# THE PRICE PRESSURE OF AGGREGATE MUTUAL FUND FLOWS

by

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# The Price Pressure of Aggregate Mutual Fund Flows


## Abstract

This paper uses a unique database: a complete record of aggregate daily flows to equity mutual funds in Israel. We find that fund flows are positively auto-correlated, and also find a high positive correlation between flows to market returns ($R^2$ of 20%). Approximately one-half of the price change is reversed within ten trading days. We demonstrate, using a trading strategy based on this pattern, that the reversal is economically significant. These findings support the "price pressure hypothesis" regarding mutual fund flows: Mutual fund flows create temporary price shocks that are subsequently corrected. These findings complement microstructure research concerning price impact and price noises in stocks by indicating price noise at the aggregate market level.



Key words: mutual funds, flows, returns, price pressure, price impact

JEL classification: G12, G14

# 1. Introduction

We use a unique database comprising a complete record of aggregate **daily** flows to equity mutual funds in Israel. Using this database we find new findings regarding the relationship between aggregate equity mutual fund flows and stock market returns. We find a high positive correlation ($R^2$ of 20%) between flows and market returns as opposed to the low correlation ($R^2$ of 3%) found in Edelen and Warner (2001) (hereafter EW) and Goetzman and Massa (2003). We find that approximately one-half of all price changes are reversed within 10 trading days. By using a trading strategy based on this pattern, we show that this reversal effect is economically significant. Furthermore, we find that aggregate flows are positively serially autocorrelated, as opposed to negative serial correlation found in EW.

Warther (1995), Edwards and Zhang (1998), and Fant (1999) document a significant positive contemporaneous relationship between aggregate net monthly fund flows and equity market returns. Two hypotheses have been proposed to explain the contemporaneous relationship between flows and returns. The first is the information hypothesis: Good (bad) news regarding the equity market leads to positive (negative) returns and to flows into (out of) equity funds. This hypothesis implies no relation between lagged flows and future returns. The second hypothesis is the price pressure hypothesis: If demand for equity is not fully elastic, a large flow into (out of) equity funds will push security prices up (down), and this will be reversed in subsequent periods. Consequently, lagged positive flows should predict negative returns, and vice versa. Finding no empirical evidence of a negative relation between lagged flows and future returns, Warther (1995) and Fant (1999) reject the price pressure hypothesis.

EW use the data of TrimTabs Company. The data are aggregate flows to equity mutual funds and they are based on voluntary reporting of a sample of 424 US equity funds. EW found a high positive correlation between market return and subsequent flows while the $R^2$ of the contemporaneous relationship was only 3% and there was no significant relation between flows and subsequent returns.[1] Their findings may be interpreted as support for the information hypothesis rather than the price pressure hypothesis. EW's results are consistent with findings by Goetzman and Massa (2003) who investigated daily flows to three S&P500 index funds. Goetzman and Massa also found a low correlation ($R^2$ of about 3%) between aggregate flows and concurrent market returns, and also they did not find any relation between flows to subsequent returns. Contrary to EW, who found that aggregate flows are negatively serially autocorrelated, Goetzman and Massa found that aggregate flows are positively serially autocorrelated

As discussed by EW (2001) (Section 2.2 and Appendix) several issues involving the timeliness of their data may have affected their analysis. A main issue is the fact that fund managers have imprecise information about the flows on the day they are created, which is one day before funds receive official information on money flows. Therefore it is not clear which day the flows affect fund transactions and indirectly affect stock prices. In Israel, all fund flows (sales and redemptions) are transferred electronically and **immediately** from investor brokers (typically banks) to the Tel Aviv Stock Exchange (TASE). The TASE transfers this information to the relevant funds at 10-15 minute intervals. We received the aggregation of flows into equity fund categories, in a daily resolution, from the TASE.

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[1] Tables 3, 7 and 8 in EW present weak and insignificant evidence for a negative relation between flows and subsequent returns.

We investigate the relationship between net daily flows (sales minus redemptions) and the returns of TA25 index.[2] We find that the flows and returns are positively contemporaneously correlated, that flows are positively auto-correlated, and that flows and returns are related to the lag of both flows and returns. The dynamic relationship between flows and returns is addressed by the Bivariate VAR's (Vector Auto Regression) of flows and returns. The Impulse Response Function simulation indicates that a shock of one standard deviation to fund flows is related to a positive contemporaneous price impact of 0.62%, followed by a reversal of 0.30% in the following 10-day period (accumulated reversal after five days is 0.21%). The accumulated reversal is statistically significant. In the next stage, using the information from the flows, we build a simple strategy that invests in the market and the risk-free rate based on lag flows. In the days of stock investing, the average stock market return is 0.179% (the standard deviation is 1.26%), while on riskless investing days the average stock market return is -0.019% (the standard deviation is 1.30%). The differences are statistically significant.

The findings of this paper are related to microstructure research investigating the price impact of uninformed traders and transaction costs [see surveys by Madavan (2001), and Biais, Glosten & Spatt (2005)]. The general message of this line of research is that uninformed investors affect prices and "push" them from the fundamentals. Empirically, this impact is reflected in the reversal of a price effect (as opposed to a permanent price effect that reflects information). The horizon used to detect a reversal is typically between 30 minutes to one day since it is hard empirical measurement of such effects in longer horizons becomes difficult.[3] Measuring these effects is done typically at

[2] We focus on TA25 index to avoid issues of non-synchronous trading. See Section 2.
[3] Papers that investigate price impacts in longer horizons are Obizhaeva (2007) and Subrahmanyam (2008).

the stock level (that is, separately for each stock). However, it is not clear whether price noises at the individual stock level vanish at the aggregate stock level. If there is a systematic component in these noises, the effect should also obtain at the aggregate level. Answering this question is difficult econometrically when observing only transactions and orders in the stock market. Data on mutual funds flows, however, can provide indirect evidence concerning this issue. Mutual funds investors are retail investors and by investing through mutual funds they indicate that they perceive themselves as uninformed investors. Since the funds are obligated to conform to a strict investment of stock investing, the flows are transmitted to transactions in the stock market. Therefore it is possible to observe the effect of uninformed investors on the market as a whole. The partial reversal pattern that we find indicates that some of the "noise" induced by uninformed traders holds at the aggregate level of the stock market. This noise is not corrected immediately, but within 10 days.

