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Institutional Traders' Behavior in an Emerging Stock Market: Empirical Evidence on Polish Pension Fund Investors

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Abstract: In this paper, we contribute to the literature on institutional herding and positive feedback trading by analysing the behavior of pension fund investors on the Polish stock market. Their entrance on the Polish stock market due to the national pension system reform in 1999 provides a unique opportunity to receive deeper insight into the behavior of institutional investors in an emerging capital market. Our results show that Polish pension fund investors are to a greater extent involved in herd-like behavior and more often pursue feedback trading strategies than their counterparts in mature markets. This finding is primarily attributed to regulatory inefficiencies and high market concentration. We do not detect, however, that trading by the pension fund investors exerts significant influence on stock prices.

JEL Classification: G20, G23

Keywords: Pension funds, Herding, Feedback trading, Polish stock market

1. Introduction

The increasing dominance of institutional investors in stock markets world-wide has stimulated public and academic discourse on the influence their trading exerts on asset prices. This interest is due to the common belief that institutional investors, being to a greater extent engaged in herding and feedback trading behavior than individual traders, may contribute to the destabilization of stock prices.

The theoretical literature provides numerous explanations of herding behavior among institutional investors. Scharfstein and Stein (1990) argue that investment managers follow the herd to preserve reputation because their reputation will be less severely damaged when other investors also make unprofitable investment decisions. Roll (1992) states, that if an investment manager's compensation depends on his performance evaluated relative to the performance of other managers, it may influence his investment decisions and result in herd behavior. Froot, Scharfstein, and Stein (1992) contend that traders are limited to short periods due to frequent performance evaluation and particularities of the transaction cost structure. In the presence of a number of similarly-informed investors it pays off to learn information early, regardless of how closely it is connected to fundamentals. Similarly, Hirshleifer, Subrahmanyam, and Titman (1994) show that early-informed investors trade more aggressively and behave like "profit-takers" in the initial period in order to reverse their positions later, when the information is incorporated into prices through trades of late-informed traders.

As pointed out in Bikhchandani and Sharma (2000), there is a striking disparity between theoretical models and empirical approaches exercised when testing for herding and feedback trading. Though extensive theoretical literature provides various models of herding behavior, empirical studies in general do not directly test any of the suggested models. Rather, they merely follow a statistical approach designed to reveal the extent of correlated trading. The majority of empirical studies on herding and feedback trading report that though institutional investors feedback trade more than individuals (Nofsinger and Sias (1999)), the extent of such trading proved to be surprisingly modest. Further investigations thoroughly explored trading behavior conditional on the type of the institution. However, being not so numerous, they are mostly focused on the performance of mutual funds, with only few of them scrutinizing the behavior of pension fund managers.[2]

One of the most influential studies that examine herding by pension funds is that of Lakonishok, Shleifer, and Vishny (1992). They investigate holdings of more than 700 US pension funds and conclude that pension fund herding and positive feedback trading in large stocks is very modest. Somewhat more pronounced evidence of positive feedback trading was revealed for smaller stocks, but even in this case, its extent is far from enough to exert any destabilizing influence on individual stock prices. The most recent study by Badrinath and Wahal (2002) examines pension funds along with a broad range of institutions of the US market including mutual funds, investment advisors, insurance companies, commercial banks, and trusts. They

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[2] For studies on mutual funds' investment behavior, see Grinblatt, Titman, and Wermers (1995), Wermers (1999), and Borensztein and Gelos (2000).

document that pension fund managers are to a lesser extent engaged in feedback trading than others, with the link between past returns and taking a position in the stocks being more pronounced in small firms. Jones, Lee, and Weis (1999), using a sample similar to Badrinath and Wahal, report that pension funds managers act as feedback traders especially on the buy side and mostly in small stocks with high past performance.

The empirical studies mentioned above focus solely on the US pension funds. However, differences in investment regulations may affect institutional trading, warranting further inquiry into investment behavior of pension funds on different markets. Yet, up to our knowledge, no study providing evidence on pension fund behavior on an emerging market is available. The launching of the national pension system reform in Poland in 1999 created the regulatory framework needed to establish open-end pension funds as a new type of institutional investor on the national stock market. Existing particularities of the regulatory environment of Polish pension funds enable us to provide further insight into the behavior of pension funds that act in a developing stock market. In particular, we address the following questions. First, to what extent are Polish pension funds engaged in herding and feedback trading and is it comparable to the degree of herding in well-established markets? Second, are there any differences in the extent of herding and feedback trading with regard to particular groups of stocks categorized in terms of size, past performance and industry? Third, is there any relationship between the excess demand of pension funds and contemporaneous stock returns?

