	3.54	2.46	3.69	2.38	1.78
Difference extreme portfolios (pvalue)	-0.27 [0.50]	-0.25 [0.48]	1.86 [0.00]	-1.74 [0.00]	1.72 [0.00]	0.99 [0.01]

The numbers are percentage monthly returns for eight portfolios. The portfolios are sorted by a characteristic of change in ownership composition. The row labeled *Difference extreme portfolios* is the average of a portfolio constructed as the difference of portfolios 1 and 8. The number in square brackets in the next row is the p-value for a test that this portfolio has return equal to zero. For each stock and owner type we calculate the two measures of change in ownership composition, *Net Number of New Owners* and *Change in Ownership Fraction*. The stocks are then sorted into eight portfolios based on the measure of change in ownership composition. We calculate the portfolio return for the same month as we measure change in ownership composition. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1992:12 to 2007:6. We include all stocks at the Oslo Stock Exchange satisfying price and liquidity bounds.

4.2 The lagged relation between change in investor composition and stock returns

While price pressure from institutions is a likely explanation of the contemporaneous comovement observed in the previous section, we do not know whether the price pressure is due to correlated trading moving prices away from fundamentals (fads), or informed trading moving prices towards fundamentals. A simple way to test for this is to look at the next month's returns. If the price movements are the results of temporary changes, we would expect a reaction where prices moved back, i.e. the difference between extreme portfolios should have an opposite sign next month.

Alternatively, if prices moved towards fundamentals, we would expect the price change to be permanent. We therefore, in table 5, show the returns for the next month for the portfolios in table 4. There is no case of a significant difference with an opposite sign. At least at this monthly frequency, the price changes seem permanent, a result which is in line with an explanation of institutional investors moving prices towards fundamentals, i.e. institutional trades contain more information than the trading of individuals and nonfinancials.

Table 5 Next month returns of portfolios sorted on changes in ownership compositionPanel A: Portfolios sorted by *Net Number of New Owners*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	State
1	1.42	1.22	1.50	1.41	0.98	1.22
2	1.35	1.35	1.29	1.43	1.99	1.78
3	1.46	1.42	1.71	1.69	1.60	1.39
4	1.81	1.87	1.64	1.87	1.53	1.10
5	1.30	1.67	2.02	1.80	1.91	1.33
6	1.97	1.73	1.78	1.82	1.95	1.50
7	1.77	2.31	1.75	1.73	1.87	1.58
8	2.28	1.89	1.83	1.70	1.64	1.62
Difference extreme portfolios (pvalue)	-0.86 [0.03]	-0.67 [0.03]	-0.34 [0.38]	-0.29 [0.50]	-0.66 [0.07]	-0.40 [0.31]

Panel B: Portfolios sorted by *Change in ownership fraction*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	State
1	1.61	1.64	2.03	2.11	1.89	1.71
2	1.60	1.53	1.67	1.45	1.52	1.70
3	1.46	2.01	1.35	1.51	1.43	1.76
4	1.41	1.27	1.74	1.37	1.26	1.90
5	1.57	1.37	1.31	1.48	1.38	1.89
6	1.19	1.67	1.23	1.98	2.02	1.54
7	2.31	1.76	1.83	1.69	1.97	1.50
8	2.25	2.10	2.26	1.80	1.90	1.49
Difference extreme portfolios (pvalue)	-0.64 [0.10]	-0.46 [0.22]	-0.23 [0.56]	0.31 [0.40]	-0.01 [0.98]	0.22 [0.50]

The numbers are percentage monthly returns for eight portfolios. The portfolios are sorted by a characteristic of change in ownership composition. The row labeled *Difference extreme portfolios* is the average of a portfolio constructed as the difference of portfolios 1 and 8. The number in square brackets in the next row is the p-value for a test that this portfolio has return equal to zero. For each stock and owner type we calculate the two measures of change in ownership composition, *Net Number of New Owners* and *Change in ownership fraction*. The stocks are then sorted into eight portfolios based on the measure of change in ownership composition. We then calculate the portfolio return for the next month. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1992:12 to 2007:6.

5 Can differences in expected returns explain the results?

A potential alternative explanation of the results showing differences in return levels in the previous section is that the return differences reflect differences in expected returns. This caveat is due to the observed differences in portfolio composition of the various owner groups, where we saw that institutions and foreigners tended to invest more in larger companies, and prefer stocks with lower volatility, etc. The risk characteristics for the portfolios of the different owner types may differ, and the differences in portfolio returns may merely reflect differences in risk. It is hard to believe that risk differences will explain return differences of two percentage points per month, but we need to assess the likelihood that this explanation is the cause of the observed results.