Our findings are also related to research on the transaction costs of institutional investors.[4] Since investor flows induce price pressure in the market level, funds should buy "high" and sell "low." That is, mutual funds may appear to be “bad timers” because they are forced to respond to their investors' flows. This is consistent with Edelen (1999) that finds that the observed negative market timing of mutual funds is attributed to their flows.

Ben-Rephael, Kandel, and Wohl (2008) (hereafter BKW) found that aggregate net exchanges to equity funds in the USA, as a proxy for shifts between bond funds and equity funds, are positively contemporaneously correlated with aggregate stock market returns. Approximately one-half of the contemporaneous relationship is reversed within

[4] See Keim and Madhavan (1997) for evidence and a literature survey.

four months. They view their findings as support for the price pressure hypothesis, which has been rejected in the past. Our paper provides complementary evidence for the price pressure hypothesis. BKW use monthly data and therefore cannot detect short term reversal patterns as are detected in this paper. Our sample is based on daily data but it is limited to a short period and therefore does not allow the detection of longer reversal patterns. The combination of the results reported in both papers suggests that the reversal pattern is underestimated in both papers because of data limitations.

The remainder of the paper is organized as follows: Section 2 describes the environment and data. Section 3 presents the summary statistics. Section 4 presents the empirical results. Section 5 concludes.

## 2. Environment and data

In Israel, there are about 35 fund families and more than 1,000 funds. Almost all mutual fund investors are retail investors. Mutual funds are NOT used for tax benefited retirement investments.

The mutual funds flows timeline is as follows:

- An investor transmits an order (to buy or sell mutual fund units) to her bank, by phone, fax, electronically, or in person. Orders for the same day can be transmitted until 15:30-16:00 (depending on the fund) where the TASE trading day ends at 17:30. This allows the funds sufficient time to adjust their positions according to the daily flows.
- The bank transfers the orders immediately and electronically to the TASE.
- The TASE transmits to each fund family its flows every 10-15 minutes. It should be emphasized that flow transmissions are not related to the trading at TASE. Flows are transmitted through the TASE because of cost saving reasons.

- At the end of the trading day (after 17:30), each fund calculates and transmits its NAV (Net Asset Value) to the TASE for clearing. The clearing is performed by the TASE but again, clearing is not related to the trading on the TASE.
- The information on each fund's monthly flows becomes publicly available two months after the end of each month.

The sample period extends from August 2002 to September 2004, covering a total of 529 trading days. In 2004, approximately 800 stocks, warrants, and convertible bonds of approximately 600 firms were traded on TASE, with a total (end of year) market value of 397 billion NIS.[5] Most of the market value and the trading activity are concentrated in the 25 largest stocks - the stocks of the TA25 index. Their market value at the end of 2004 was 242 billion NIS, or an average market value of 9.7 billion NIS per stock. The average market value of the 75 next largest stocks (the TA75 index ) is only 1.1 billion NIS. In 2004, the average daily trading volume of TA25 stocks was 1.11 billion NIS (440 million NIS per stock), and the daily average number of transactions in TA25 stocks was 24,951 (approximately 1000 transactions per stock). The respective volume figures for TA75 stocks are much smaller: The average daily number of transactions per TA75 stock was 94, and the average trading volume was 1.825 million NIS. In Israel, no options are written on individual stocks although there is an active market for index options on TA25 index. Since most of the trading activity in the TASE is concentrated in the TA25, and in order to avoid analysis problems arising from non-synchronous trading,

[5] On the sample period 1 NIS (New Israeli Shekel) Dollar was equal on average 0.22 USD.

we focus on the TA25 index.[6] We present its returns in percentage terms, denoted as Ret.

We received daily flows data aggregated by fund categories from the TASE. That is, we have no information on the flows of any specific fund. TASE categories include twelve different types of domestic equity funds. For example, one category is TA25 funds that invest mainly in TA25 stocks. Redemptions are defined as negative flows. If money is transferred from one fund to another it is recorded as two distinct transactions. The TASE data do not include first-day inflows of new funds. Since we use TA25 as a proxy for market returns, we focus on the net daily flows in the TA25 fund category and denote it by Flows. Return and volume data were obtained from the TASE. Bank of Israel short term interest rate data were obtained from its site.

## 3. Summary statistics

The summary statistics of the sample are reported in Table 1. The average of Ret (the daily return of TA25 index) is 0.076%, which accumulates to 44.4% over the sample period. The standard deviation of Ret is 1.28%, approximately 20.3% on an annual basis. The accumulated return over the sample period is presented in Figure 1. The net flows into and out of the TA25 funds were positive on approximately one-half (266 out of 529) of the days, and were on average positive (0.57 million NIS). FundsVol is the sum of the inflows and outflows. Its average value is 14.7 million NIS. Net flows over the sample period are shown in Figure 2.

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[6] There are indications for potential non-synchronous trading in TA75 stocks [see Campbell, Lo and MacKinlay (1997) Chapter 3.1]. The correlation between the return of TA75 and its lag is 0.20 with p-value of 0.001 while correlation between the return and lag of return in TA25 index is not significantly different from zero. Also the correlation between Ta75 return and the lag of Ta25 return is 0.137 with p-value of 0.002 while the correlation between Ta25 return and the lag of Ta75 return is not significantly different from zero.