The rest of the paper is structured as follows. The next section describes the Polish pension reform and pension fund market. The statistical methodology used to assess the extent of herding and feedback trading is outlined in section 3. Section 4 describes the data set used in the study. Empirical findings are represented in section 5. Finally, section 6 concludes.

2. Pension Funds in Poland

The major flaw of the old pay-as-you-go pension system laid in the lack of symmetry between contributions and future pensions entitlements. The inability to accommodate for the growing aging of the Polish society, the decline in the number of employees and the resulting enormous fiscal pressure were additional factors that contributed to the need for reform of the existing system.[3] The new pension system launched in 1999 rests on three pillars.[4] It consists of the reformed pay-as-you-go government-run system represented by the Zakład Ubiezpeczeń Spolecznych (ZUS), the system of open pension funds run by private managing companies, and privately funded pension security schemes. The first two pillars are compulsory, the third one is

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[3] By the mid 1990s, the level of deductions from personal incomes soared to 45 % and the amount of pensions to be paid reached 15 % of Polish GDP.

[4] The pension systems of Latin American countries served as a model for the new Polish one.

voluntary and aims to provide above-the-minimal standard of living by promoting long-term private savings through different types of investments.[5]

Polish pension funds are defined-contribution funds, which implies, that amount of future pensions depends solely on returns on invested assets.[6] Employees transfer 7.3 % of their gross salary through the ZUS to the pension funds, which invest it mostly in domestic financial instruments.[7] Supplied with regular, significant cash flows, open pension funds were expected to trigger an upturn in the national stock market and boost its liquidity and trading volume.

Out of prudence considerations, investment activity of the pension funds is subject to strict regulation. The Law on Organisation and Operation of Pension Funds (1997) imposes restrictions on asset allocation in each financial instrument. In particular, the proportion of funds invested in shares is limited to 40 % of the total fund portfolio; additional 20 % may be invested in shares indirectly via holdings in mutual funds. Moreover, funds are required to guarantee a minimum rate of return on their investments, with failure to achieve it being punished by penalties. The Polish law defines the mandatory minimum rate of return as the rate of return lower by 50 % than the weighted average rate of all funds established for a given period, or a rate of

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[5] For a detailed description of the three pillars see Hadyniak and Monkiewicz (1999) and Mech (2001). Our discussion refers primarily to the second one.

[6] For an analysis of distinctions between defined-contribution and defined-benefit pension funds, see Davis (1997).

[7] Only at the end of 2001 two of the pension funds realized the possibility provided by law to invest in foreign assets (Karpinski (2002a)).

return four percentage points lower than the aforesaid average, whichever is lower. Eventually, a lower rate of return should be covered from the pension fund's own funds. Moreover, if its own assets will not suffice to cover the difference, funds will be withdrawn from the special government managed guarantee fund. A minimum required return is calculated and announced on a quarterly basis for the previous two-year period. Surveillance of the pension funds is being undertaken by the Komisja Nadzoru Ubiezpeczen i Funduszy Emerytalnych.

At the end of the second quarter of 2002, 17 pension funds were operating in the Polish stock market with assets under management totalling 25 billion zlotys and with additional seven billion zlotys still to be transferred to the funds' accounts by the ZUS.[8] In terms of capital, pension funds already outweigh mutual funds and insurance companies, whose assets total only three billion and twelve billion zlotys, respectively. Such a substantial value of assets turned open pension funds into an influential group of institutional investors on the Polish stock market.

In the second quarter of 2002, open pension funds' investments into stocks listed on the Warsaw Stock Exchange (WSE) amounted to 30 % of their assets or eight billion zlotys. They are predominantly concentrated in the large capitalization stocks that are a part of the blue-chip index, WIG20, and usually belong to the Top 5 in their industry (Karpinski (2002b)). Funds' holdings amounted to 17 % of stocks that are in the free-float, and their participation in the capitalization of the WSE

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[8] The average exchange rate of Polish zloty to US dollar in June 2002 was 4.06.

already surpasses 5 % (www.igte.com.pl).[9] This turned pension funds into the protagonists in the national stock market, able to affect asset prices and cause their abrupt swings.[10] Since pension funds still do not exploit their potential to invest up to 40 % of their portfolio into stocks, market observers voice concern of impending liquidity attenuation in the Polish stock market (Brycki and Karpinski (2002)).