To this end we do a simple risk adjustment, calculating excess returns by subtracting an estimate of expected returns from realized returns.

$$er_{i,t} = r_{i,t} - E[\widehat{r}_{i,t}]$$

where $er_{i,t}$ is the excess return for stock i at time t , $r_{i,t}$ the realized return and $E[\widehat{r}_{i,t}]$ the estimate of expected return. To make a risk adjustment we need to make stand on a model of expected returns. We report results using the CAPM as a return model,

$$E[\widehat{r}_{i,t}] = r_{f,t} + \beta_{i,t}(r_{m,t} - r_{f,t})$$

where $r_{f,t}$ is an estimate of the risk free rate and $r_{m,t}$ is the return on a market portfolio. We estimate betas from a market model regression on historical data.⁹ The results are shown in tables 6 and 7. The results confirm our conclusions using returns. The portfolios where mutual funds and foreign investors have increased their holdings the most have significantly larger excess returns in the same month. The portfolios where individual and nonfinancial owners have reduced their stake the most have significantly higher returns. Again, we see no significant differences in the next month excess returns.

Our results are thus robust to risk differences, at least if the CAPM is a sufficient model for expected stock returns. We justify the use of CAPM by evidence in Næs, Skjeltorp, and Ødegaard (2008) that the single market factor is the most important factor for pricing Norwegian asset returns. However, we have for robustness implemented a number of different risk adjustments. We have calculated excess returns using Norwegian versions of the Fama and French (1995) three factor model and the Carhart (1997) four factor model, both calculating averages of realized excess returns, and embedding the estimation in a formal Black, Jensen, and Scholes (1972) framework. We do not report results using these alternative estimations,¹⁰ but they do not change our overall conclusions.

⁹Betas are re-estimated each period using three years of weekly returns data for estimation. The data series for risk free rates is one month NIBOR interest rates from Norges Bank. The stock market index is an equally weighted index described in Ødegaard (2007b).

¹⁰The results using alternative methods are available upon request.

Table 6 Same month returns in excess of the CAPM of portfolios sorted on changes in ownership composition

Panel A: Portfolios sorted by *Net Number of New Owners*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	Nonfinancial
1	-0.73	0.51	1.67	0.15	2.45	0.16
2	-0.66	-0.20	0.29	0.23	0.47	-0.65
3	-0.46	-0.19	0.15	-0.12	-0.26	-0.31
4	-0.56	0.21	-0.04	0.07	-0.33	-0.42
5	-0.14	-0.11	-0.28	0.29	0.25	-0.21
6	-0.01	0.46	0.25	0.46	0.07	-0.29
7	0.99	0.81	0.63	0.94	0.46	-0.23
8	2.11	1.27	-0.05	0.54	-0.52	-0.17
Difference extreme portfolios (pvalue)	-2.84 [0.00]	-0.76 [0.11]	1.72 [0.00]	-0.38 [0.42]	2.98 [0.00]	0.32 [0.47]

Panel B: Portfolios sorted by *Change in Ownership Fraction*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	Nonfinancial
1	1.42	1.81	2.90	0.35	2.60	0.98
2	0.05	0.09	1.00	-0.11	0.73	0.01
3	-0.18	-0.32	-0.10	-0.21	0.06	0.40
4	0.21	-0.42	-0.57	0.04	-0.69	0.61
5	0.25	-0.41	-0.74	-0.18	-0.07	0.57
6	-0.67	-0.09	-0.77	-0.02	-0.45	0.01
7	0.26	0.27	-0.09	0.92	-0.31	0.03
8	1.55	1.91	1.11	2.05	1.00	0.22
Difference extreme portfolios (pvalue)	-0.14 [0.72]	-0.11 [0.77]	1.78 [0.00]	-1.70 [0.00]	1.60 [0.00]	0.76 [0.06]

The numbers are percentage monthly excess returns for eight portfolios. The portfolios are sorted by a characteristic of change in ownership composition. The row labeled *Difference extreme portfolios* is the average of a portfolio constructed as the difference of portfolios 1 and 8. The number in square brackets in the next row is the p-value for a test that this portfolio has return equal to zero. For each stock and owner type we calculate the two measures of change in ownership composition, *Net Number of New Owners* and *Change in ownership fraction*. The stocks are then sorted into eight portfolios based on the measure of change in ownership composition. We calculate the portfolio excess return for the same month as we measure change in ownership composition. Excess return for stock i at time t are calculated as $r_{it} - \widehat{E}[r_{it}]$, where r_{it} is the realized return and $\widehat{E}[r_{it}]$ is an estimate of the expected return. We use the CAPM as an estimate of expected return, $\widehat{E}[r_{it}] = r_{ft} + (r_{mt} - r_{ft})$, where r_{ft} is the one month treasury interest rate, and r_{mt} the return on an equally weighted market index. Betas are re-estimated each month using three years of historical data. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1992:12 to 2007:6. We include all stocks at the Oslo Stock Exchange satisfying price and liquidity bounds.