The daily correlation between flows and returns is presented in Table 2. The contemporaneous correlation between the flows and Ret is 0.451, which indicates a strong positive relation.[7] The correlation between Flows and its lag (Lflows) is 0.304, which indicates a strong autocorrelation in the flows. The correlation between Flows and one day lag of Ret (Lret) is significant and quite large: 0.219.

# 4 Empirical Results

In this section we analyze the relationship between Flows and Ret. Based on these relations, we estimate the dynamic effect of a shock to flows on returns using VAR (Vector Auto Regression) analysis.

## 4.1 The relation between flows, lagged flows, and returns

We start from an estimation of the relations between Flows and lagged variables. The coefficients from the time series regressions of Flows as a dependent variable on the respective lag variables are presented in Table 3. The basic number of lags in the regression specifications is set as four.[8] The regression of Flows on its own lags (specification 1) presents positive and significant autocorrelation. The Adj-$R^2$ is 0.103 and the p-value of lags' significance is less than 0.001. The regression of Flows on Ret lags (specification 2) also present positive correlation. The Adj-$R^2$ is 0.079 and the p-value of lags' significance is less than 0.001. Specification (3) includes both lags of Flows and Ret. The Adj-$R^2$ is 0.115. The p-value of the F-test for Ret lags after controlling for the flow lags is 0.025, which indicates that the lag of the return has an effect on the flows

[7] Consistent with previous papers (for example Warther (1995)), we find that the contemporaneous relation between flows and returns is mainly due to the unexpected component of the flows. The Adj-$R^2$ is 0.236.

[8] Our main focus in this paper is the estimation of the dynamic relation between flows and returns based on the Impulse Response Function of four lag VAR. The number of lags was set by the next likelihood ratio test: $(T-k)(\ln Det_R - \ln Det_{ur}) \sim \chi^2(q)$ .

beyond the lag of the flows. The F-test for lags 2-4 of Ret indicates that it may be possible to use the first lag of Ret only. Specification (4) includes only one lag of Ret, and the p-value of Ret is 0.006. In all the specifications we find positive correlations and autocorrelations. Based on the results of these regressions, it is evident that both lags of Flows and Ret cause Flows positively.[9]

### 4.2 The relationship between returns, lagged flows, and returns

Coefficients from the time-series regressions of Ret as a dependent variable on lagged variables are presented in Table 4. The first specification is the regression of Ret on the lags of the Flows. The first two lags of Flows are positive but not significant, while lags 3 and 4 are negative and significant. The p-value of the F-test for the lags 1 and 2 is 0.5846, while the F-test for lags 3 and 4 is 0.0149. Specification (2) regresses Ret on Ret lags. The coefficients of the regression are not significant and the lags of return do not predict future returns. Specifications (3) and (4) estimate different relations between Ret and lags of Flows and Ret. Specification (3) uses four lags of flows and four lags of return, while specification (4) uses only the first lag of return, similar to Table 3. In both specifications the lags of the flows are significant, and the lags of Ret are not significant; in specification (4), the first lag of Ret is marginally significant. To summarize, lagged flows seem to predict future returns while lagged returns do not.

### 4.3 VAR analysis of Flow and Ret

In Sections 4.1 and 4.2 we estimated the relations between flows and returns by OLS regressions. The following analysis uses the Impulse Response Function simulation

[9] See Granger (1963) and Geweke (1982).

to estimate the dynamic relations between Flows and Ret. . The VAR (Vector Auto Regression) system based on the optimal lag test includes four lags of Flows and Ret:[10]

$$
\begin{aligned}
Flows_t &= \alpha_{1,t} + \sum_{i=1}^{4} \beta_i Flows_{t-i} + \sum_{i=1}^{4} \gamma_i \operatorname{Re} t_{t-i} + \varepsilon_t \\
\operatorname{Re} t_t &= \alpha_{2,t} + \sum_{i=1}^{4} \lambda_i Flows_{t-i} + \sum_{i=1}^{4} \delta_i \operatorname{Re} t_{t-i} + \eta_t
\end{aligned}
\tag{1}
$$

The periodic and accumulated impulse response of Ret to a 1 std. shock to Flows is presented in Table 5. The effect of a shock of 1 std. to Flows on Ret is 0.62%. This response is followed by two days of mixed effects that are not significant. The accumulated effect from day 1 to day 10 is -0.306%, and significant with a *t*-statistic of 2.06.[11] If we exclude the first two insignificant days, the t-statistic of the accumulated effect for days 3-10 is 2.76. Since the reversal is partial, the permanent price effect of a shock of 1 std. to flows is 0.314% and significant (the t-statistic for the accumulated effect from day 0 to day 10 is 2.02) and is approximately one-half of the immediate effect of 0.62%. VAR relations are plotted in Panels A–D of Figure 3. Panel A plots the results of Table 5. We can see a reversal of Ret within 10 days after the shock to Flows. The accumulated response of Ret to shock in Ret, or the continuation effect of market return, is presented in Panel B. On day 0, the graph shows 1 std. of the unexpected component of Ret (see equations (1) - $\eta_t$), which is 1.12%. On the following ten days, the continuation effect is 0.17%, creating a total effect of 1.29%. This continuation effect is marginally

[10] The number of lags was set by the next likelihood ratio test: $(T-k)(\ln Det_R - \ln Det_{ur}) \sim \chi^2(q)$. In the Impulse Response analysis we assume that the causality runs from Flows to Ret. Meaning that, at time *t* shock to Flows affects Ret but a shock to Ret does not affect Flows. For robustness, we also check a system where a shock to Ret affect Flows contemporaneously. In this specification we find that a shock of 1 std to Flows is followed by a return of -0.35% over the next 10 trading days. The t-statistic for the accumulated return over days 1-10 is 2.53.