The pension fund industry in Poland is highly concentrated, which is typical for developing countries whose pension systems followed the same track of reforms (Hadyniak and Monkiewicz (1999)). Among all funds, the four largest (Commercial Union, ING Nationale-Nederlanden Polska, PZU Złota Jesień, and AIG) dominate the market. By the end of June 2002 they had attracted 74 % of the all funds' assets and 63 % of the participants. At the very onset of their operations, due to the limited size of their portfolios, funds mostly invested in treasury bills, treasury bonds, and bank deposits. In the second half of 1999 the bull market prompted pension funds' managers to switch to shares (Mech (2001)). The increase in the amount of shares held by pension funds was rewarded by higher levels of returns. Two of the funds, namely, DOM and Polsat, obtained especially notable profits mainly due to their investment in shares.

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[9] One particularity of the Polish stock market is that the company's stocks being in the free float do not exceed 37 %, while the majority of stocks are owned by long-term (mostly foreign) investors.

[10] As it was said by one of the money managers in an interview to one of the most popular Polish newspapers "I have earned my biggest money by trying to predict what pension funds are going to do" (Brycki and Karpinski (2002)).

The main consequences of the heavy concentration in the pension fund industry and the regulatory requirements are similar portfolio compositions and similar financial results among Polish pension funds. These outcomes mainly stem from the regulation that requires offset of losses faced by fund's participants from fund's own assets, when it falls short of the minimum required rate of return. This influences managers' incentives making them loath to experiment with the assets' selection and impelling them to emulate each other's investment decisions. Such regulatory provisions are considered to favor reduced competition and intensified herding behavior among Polish pension funds.

3. Herding and Feedback Trading Measures

To evaluate herding we utilize the measure suggested by Lakonishok, Shleifer, and Vishny (1992) which is one of the most widely used herding measure in the empirical finance literature. It estimates herding as a degree of correlated trading among investors. Since it is more probable to reveal herding inside a homogenous group of investors that are directly competing for customers and are identically evaluated, than in a random sample of institutions, it is usually calculated for a group of identical institutions. The Lakonishok-Shleifer-Vishny measure gauges their average tendency to end up on the same side of the market in a particular stock and in a particular time period. The measure for stock i in period t is defined as:

$$H_{i,t} = \left| p_{i,t} - p_t \right| - AF_{i,t} \tag{1}$$

with $p_{i,t} = B_{i,t}/(B_{i,t} + S_{i,t})$. $B_{i,t}$ $(S_{i,t})$ denotes the number of investors in the group that buy (sell) stock i in period t. p_t is the average of the $p_{i,t}$s over all stocks that

were traded in period t and measures the number of investors buying in a given period relative to the number of investors active in period t.

The adjustment factor in equation (1), $AF_{i,t}$, is defined as the expected absolute difference between $p_{i,t}$ and p_t:

$$AF_{i,t} = E\big(|\,p_{i,t} - p_t\,|\big), \tag{2}$$

where E denotes the expectation operator. $AF_{i,t}$ is calculated under the null hypothesis that $B_{i,t}$ follows a binomial distribution with the parameter p_t. The inclusion of the adjustment factor prevents the bias in $|\,p_{i,t} - p_t\,|$ for stocks that are traded by a low number of investors. In our empirical application the herding measures computed for each stock are averaged first across different sub-groups of stocks and then across periods. Under the assumption of normality, positive values of these averaged herding measures that are different from zero will constitute evidence in favor of herd behavior.

Despite its popularity, the Lakonishok-Shleifer-Vishny measure has several shortcomings (Bikhchandani and Sharma (2000)). First, the measure limits the ability to differentiate between herding and a rational response of investors to publicly available information, thus failing to account for changes in fundamentals. Second, since it is not possible to trace intertemporal trading behavior with the Lakonishok-Shleifer-Vishny measure, it is also not possible to determine whether a particular investor persists to herd. Third, taking only the number of investors active and disregarding the value of stocks they trade threatens to omit herding which can in fact be present. Finally, as shown in Jones, Lee, and Weis (1999), the expected value of

$H_{i,t}$ may be negative, since for low activity stocks the adjustment factor, $AF_{i,t}$, may take large values.

Feedback trading, which is a particular case of herding, presumes that past stock returns affect current investors' demand. Positive feedback trading refers to acquiring stocks that were past winners and selling those that are past losers. Positive feedback trading strategies were paid much attention in the academic literature since they were believed to aggravate price destabilization (Lakonishok, Shleifer, and Vishny (1992)). To estimate the extent of positive feedback trading we use the measures applied by Jones, Lee, and Weis (1999), which include slight modifications to those initially suggested in Lakonishok, Shleifer, and Vishny.