Table 7 Next month returns in excess of the CAPM of portfolios sorted on changes in ownership composition

Panel A: Portfolios sorted by *Net Number of New Owners*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	Nonfinancial
1	-0.39	-0.55	-0.45	-0.51	-0.98	-0.70
2	-0.26	0.04	-0.38	0.05	0.38	0.18
3	0.18	0.32	0.43	0.33	0.47	-0.20
4	0.57	0.87	0.79	0.81	0.63	-0.50
5	0.08	0.67	1.21	0.86	0.96	0.04
6	0.47	0.63	0.72	0.64	0.94	0.10
7	0.01	0.76	0.42	0.29	0.43	0.16
8	0.29	-0.01	0.14	0.14	-0.10	-0.35
Difference extreme portfolios (pvalue)	-0.68 [0.12]	-0.54 [0.11]	-0.60 [0.13]	-0.65 [0.15]	-0.88 [0.02]	-0.35 [0.34]

Panel B: Portfolios sorted by *Change in Ownership Fraction*

	Mutual Fund	Financial	Individual	Foreign	Nonfinancial	Nonfinancial
1	-0.16	0.15	0.52	0.52	0.51	0.06
2	0.03	0.11	0.32	-0.10	-0.01	0.22
3	0.46	0.77	-0.20	0.25	-0.07	0.59
4	0.81	0.49	0.56	0.46	0.18	0.80
5	0.54	0.52	0.15	0.59	0.30	0.92
6	-0.18	0.16	-0.15	0.80	0.69	0.43
7	0.73	0.12	0.52	0.08	0.54	-0.04
8	0.56	0.37	1.03	0.09	0.56	-0.25
Difference extreme portfolios (pvalue)	-0.72 [0.06]	-0.21 [0.58]	-0.52 [0.21]	0.43 [0.25]	-0.06 [0.87]	0.31 [0.34]

The numbers are percentage monthly excess returns for eight portfolios. The portfolios are sorted by a characteristic of change in ownership composition. The row labeled *Difference extreme portfolios* is the average of a portfolio constructed as the difference of portfolios 1 and 8. The number in square brackets in the next row is the p-value for a test that this portfolio has return equal to zero. For each stock and owner type we calculate the two measures of change in ownership composition, *Net Number of New Owners* and *Change in Ownership Fraction*. The stocks are then sorted into eight portfolios based on the measure of change in ownership composition. We then calculate the portfolio excess return for the next month. Excess return for stock i at time t are calculated as $r_{it} - \widehat{E}[r_{it}]$, where r_{it} is the realized return and $\widehat{E}[r_{it}]$ is an estimate of the expected return. We use the CAPM as an estimate of expected return, $\widehat{E}[r_{it}] = r_{ft} + (r_{mt} - r_{ft})$, where r_{ft} is the one month treasury interest rate, and r_{mt} the return on an equally weighted market index. Betas are re-estimated each month using three years of historical data. The owner types are: *Mutual Funds*: Financial owners which are mutual funds, a subset of the group of all financial owners, *Financial owners*: Banks, insurance companies and other financial owners, including mutual funds, *Individual owners*: Private, individual owners, *Nonfinancial owners*: Corporate (industrial) owners, *Foreign owners*: International owners, *State owners*: State, local government and governmental pension funds. Data for the Oslo Stock Exchange 1992:12 to 2007:6.

6 Conclusion

We have looked at simultaneous changes of ownership composition and stock returns at the Oslo Stock Exchange, using data on the ownership proportions of mutual funds, financial, foreign, individual, nonfinancial and state owners. We first described the levels of these various ownership fractions, showing that the fractions vary systematically with firm characteristics, for example confirming results from other countries that financials tend to invest in larger firms with highly liquid stock, and that foreigners have a similar investment pattern.

The most important contribution of the paper is our investigation of the crosssectional changes in ownership composition, where we change the literature's view of simultaneous correlations between *quarterly* changes in ownership and stock returns to a view of *monthly* simultaneous changes in ownership and stock returns. Our finding of little effects over the next month makes the literature's hypothesed lead-lag relations within a quarter less likely, we show that the frequency of interest must be shorter term, of at most a month. Our findings is a direct confirmation of the indirect evidence of Sias et al. (2006) which used within-quarter returns to bound the lead-lag relationships within the quarter, and argue for the effects being simultaneous at higher frequencies. Our results also confirm more limited evidence using microstructure level data of price movements caused by institutional trading being almost immediate.