[11] The *t*-statistics of the accumulated periods were estimated using a Monte Carlo simulation. See Hamilton (1994).

significant. The *t*-statistic for the accumulated return from day 1 to 10 is 1.54. The response of Flows to shock in the Flows, or the continuation effect of Flows is presented in Panel C. We can see a positive strong continuation after the shock. On day 0, the graph shows 1 std. of the unexpected component of Ret (see equations (1) -$\varepsilon_t$) which is 7.08 (in million NIS). On the next ten days the continuation effect is 3.94 (million NIS). This continuation effect is highly significant. The *t*-statistic for the accumulated Flows from day 1 to 10 is 3.20. The response of the flows to shock in returns is presented in Panel D. It can be seen that a shock of 1 std. of return (Ret) is related to an accumulated response of the Flows of 3.00 million NIS, which is spread over seven trading days (the *t*-statistic is 2.87).

For robustness, in non-presented results, we also estimated a restricted VAR system based on specification 4 of Tables 3 and 4. The results are qualitatively similar to the complete VAR results. Kalay, Sade and Wohl (2004) studied the opening call auctions in the TASE and found that the price impact of buys is larger than sells and its reversal is smaller. Following these results we analyze a VAR system with different effects for negative and positive Flows. We did not find significant differences between positive Flows and Negative Flows. For the sake of brevity, we do not report these results in detail.

To sum up:

- Equity mutual fund flows are positively correlated.
- They are positively correlated contemporaneously with market returns.
- Approximately one-half of the contemporaneous relation is reversed within 10 trading days.

It should be emphasized that fund flows are probably correlated with other individual investor flows, and it is plausible to assume that price changes are related to larger demand shocks than the mutual funds flows.

### 4.4 Simple Strategy Based on Lagged Flows

To demonstrate the economic significance of the relation between flows and returns, we examine a simple trading strategy based on the flow-return relationship. Based on the results shown in Table 4, we construct an indicator for investment that is the sum of lag flows 3 and 4 ($SumFlows_{\_34}$). Based on the negative relation between lag 3 and 4 of flows and return, we create the following decision rule for investment in the stock market: For each day *t*, we look at $SumFlows_{\_34}$ (these flows are known at period *t-1*). If the indicator is smaller than 0 (which is a natural reference point), the decision is to invest 100% in the stock market. If the forecast result is higher than 0, the decision is to invest 100% at the risk-free rate (the Bank of Israel risk-free rate).

The strategy results are presented in Table 6 and in Figures 4A and 4B. As can be seen from Panel A, on 257 days (48.95%) the strategy recommends investing in the market. The average stock market return (Ret) for these days is 0.179% and the standard deviation is 1.26%. On 268 days (51.05%) the strategy recommends to invest in the riskless asset. The average stock market return (Ret) for these days is 0.019% and the standard deviation is 1.30%. That is, the average return is higher and the standard deviation is mildly lower on days that the strategy recommends stock investing, compared to other days. The difference between two series' average returns is marginally significant (the p-value is 0.07).

Figure 4A plots the strategy decisions over time. There are 129 switches in strategy over the 525-day investment period. The average return, standard deviation and Sharpe ratios of four strategies are presented in Panel B of Table 6. Strategy (1) invests in Ret and $R_f$ at a constant ratio of 48.95% in the stock market and 51.05% in the riskless interest rate. The average return of Strategy (1) is 0.052% with a Sharpe ratio of 0.04. Strategy (2) invests according to the forecast indicator. The average return is 0.101% with a Sharpe ratio of 0.084. We employ the Treynor-Mazuy (1966) and Henriksson-Merton (1981) timing tests for the excess return series of Strategy (2). The *t*-statistics are 3.31 and 2.65 respectively. Strategy (3) invests in the stock market for the entire period: The average market return for that period is 0.078% with a Sharpe ratio of 0.056.[12] Strategy (4) is the market risk equivalent of the forecast strategy (3). In order to maintain he same risk (measured by the standard deviation), the strategy invests 147.5% in the stock market (and borrows 47.5% at the risk-free rate) when the decision is to invest in the market, and invests 100% in risk-free rate when the decision is to invest 0 in the market. The average return is 0.135% and the Sharpe ratio is 0.084. Figure 5 depicts the accumulated return over time of strategy (4) and its risk equivalent strategy (3). The accumulated return of the market investment is 44.4% while the risk equivalent strategy accumulated return amounts to 94.1%.

## 5 Conclusions

We use a unique database of aggregate daily flows to equity mutual funds in Israel. We find that aggregate daily flows are positively serially auto-correlated; We find a high positive contemporaneous correlation ($R^2$ of 20%) between flows to market returns and demonstrate that approximately one-half of the price change is reversed within 10

[12] The difference from Table 1 is due to dropping off the first 4 days that are used for the first decision.

trading days. Our results support the price pressure hypothesis, which claims that investor flows temporarily shift prices from their fundamentals.

Ben-Rephael, Kandel and Wohl (2008) (hereafter BKW)found that aggregate net exchanges to equity funds in the USA, as a proxy for shifts between bond funds and equity funds, are positively contemporaneously correlated with aggregate stock market returns. Approximately one-half of the contemporaneous relation is reversed within four months. BKW use monthly data and therefore cannot detect short term reversal patterns as are detected in the work reported in this paper. Our paper, on the other hand, uses daily data but for a short sample period and therefore cannot detect longer time reversal patterns. Therefore this paper and BKW are complimentary. Together they are the first evidence supporting the price pressure hypothesis. Moreover, the combination of the results in both papers suggests that the reversal pattern is underestimated in both papers because of data limitations.

The findings of this paper are related to microstructure research dealing with price impact of uniformed traders and transaction costs. Our findings suggest that a part of the price noise induced by uninformed trading is not vanished at the aggregate level, but is difficult to detect because the reversal is not immediate but occurs within several days.