The so-called numbers ratio measure, $nratio_{i,t}$, is defined as:

$$nratio_{i,t} = B_{i,t}/(B_{i,t} + S_{i,t}) - p_t, \tag{3}$$

where, as in (1), $B_{i,t}$ is the number of institutions that purchased stock i in period t and $S_{i,t}$ denotes the number of investors which sold the stock. p_t is the average proportion of the investors that increased their holdings in a given stock during a given period. The modification by Jones, Lee, and Weis consists in subtracting p_t from the ratio of the number of buyers to the total number of institutions active in a stock in a given period. Thus, this measure estimates the relative demand as a fraction of investors moving in the same direction that is in excess of the average.

The dollars ratio measure, $dratio_{i,t}$, is calculated as:

$$dratio_{i,t} = \$B_{i,t}/\$(B_{i,t} + S_{i,t}) - \$p_t, \tag{4}$$

where $\$B_{i,t}$ ($\$S_{i,t}$) is zloty amount of the stock i bought (sold) by the investors in period t and $\$p_t$ denotes the average proportion of the institutional holdings increases in a given period, also denominated in zlotys.[11] The *nratio* and the *dratio* measures can be viewed as complementary. While the *nratio* measure provides an indication about the number of investors that increased their holdings in a particular asset during a given period, regardless of the extent of the ownership changes, the *dratio* measure focuses instead on the zloty amounts of the shares being traded. Higher absolute values of *nratio* and *dratio* measures reflect stronger investors' demand or supply for a given stock. We calculate values of these two measures and average them across different groups of stocks categorized by size and past returns, trying to shape trading patterns in terms of stock characteristics.

Additionally, Lakonishok, Shleifer, and Vishny (1992) used a measure of excess institutional demand, *exdemand*$_{i,t}$, computed as:

$$exdemand_{i,t} = (\$B_{i,t} - \$S_{i,t}) / MVE_{i,t}, \tag{5}$$

where $\$B_{i,t}$ and $\$S_{i,t}$ are as defined above and $MVE_{i,t}$ denotes the market value of stock i in period t. $MVE_{i,t}$ serves as a scaling factor which enables us to distinguish the effect of the excess demand on moving stock prices. Positive values of

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[11] We follow the original name of the dollars ratio feedback trading measure, as introduced in Lakonishok, Shleifer, and Vishny (1992). However, since the reported values of pension fund holdings are expressed in the national currency, Polish zloty, the values of $\$B_{i,t}$ ($\$S_{i,t}$) are also expressed in zlotys.

exdemand$_{i,t}$ for a group of stocks indicate that the group is in excess demand, and negative values indicate excess supply. Computed values are again averaged across groups clustered by the degree of excess demand (supply) and past period returns. The available data enables us to perform this grouping only for the stocks in excess demand (in which investors are net buyers), since the low number of stocks in excess supply (in which investors are net sellers) precludes such segmentation.

4. Data Description

In this study we use data on pension funds' ownership relying on reports about the structure of their portfolios. According to the Decree of the Polish Council of Ministers of July 3, 2001, on the financial reports on joint security portfolio, investment funds are obliged to provide annual and semi-annual reports covering information about portfolio structures, including the name of the stocks and their proportion of total fund holdings. Pension funds are required to disclose these data to the public to keep current and potential investors informed about the level of risk exposure of the funds' investments.

Our hand-collected data set relies on the semi-annual and annual reports for 17 pension funds for the period from 1999 to 2001. Semi-annual reports provide information on the value of the assets that exceed 1 % of the portfolio, while annual statements supply the data on all stocks that are being held. The ownership reports contain the name, the value, and the proportion of each asset in the portfolio at the end

of the year.[12] Relying on the yearly pension funds' ownership data, it is possible to estimate the value of purchases (sales), $B_{i,t}$ $(S_{i,t})$, of stock i in period t by subtracting the holdings in the current period from the holdings in the previous period.[13] The data on institutional ownership are supplemented by data on daily stock prices and stock capitalization, obtained directly from the WSE. The values of holdings are reported in Polish zlotys.

To describe pension funds portfolios by the past performance of the stocks owned, we consider holdings of all pension funds as if it were one universal fund and classify the stocks into five quintiles based on their past period performance. The procedure is repeated for every period for which the data are available. When quintile compositions are known, we are able to calculate how much from each performance group is being purchased, sold, or held by all pension funds.