We also showed that foreign investors seem to have similar effects as (domestic) institutional investors, a result which is very likely due to the fact that most foreign investors *are* institutional.

Finally, we observe that individual and nonfinancial owners as groups are offsetting institutional and foreign investors. This points to the dangers of analyzing one group in isolation. What may seem like "stupid" behaviour by e.g. individual investors may just be that this group has a demand curve that is less sensitive than e.g. the institutional investors, leaving the individuals as the residual investors. However, going into detailed analysis of the interaction between investor groups would require more detailed data on the timing of trading, and must be left as an important direction for future research.

References

- Brad M Barber and Terrence Odean. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance*, 55(2):773–806, April 2000.
- Brad M Barber, Yi-Tsung Lee, Yo-Jane Liu, and Terrance Odean. Who loses from trade? Evidence from Taiwan. Working paper, University of California, Davis, January 2005a.
- Brad M Barber, Terrance Odean, and Ning Zhu. Do noise traders move markets? Working Paper UC Davis, December 2005b.
- Sushil Bikhchandani, David Hirshleifer, and Ivo Welch. A theory of fads, fashion, custom, and cultural change as informational cascades. *Journal of Political Economy*, 100:992–1026, 1992.
- Sushil Bikhchandani and Sunil Sharma. Herd behavior in financial market: A review. IMF Working Paper 00/48, 2000.
- Sushil Bikhchandani, David Hirshleifer, and Ivo Welch. Learning from the behavior of others: Confirmity, fads, and informational cascades. *Journal of Economic Perspectives*, 12(3): 151–170, 1998.
- Fisher Black, Michael Jensen, and Myron Scholes. The capital asset pricing model, some empirical tests. In Michael C Jensen, editor, *Studies in the theory of capital markets*. Preager, 1972.
- Brian Boyer and Lu Zheng. Investor flows and stock market returns. *Journal of Empirical Finance*, 16(1), January 2009.
- Øyvind Bøhren and Bernt Arne Ødegaard. The ownership structure of Norwegian firms: Characteristics of an outlier. Research Report Nr 13/2000, Norwegian School of Management, September 2000.
- Øyvind Bøhren and Bernt Arne Ødegaard. Patterns of corporate ownership: Insights from a unique data set. *Nordic Journal of Political Economy*, pages 57–88, 2001.
- Laurent E Calvent, John Y Campbell, and Paolo Sodini. Down or out: Assessing the welfare cost of household investment mistakes. *Journal of Political Economy*, 115:707–747, 2007.
- Laurent E Calvent, John Y Campbell, and Paolo Sodini. Fight or flight? Portfolio rebalancing by individual investors. *Quarterly Journal of Economics*, 2008. forthcoming.
- John Y Campbell, Tarun Ramadorai, and Allie Schwartz. Caught on tape: Institutional trading, stock returns, and earnings announcements. *Journal of Financial Economics*, 2009. forthcoming.
- John Campbell. Household finance. *Journal of Finance*, LXI(4):1553–1604, 2006.
- Mark M Carhart. On persistence in mutual fund performance. *Journal of Finance*, 52(1):57–82, March 1997.
- An-Sing Chen and Bi-Shia Hong. Institutional ownership changes and returns around analysts’ earnings forecast release events: Evidence from Taiwan. *Journal of Banking and Finance*, 30: 2471–2488, 2006.
- Joseph Chen, Harrison Hong, and Jeremy C Stein. Breadth of ownership and stock returns. *Journal of Financial Economics*, 66:171–205, 2002.
- Hyuk Choe, Bong-Chan Kho, and Rene M Stulz. Do foreign investors destabilize stock markets? The Korean experience in 1997. *Journal of Financial Economics*, 54(2):227–264, November 1999.
- Randolph B Cohen, Paul A Gompers, and Tuomo Vuolteenaho. Who underacts to cash-flow news? Evidence from trading between individuals and institutions. *Journal of Financial Economics*, 66: 409–462, 2002.
- Vicentiu Covrig, Sie Ting Lau, and Lilian Ng. Do domestic and foreign fund managers have similar preferences for stock characteristics? A cross-country analysis. *Journal of International Business Studies*, 37(3):407–429, May 2006.
- Magnus Dahlquist and Göran Robertsson. A note on foreigners’ trading and price effects across firms. *Journal of Banking and Finance*, 28:615–632, 2004.
- Magnus Dahlquist and Göran Robertsson. Direct foreign ownership, institutional investors, and firm characteristics. *Journal of Financial Economics*, 59(3):413–440, March 2001.
- Daniel Dorn, Gur Huberman, and Paul Sengmueller. Do individual investors move together and thereby affect prices? Working Paper, Drexel University, April 2004.
- Roger M Edelen and Jerold B Warner. Aggregate price effects of institutional trading: a study of mutual fund flow and market returns. *Journal*