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**Table 1 – Summary Statistics**

The table reports the summary statistics of the sample. The data span the period from August 2002 to September 2004, a total of 529 days. Ret is the percentage return of TA25 (the index of the largest 25 stocks in the TASE). Flows is the net aggregate flows to the TA25 equity funds (in millions NIS). FundsVol is the sum of the inflows and outflows to/from to TA25 equity funds (in millions NIS). In the sample period, 1 NIS (New Israeli Shekel) Dollar was equal on average to 0.22 USD.

| Variable | Mean | Median | Std. | Min | Max |
|---|---|---|---|---|---|
| Ret (%) | 0.076 | 0.004 | 1.28 | -3.49 | 7.19 |
| Flows (M NIS) | 0.572 | 0.015 | 7.50 | -55.62 | 52.13 |
| FundsVol (M NIS) | 14.7 | 12.5 | 10.5 | 1.5 | 76.1 |

**Table 2 – Correlation Matrix**

Pearson's correlations with p -values in parenthesis are reported. The data span the period from August 2002 to September 2004, a total of 529 days. Ret is the percentage return of TA25 (the index of the largest 25 stocks in the TASE) Lret is the 1 day lag of Ret. Flows is the net aggregate flows to the TA25 equity funds (in millions NIS). Lflows is the one day lag of Flows.

| Variables | Lflows | Ret | Lret |
|---|---|---|---|
| Flows | 0.304 | 0.451 | 0.219 |
| | [<.0001] | [<.0001] | [<.0001] |
| Lflows | | -0.015 | 0.451 |
| | | [0.72] | [<.0001] |
| Ret | | | 0.057 |
| | | | [0.19] |

## Table 3 – Regressions of Flows on Lag Variables

The table presents the coefficients from the time series regression of Flows on the respective variables. The data span the period from August 2002 to September 2004, a total of 529 days. Flows is the net aggregate flows to the TA25 equity funds (in millions NIS). $Flows_{(t-1)}$ to $Flows_{(t-4)}$ are the lags of Flows from day t-1 to day t-4. $Ret_{(t-1)}$ to $Ret_{(t-4)}$ are the returns of TA25 (the index of the largest 25 stocks in the TASE ) from day t-1 to day t-4 (in percentage points).The table presents the p-values of the F-tests for regression significance and for variable significance. For example Flows lags' p-value is the p-value of the F-test for Flows lags as a group.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Intercept | 0.344 | 0.330 | 0.267 | 0.298 |
| | [1.10] | [1.04] | [0.85] | [0.96] |
| $Flows_{(t-1)}$ | 0.264 | | 0.187 | 0.196 |
| | [6.02] | | [3.71] | [3.92] |
| $Flows_{(t-2)}$ | 0.107 | | 0.094 | 0.125 |
| | [2.36] | | [1.84] | [2.75] |
| $Flows_{(t-3)}$ | 0.068 | | 0.043 | 0.070 |
| | [1.51] | | [0.85] | [1.55] |
| $Flows_{(t-4)}$ | -0.042 | | -0.015 | -0.022 |
| | [0.95] | | [0.30] | [0.50] |
| $Ret_{(t-1)}$ | | 1.207 | 0.756 | 0.769 |
| | | [4.90] | [2.71] | [2.76] |
| $Ret_{(t-2)}$ | | 0.719 | 0.289 | |
| | | [2.91] | [1.04] | |
| $Ret_{(t-3)}$ | | 0.753 | 0.418 | |
| | | [3.05] | [1.51] | |
| $Ret_{(t-4)}$ | | 0.326 | 0.117 | |
| | | [1.32] | [0.43] | |
| Adj-$R^2$ | 0.103 | 0.079 | 0.115 | 0.114 |
| **p values of F-test for:** | | | | |
| Regression | <.0001 | <.0001 | <.0001 | <.0001 |
| Flows lags | <.0001 | | <.0001 | <.0001 |
| Ret lags | | <.0001 | 0.025 | 0.006 |
| Ret lags 2-4 | | | 0.305 | |

## Table 4 – Regressions of Ret on Lag Variables

The table presents the coefficients from the time series regression of Ret on the respective variables. The sample period spans the period from August 2002 to September 2004, total of 529 days. Flows is the net aggregate flows to the TA25 equity funds (in millions NIS). $Flows_{(t-1)}$ to $Flows_{(t-4)}$ are the lags of Flows from day t-1 to day t-4. $Ret_{(t-1)}$ to $Ret_{(t-4)}$ are the returns of TA25 (the index of the largest 25 stocks in the TASE ) from day t-1 to day t-4 (in percentage points). P-values of the F-tests for regression significance and for variable significance are presented. For example, Flows lags' p-value is the p-value of the F-test for Flows lags significance as a group.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Intercept | 0.0900 | 0.0697 | 0.0808 | 0.0859 |
| | [1.60] | [1.24] | [1.44] | [1.53] |
| $Flows_{(t-1)}$ | -0.0002 | | -0.0077 | -0.0062 |
| | [0.02] | | [0.84] | [0.68] |
| $Flows_{(t-2)}$ | 0.0082 | | 0.0054 | 0.0098 |
| | [1.01] | | [0.59] | [1.20] |
| $Flows_{(t-3)}$ | -0.0180 | | -0.0233 | -0.0179 |
| | [2.23] | | [2.54] | [2.21] |
| $Flows_{(t-4)}$ | -0.0099 | | -0.0079 | -0.0081 |
| | [1.25] | | [0.89] | [1.02] |
| $Ret_{(t-1)}$ | | 0.0520 | 0.0650 | 0.0677 |
| | | [1.19] | [1.29] | [1.35] |
| $Ret_{(t-2)}$ | | 0.0491 | 0.0363 | |
| | | [1.12] | [0.73] | |
| $Ret_{(t-3)}$ | | 0.0174 | 0.0753 | |
| | | [0.40] | [1.51] | |
| $Ret_{(t-4)}$ | | -0.0159 | 0.0339 | |
| | | [0.36] | [0.69] | |
| Adj-$R^2$ | 0.009 | 0.000 | 0.011 | 0.010 |
| **p values of F-test for**: | | | | |
| Regression | 0.072 | 0.535 | 0.088 | 0.064 |
| Flows lags | 0.072 | | 0.031 | 0.066 |
| Ret lags | | 0.535 | 0.269 | 0.178 |
| Ret lags 2-4 | | | 0.338 | |