It follows from the results reported in Table 1 that pension funds holdings in the extreme quintiles are distributed almost evenly. 43 % of funds' assets are allocated into stocks from the top two performance quintiles and 46 % of the assets are allocated into the two quintiles including stocks with the poorest performance (columns 1, 2 and 4 and 5). Moreover, it is also shown that funds are much more disposed towards purchasing stocks with excellent past performance which amounts to

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[12] The pension fund portfolios besides corporate stocks also include stocks of the National Investment Funds, treasury bills and bonds.

[13] However, since we do not possess information about the trades of the pension funds during a year, we are not able to account for possible changes in ownership that take place throughout the period.

about 80 % of total buys (column 1 and 2). At the same time funds try to dampen the proportion of extreme losers (column 5). Sells in the worst performance quintile size to 37 % of total sells whereas buys equal only to 8 %. Thus, funds are intensively selling extreme losers and buying extreme winners. This apparent discrepancy between the past performance of the assets that are being purchased and sold may serve as preliminary evidence on feedback trading.

Table 1 around here

5. Empirical Results and Comparison with Previous Literature

A. Empirical Results on Herding

The main findings on herding in the sample of Polish pension funds are represented in Table 2. The first column in Panel A provides the values of the Lakonishok-Shleifer-Vishny herding measure computed across all stocks owned by pension funds. The number 0.146 implies that if it is assumed that 50 % of the ownership changes were increases, then 64.6 % of all investors were changing their position in a stock in one direction and 35.4 % in the opposite direction. Panel A also provides values of the herding measure for stocks partitioned by the total number of investors trading these stocks. As expected, the Lakonishok-Shleifer-Vishny statistic attains its highest value of 0.165 for the stocks traded by a substantial number of institutional traders (more than 15). The measures in Panel B suggest that among the actively traded stocks, i.e., stocks traded by more than ten investors, institutions herd

more into stocks from extreme size quintiles (the largest and smallest firms), where size is defined in terms of capitalization.[14]

Table 2 around here

The values of the herding measures reported in Table 2 are rather high in comparison with analogous statistics for pension funds in mature markets. The magnitude of herding revealed by Wermers (1999) is 0.034 while Lakonishok, Shleifer, and Vishny (1992) as well as Jones, Lee, and Weis (1999) obtained even smaller values of 0.027 and 0.016, respectively. An explanation for such substantial herding found in the sample of Polish pension funds could stem from the above-mentioned regulation design of the funds' performance evaluation. Since the minimum required rate of return is computed as a weighted average of the rates of return achieved by all pension funds, the high concentration of the pension funds market results in a heavy influence of the returns attained by the largest institutions.

Moreover, the quarterly frequency at which the minimum required rate of return is calculated and announced provides pension fund managers with the additional incentive to undertake short-term investment strategies to be sure not to fall behind their peers. Therefore, smaller pension funds, aiming not to under-perform their larger counterparts and to avoid penalties imposed by regulation in case of their

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[14] The "small" nature of our data base implies high standard errors of the measures. Therefore, we rely solely on the point estimates without reporting their standard errors.

failure to achieve the minimum required return, simply track large pension fund investment behavior.

Our results support the findings of Blake and Timmermann (2002) stating that, under relative performance evaluation, investors are striving not to under-perform their peers with the median outcome. When the evaluation benchmark is set to a weighted average, the safest investment strategy is the strategy followed by the market leaders. These findings also lend empirical substance to the widespread belief that smaller pension funds in the Polish stock market are imitators of the actions of the larger ones. Among the consequences of herd-like behavior are identical financial outcomes, reduced competition among the Polish pension funds, and higher opportunity costs arising from giving up long-term investment strategies that might provide funds with more substantial capital accumulation.[15]

Since it is likely that investors may be more involved in herding in particular groups of stocks, we proceed with the analysis of herding for stocks classified by size, past performance, and industry. These results are shown in Table 3. Panel A demonstrates that when divided by size, the two highest values of the Lakonishok-Shleifer-Vishny herding measure (0.182 and 0.146) correspond to the two smallest size quintiles. However, the relationship is not monotonic. Herding in the largest stocks, although smaller, still amounts to a value of 0.133.

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[15] For the discussion of pension fund evaluation measures and their influence on fund performance see Blake and Timmermann (2002) and Blake, Lehmann, and Timmermann (2002). For an analysis of the performance of Polish pension funds see Stanko (2003).