- of *Financial Economics*, 59(2):195–220, February 2001.
- Eric G Falkenstein. Preferences for stock characteristics as revealed by mutual fund portfolio holdings. *Journal of Finance*, 51(1):111–135, March 1996.
- Eugene F Fama and Kenneth R French. Size and book-to-market factors in earnings and returns. *Journal of Finance*, 50(1):131–56, March 1995.
- Paul A Gompers and Andrew Metrick. Institutional investors and equity prices. *Quarterly Journal of Economics*, pages 229–259, 2001.
- John M Griffin, Jeffrey Harris, and Selim Topaloglu. The dynamics of institutional and individual trading. *Journal of Finance*, LVIII(6): 2285–2320, December 2003.
- Mark Grinblatt and Matti Keloharju. What makes investors trade? *Journal of Finance*, 56:589–616, 2001.
- Mark Grinblatt and Matti Keloharju. The investment behavior and performance of various investor-type: a study of Finland’s unique data set. *Journal of Financial Economics*, 55(1):43–67, January 2000.
- David Hirshleifer and Siew Hong Teoh. Herd behavior and cascading in capital markets: A review and synthesis. *European Financial Management*, 9(1):25–66, 2003.
- David Hirshleifer, Avanidhar Subrahmanyam, and Sheridan Titman. Security analysis and trading patterns when some investors receive information before others. *Journal of Finance*, 49(5): 1665–1698, December 1994.
- Soeren Hvidkjaer. Small trades and the cross-section of returns. Working Paper, University of Maryland, September 2006.
- Andrew Jackson. The aggregate behaviour of individual investors. Working Paper, London Business School, July 2003.
- Jun-koo Kang and René M Stulz. Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics*, 46:2–28, 1997.
- Ron Kaniel, Gideon Saar, and Sheridan Titman. Individual investor trading and stock returns. Working Paper, Duke University, May 2005.
- Josef Lakonishok, Andrei Shleifer, and Robert W Vishny. The impact of institutional trading on stock prices. *Journal of Financial Economics*, 32:23–43, 1992.
- Karen Lewis. Trying to explain home bias in equities and consumption. *Journal of Economic Literature*, XXXVII:571–608, June 1999.
- Karen K Lewis. *Puzzles in International Financial Markets*, volume 3 of *Handbook of International Economics*, chapter 37, pages 1913–1971. North-Holland, 1995.
- Randi Næs, Johannes Skjeltorp, and Bernt Arne Ødegaard. What factors affect the Oslo Stock Exchange? Working Paper, Norges Bank and Norwegian School of Management BI, May 2008.
- John R Nofsinger and Richard W Sias. Herding and feedback trading by institutional and individual investors. *Journal of Finance*, LIV(6): 2263–2295, December 1999.
- Granit San. Who gains more by trading - individuals or institutions? Working Paper, Tel Aviv University, June 2005.
- David S Scharfstein and Jeremy C Stein. Herd behavior and investment. *American Economic Review*, 80:465–479, 1990.
- Richard W Sias. Institutional herding. *Review of Financial Studies*, 17(1):165–206, 2004.
- Richard W Sias, Laura T Starks, and Sheridan Titman. Changes in institutional ownership and stock returns: Assessment and methodology. *Journal of Business*, 70(6):2869–2910, November 2006.
- Andreas Walter and Friedrich Moritz Weber. Herding in the German mutual fund industry. *European Financial Management*, 12(3):375–406, 2006.
- Vincent A Warther. Aggregate mutual funds and security returns. *Journal of Financial Economics*, 36:209–235, 1995.
- Russ Wermers. Mutual fund herding and the impact on stock prices. *Journal of Finance*, LIV(2):581–622, April 1999.
- Bernt Arne Ødegaard. Price differences between equity classes. Corporate control, foreign ownership or liquidity? *Journal of Banking and Finance*, 31:3621–3645, 2007a. <http://dx.doi.org/10.1016/j.bankfin.2007.01.013>.
- Bernt Arne Ødegaard. Asset pricing at the Oslo Stock Exchange. A source book. Manuscript, BI Norwegian School of Management, available at <http://finance.bi.no/~bernt>, April 2007b.