**Table 5 – Impulse Response Simulation**

The table presents the Impulse Response Function results, of the Bivariate VAR analysis with 4 lags of Flows (the net aggregate flows to the TA25 equity funds) and Ret (the returns of TA25 index). The sample period spans a period from August 2002 to September 2004, a total of 529 days. Day 0 is the contemporaneous period of the shock. The Response column is the periodic effect, and the t-statistic relates to that period effect. The Accumulated column is the accumulated periodic response.

| | **Impulse Response in %** | | |
|---|---|---|---|
| Day | Response | t-statistic | Accumulated |
| 0 | 0.620 | 11.86 | 0.620 |
| 1 | -0.014 | 0.25 | 0.607 |
| 2 | 0.046 | 0.82 | 0.653 |
| 3 | -0.115 | 2.07 | 0.537 |
| 4 | -0.085 | 1.59 | 0.453 |
| 5 | -0.045 | 2.01 | 0.408 |
| 6 | -0.044 | 2.49 | 0.364 |
| 7 | -0.028 | 1.75 | 0.336 |
| 8 | -0.013 | 1.39 | 0.323 |
| 9 | -0.006 | 1.01 | 0.316 |
| 10 | -0.002 | 0.35 | 0.314 |
| 11 | 0.000 | 0.11 | 0.315 |
| 12 | 0.001 | 0.45 | 0.316 |
| 13 | 0.001 | 0.68 | 0.318 |
| 14 | 0.001 | 0.80 | 0.319 |
| 15 | 0.001 | 0.85 | 0.320 |

## Table 6 –Strategy Results

The table presents the results of a simple strategy based on lags 3 and 4 of the flows. If the sum of lags 3 and 4 of Flows (the net aggregate flows to the TA25 equity funds) is negative the investment decision is to invest in the stock market (and obtain its return Ret which is the return of TA25). If the sum is positive the investment decision is to invest in risk-free asset – $R_f$ (Bank of Israel interest rate). Average and standard deviation of Ret conditional on the decision to invest in the market stock market (In or Out) is presented in Panel A, and the average returns and Sharpe ratios of four different strategies are presented in Panel B.

Panel A

| **Market Return Based on Strategy Decision** | IN | OUT |
|---|---|---|
| Number of days | 257 | 268 |
| Average market return | 0.179% | -0.019% |
| Std. | 1.26% | 1.30% |

Panel B

| **Comparison of Different Strategies** | Mean | Std. | Sharpe |
|---|---|---|---|
| 1. Constant weights of 0.49 in Ret & 0.51 in Rf | 0.052% | 0.63% | 0.040 |
| 2. Investment of  0% or 100% in Ret based on SumFlows_34 | 0.101% | 0.89% | 0.084 |
| 3. Ret investment | 0.078% | 1.28% | 0.056 |
| 4. Investment of -47.5% or 147.5% in Ret based on SumFlows_34 | 0.135% | 1.28% | 0.084 |

**Figure 1 – Accumulated Return of TA25 Index**

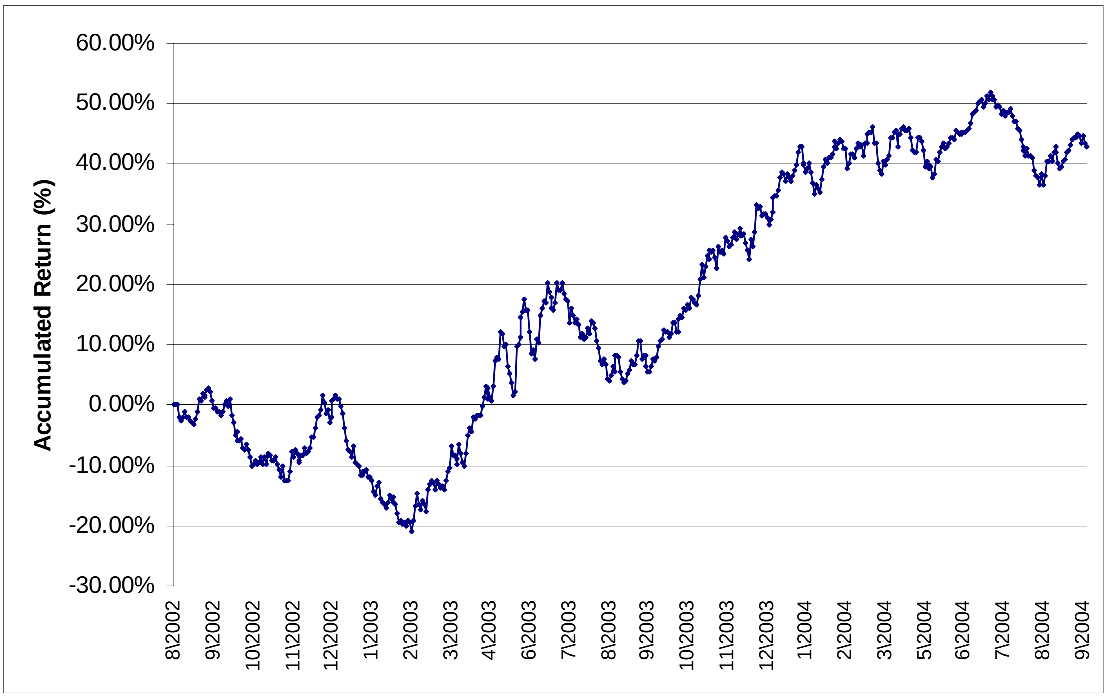



Figure 1 depicts the accumulated return of TA25 (Tel Aviv Stock Exchange 25 largest stocks index) from end of July 2002 to September 2004.