Table 3 around here

The literature provides two types of explanations that justify a higher degree of herding in small stocks compared to larger stocks. Depending on the motivation behind investment decisions, it distinguishes between intentional and unintentional herding. Intentional herding arises due to the lack of analyst coverage and publicly available information about small firms, which prompts investment managers to pay more attention to the actions of other investors (Bikhchandani and Sharma (2000), Lakonishok, Shleifer, and Vishny (1992)). Unintentional herding arises when investors, not deliberately emulating other's behavior, undertake identical investments when facing similar decision problems.[16] For example, investors may seek to dispose of small poorly performing stocks due to evaluation concerns. This so-called "window dressing" phenomenon was brought forth by Lakonishok et al. (1991). Such behavior is more distinct in smaller rather than in larger stocks, since the latter are held by many investors.[17]

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[16] For theoretical models assuming unintentional herding see Banerjee (1992), Scharfstein and Stein (1990), and Froot, Scharfstein, and Stein (1992).

[17] Selling extreme losers is probably the most widely used, though by no means unique form of window dressing. To other forms of window dressing also refer slowing down the pace of selling winners and buying losers (Lakonishok et al. (1991)).

Additionally, we analyse herding intensity conditional on past return performance. The findings reported in Panel B show that herding is high for the two groups of extreme winners with herding measures being equal to 0.147 and 0.162. Fund investors also seem to follow herd-like behavior in extreme losers. This performance quintile also demonstrates a rather high magnitude of herding (0.146). It is difficult, however, to discern a monotonic relationship conditional on the past performance history.

In Panel C we provide results for stocks classified by industry, since one may expect a higher degree of herding for stocks that belong to certain branches. This hypothesis is attributed to the sentiments that investors may share regarding particular industries, associated with uncertainty about their profits and cash flows. From the data set on pension fund holdings we determined the five industries in which institutions allocate their funds more often. These industries are banking, computer services, metal production, pharmaceutics, and construction branches. In fact, computer services and construction stocks demonstrate a higher magnitude of herding (0.140 and 0.163) relative to stocks that belong to banking, metal production, and pharmaceutics branches (0.128, 0.114, and 0.098).

Finally, Table 4 presents herding statistics aggregated across both past return performance and size of stocks. All stocks held in the pension fund portfolios were first divided into five size quintiles, which then were assigned into four performance quartiles. This stock partitioning is motivated by the consideration that, e.g., there can be an overlap between the small actively traded and poorly performing firms. The results from Table 4 imply that herding in the largest size quintile is more pronounced

among the extreme performance groups (the stocks that performed the best and the worst) for which herding measures reach 0.165 and 0.144, respectively. Notably, small stocks from the medium performance groups also demonstrate a considerable degree of herding reaching 0.221 and 0.222. For the smallest stocks herding pattern resembles the one for the largest ones. Namely, investors tend to herd into the outermost performance quartiles. It should be noted that patterns in trading behavior are more apparent in terms of size of the assets rather than in terms of their performance, making it difficult to discern any monotonically changing pattern in the dual size-performance classification.

Table 4 around here

B. Empirical Results on Feedback Trading

Finding a relationship between investor demand and past stock performance will provide evidence in favor of the presence of feedback trading. To assess the extent of institutional feedback trading we use the dollars ratio and the numbers ratio discussed in section 2. The findings are shown in Table 5 where we use the same dual partitioning of stocks in terms of their size and past history as in Table 4. The dollars ratio measures in Panel A clearly indicate that pension funds aspire to sell stocks of the smallest companies (column 5) and especially those that were performing poorly in the previous period. The overall minimum value (– 0.407) corresponds to the worst performance quartile of the smallest stocks. This finding is consistent with the general view that due to the higher level of uncertainty attributed to smaller firms fund

managers for evaluation reasons are more disposed to imitate actions of other market participants.

Table 5 around here

The insufficient liquidity of the Polish stock market could be a further reason for the unwillingness of the pension funds to hold small losers. Since small stocks are characterized by especially low liquidity and pension fund holdings are usually large relative to the market, to exit a position in a stock may require for a fund considerable amount of time.[18] Thus, fears of inability to quickly correct unprofitable investment decisions may provide the pension funds with an additional incentive to sell small poorly performing stocks. Notably, only for the stocks of the largest firms (column 1) the dollars ratio measure takes positive values for all levels of past period return and at the same time achieves the second overall maximum amounting to 0.233. It suggests that the largest stocks are being excessively demanded by pension funds.

The herding discovered in the two extreme size-performance groups in section 5.A manifests itself through positive feedback trading in large winners and small losers. At the same time, a contrarian type of behavior is more prevalent in large losers and the smallest winners. These findings are consistent with the results from Table 1

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[18] Selling a stock completely may require a pension fund to participate in up to twenty trading sessions. Sometimes the needed number of trading sessions may come to several dozens (Karpinski (2003)).

described in section 4 and show a distinct inconsistency between performance characteristics of purchased and sold stocks. Our results are also in line with the evidence on feedback trading documented by Jones, Lee, and Weis (1999) for the US market.

The results on the numbers ratio measures are presented in Panel B. Numbers ratio values of 0.161 and 0.253 show that institutions are apt to buy stocks from the largest size quintiles with moderate past period performance but are reluctant to buy small stocks (0.057 and 0.054). The fraction of the institutions buying is considerably less in the fifth size group, being especially low in the worst performance quartile (0.023). The small positive values of the numbers ratio for the fifth size quintile in Panel B that correspond to the larger in absolute terms negative values of the dollars ratio measure in Panel A may reflect large sells by a few funds, possibly indicating high concentration of the Polish pension fund industry.

C. Current Returns and Excess Institutional Demand

The excess demand measure outlined in section 2 enables us to uncover the effects of herding and positive feedback trading that are unrelated to past stock returns. For this purpose contemporaneous size-adjusted stock returns are grouped based on past period returns and values of the excess demand measure. The available data permits us to perform this grouping only for the stocks being in excess demand (in which investors are net buyers). The low number of stocks in excess supply (in which investors are net sellers) does not allow us to perform such segmentation.

If negative (positive) contemporaneous returns coincide with poor (good) past performance regardless of the value of the excess supply (demand) measures, then changes in the returns can be attributed exclusively to momentum. If stocks with extreme negative (positive) returns correspond to the largest excess supply (demand) measure no matter how well they performed in the past, this will indicate that contemporaneous returns are driven solely by institutional demand. The results in Table 6 illustrate that stocks experiencing large excess demand demonstrate a positive size-adjusted return of 2.23 % contrary to the stocks in which pension funds are net sellers. In this case, they exhibit high negative returns of − 30.77 %. However, the negative contemporaneous returns documented for groups of stocks with moderate and small excess demand show that feedback trading is not crucial in explaining posterior returns movements.

When stocks in excess demand are categorized by their past performance, institutional trading appears to trigger positive returns of 1.95 % in the worst past performers, thus indicating that in this case institutional trading surpasses momentum. Medium excess demand stocks display considerable positive returns of the best and average past performance groups, while small excess affects only stocks with average past performance. Absence of the apparent link between the extent of institutional demand and posterior stock performance casts doubts on the conjecture that returns of the stocks experiencing excess demand are driven by institutional traders in the next period.

Table 6 around here

The effect of feedback trading on the stocks being in excess supply appears to be more pronounced and strengthening momentum. Stock returns of this group, which demonstrate negative current returns for all levels of excess supply, are decreasing with the increase in supply. These results show that positive feedback trading appears to reinforce a momentum effect in returns of the damped stocks and sometimes even to exceed it. Jones, Lee, and Weis (1999) report similar findings for the US market. They also uncover a clear relationship between past stock performance and institutional demand only for the stocks being excessively sold.

6. Conclusion

Although pension funds were introduced in Poland just a few years ago as a result of the national pension reform, they already represent a key group of institutional investors on the Polish stock market. In this paper, we investigate the degree to which pension fund investors follow herd-like behavior and its effects on price formation on the Polish stock market. Our findings provide evidence in favor of the presence of herding by Polish pension fund investors, especially for small size stocks and stocks of particular industries, like computer service and construction. Conditional on the past return performance, herding is detected for both past winners and past losers. We also find that pension fund managers in Poland are apt to track positive feedback trading strategies, being actively engaged in selling stocks of smaller firms that performed poorly in the previous period and acquiring well-performing stocks with large capitalization.

The application of the widely used measure suggested by Lakonishok, Shleifer, and Vishny (1992) enables us to compare the degree of herding and positive feedback trading between the Polish and developed stock markets. The values found for Polish pension funds are higher than values of herding measures reported in studies of institutions acting in mature markets. This outcome is primarily attributed to specific regulatory provisions, i.e. relative performance evaluation, penalties' structure, and the extent of concentration in the Polish pension fund industry. We do not find, however, that herding and positive feedback trading by institutions has a significant effect on Polish stock prices.