**Figure 2 – Daily Funds Flows during the Sample Period**

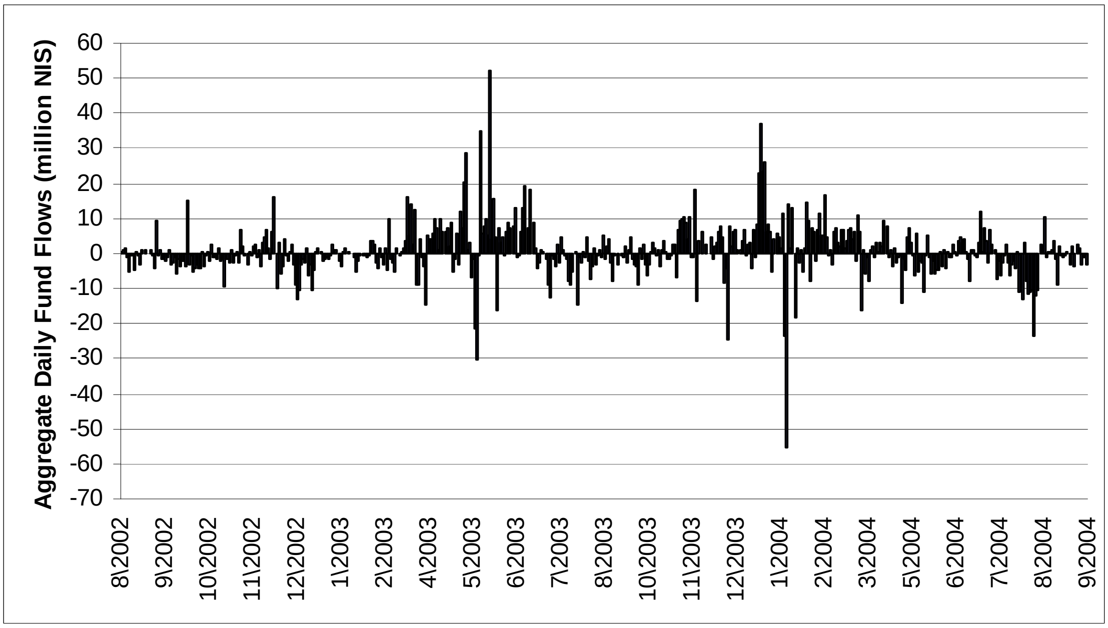
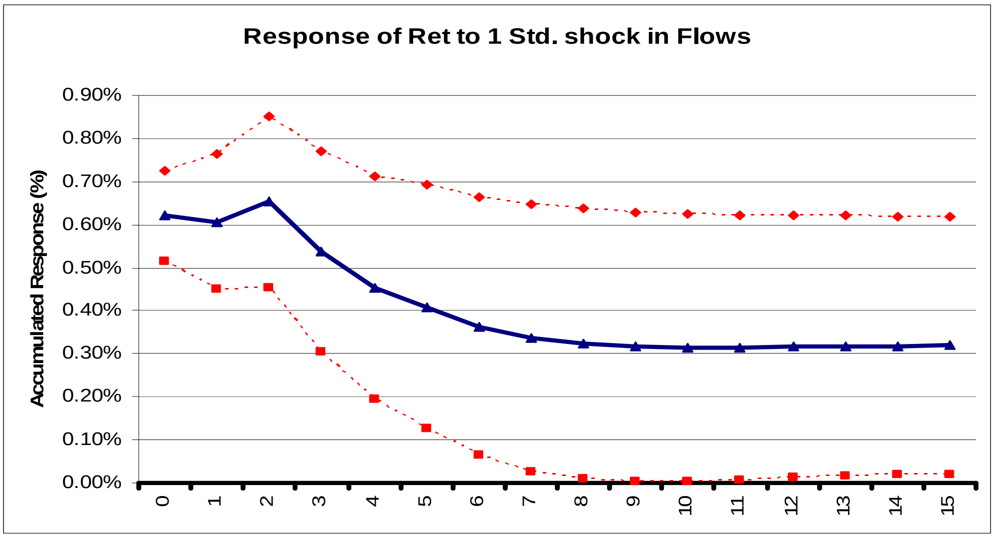



Figure 2 depicts the daily net aggregate flows into and out the TA25 equity funds from August 2002 to September 2004 (in millions NIS).

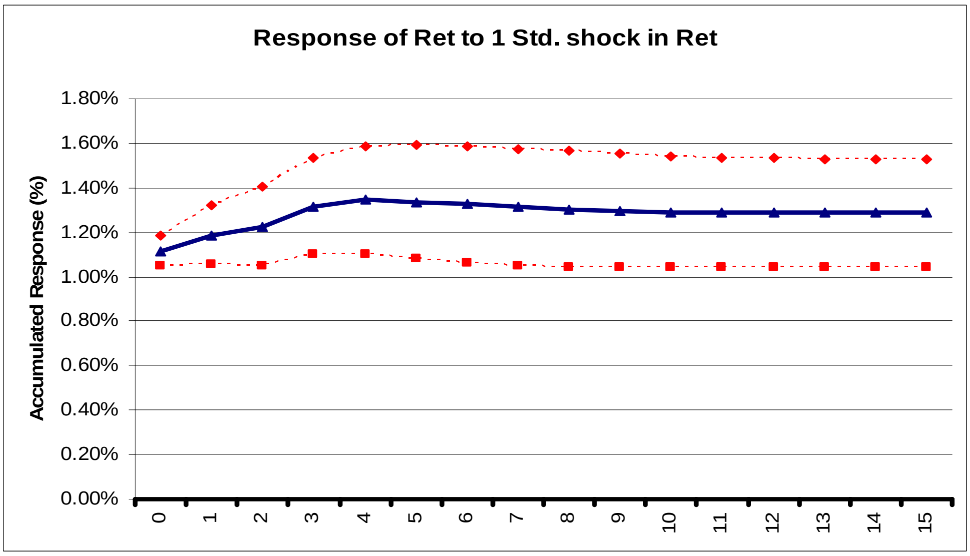
**Figure 3 – Accumulated Impulse Response Functions**