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Table 1: Holdings of Pension Funds by Past Performance

	Past Performance Quintile				
	1 (best)	2	3	4	5 (worst)
Quintile Holdings as % of Total Holdings	20	23	14	27	19
Purchases in Quintile as % of Total Purchases	39	39	5	9	8
Sales in Quintile as % of Total Sales	10	27	12	14	37

Note: Total holdings are aggregated holdings of all pension funds as of one universal fund and then are assigned into quintiles according to the past performance of the assets. 1 indicates the quintile including stocks that performed the best in the past period and 5 indicates the quintile including stocks that performed the worst.

Table 2: Herding Measures by Trading Activity

Panel A: Herding Measures			
All	Number of Active Institutions		
Stocks	> 5	> 10	> 15
0.146	0.109	0.115	0.165

Panel B: Herding Measures for Actively Traded Stocks				
Size				
1 (largest)	2	3	4	5 (smallest)
0.147	0.065	0.116	0.062	0.119

Note: The mean of the Lakonishok-Shleifer-Vishny statistics across periods for a given group of stocks are presented. In Panel B, 1 indicates the quintile including stocks with the largest capitalization and 5 indicates the quintile including stocks with the smallest capitalization. For details see section 2.

Table 3: Herding Statistics by Firm Size, Past Performance, and Industry

Panel A: Firm Size Quintile				
1 (largest)	2	3	4	5 (smallest)
0.133	0.085	0.144	0.182	0.146

Panel B: Past Performance Quintile				
1 (best)	2	3	4	5 (worst)
0.147	0.162	0.132	0.098	0.146

Panel C: Industry				
Banking	Computer Services	Metal Production	Pharmaceutics	Construction
0.128	0.140	0.114	0.098	0.163

Note: The mean of the Lakonishok-Shleifer-Vishny statistics across periods for a given group of stocks are presented. In Panel A, 1 indicates the quintile including stocks with the largest capitalization and 5 indicates the quintile including stocks with the smallest capitalization. In Panel B, 1 indicates the quintile including stocks that performed the best and 5 indicates the quintile including stocks that performed the worst in the previous period. For details see section 2.

Table 4: Herding Measures by Size of Stocks and Past Performance

Past Performance Quartiles	Size Quintiles				
	1 (largest)	2	3	4	5 (smallest)
1 (best)	0.165	0.062	0.147	0.199	0.164
2	0.090	0.112	0.149	0.221	0.070
3	0.093	0.176	0.151	0.222	0.137
4 (worst)	0.144	0.093	0.070	0.142	0.121

Note: The mean of the Lakonishok-Shleifer-Vishny statistics across periods for a given group of stocks are presented. For details see section 2.

Table 5: Demand of Pension Funds by Size and Past Quarter Returns

	Panel A: Dollars Ratio Measures				
	Size				
Past Period Performance	1 (largest)	2	3	4	5 (smallest)
1(best)	0.233	0.204	− 0.061	0.029	− 0.104
2	0.120	− 0.017	0.170	0.015	− 0.084
3	0.238	0.121	− 0.082	0.072	− 0.111
4 (worst)	0.230	0.134	0.032	− 0.120	− 0.407

	Panel B: Numbers Ratio Measures				
	Size				
Past Period Performance	1 (largest)	2	3	4	5 (smallest)
1(best)	0.061	0.025	− 0.100	0.057	0.054
2	0.161	0.096	0.177	0.038	0.009
3	0.253	0.256	0.063	− 0.015	0.087
4(worst)	0.013	0.149	0.059	0.141	0.023

Note: The mean of the dollars ratio and the numbers ratio statistics across periods for given stock groups are presented. For details see section 2.

Table 6: Contemporaneous Size-Adjusted Returns by Past Returns and Levels of Excess Demand and Supply

Firms in Excess Demand	Past Period Returns				Firms in Excess Supply
	All Firms	1 (best)	2	3 (worst)	
Large Excess	2.23	7.95	− 2.82	1.95	− 30.77
Medium Excess	− 0.17	2.50	5.39	− 10.76	− 19.16
Small Excess	− 2.03	− 2.32	3.20	− 7.73	− 4.06

Note: The stocks are first divided into two groups conditional on whether they are in excess demand or excess supply based on the values of measure (5). Next, they are assigned according to the extent of the excess demand (supply). Stocks in excess demand and also grouped by their past period performance. The procedure is repeated every period. The figures displayed show the value of the current returns averaged across the assets in the group and the periods.