Panel A



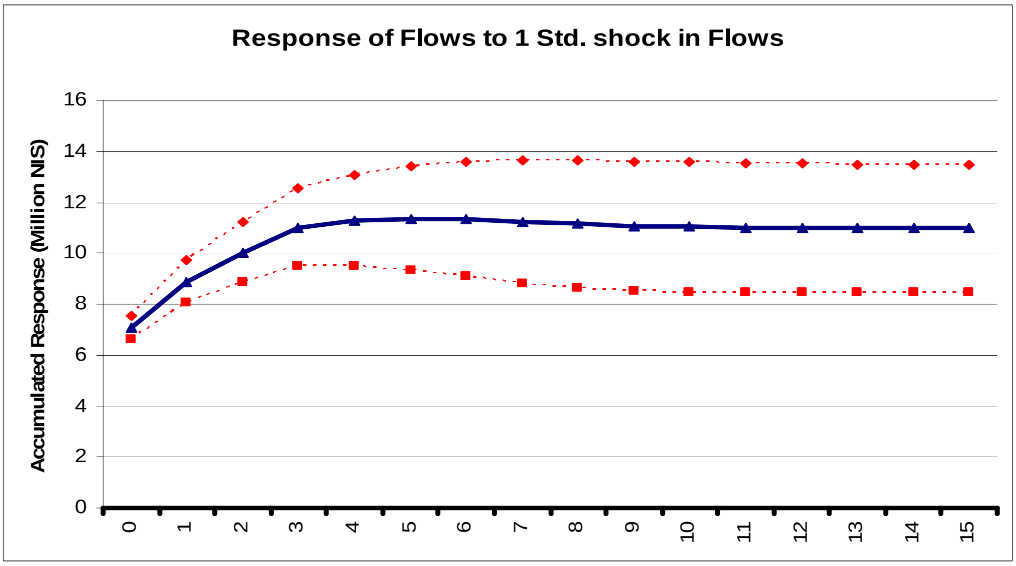

Panel A depicts the accumulated impulse response simulation of Ret (in %) to 1 std. shock in Flows. The Bivariate VAR includes 4 lags of flows and returns. The contemporaneous relation between flows and returns is such that: shock to flows effect the returns. Day 0 is the contemporaneous response to the shock. Confidence intervals of 95% are plotted in dashed red line.

Panel B



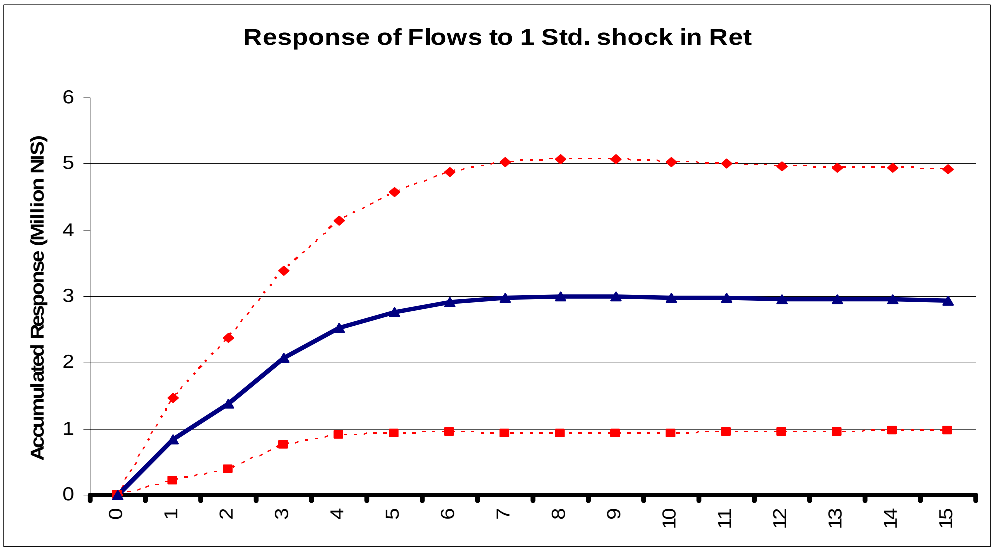

Panel B depicts the accumulated impulse response simulation of Ret (in %) to 1 std. shock in Ret. The Bivariate VAR includes 4 lags of flows and returns. The contemporaneous relation between flows and returns is such that shock to flows affects the returns. Day 0 is the shock itself. Confidence intervals of 95% are plotted as dashed red lines.

Panel C




Panel C depicts the accumulated impulse response simulation of Flows (in million NIS) to 1 std. shock in Flows. The Bivariate VAR includes 4 lags of flows and returns. The contemporaneous relation between flows and returns is such that shock to flows affects the returns. Day 0 is the contemporaneous response to the shock. Confidence intervals of 95% are plotted in dashed red lines.

Panel D




Panel D depicts the accumulated impulse response simulation of Flows (in million NIS) to 1 std. shock in Ret. The Bivariate VAR includes 4 lags of flows and returns. The contemporaneous relation between flows and returns is such that: shock to flows effect the returns. Day 0 is the contemporaneous response to the shock. Confidence intervals of 95% are plotted as a dashed red line.

**Figure 4 – Trading Strategy over Time**

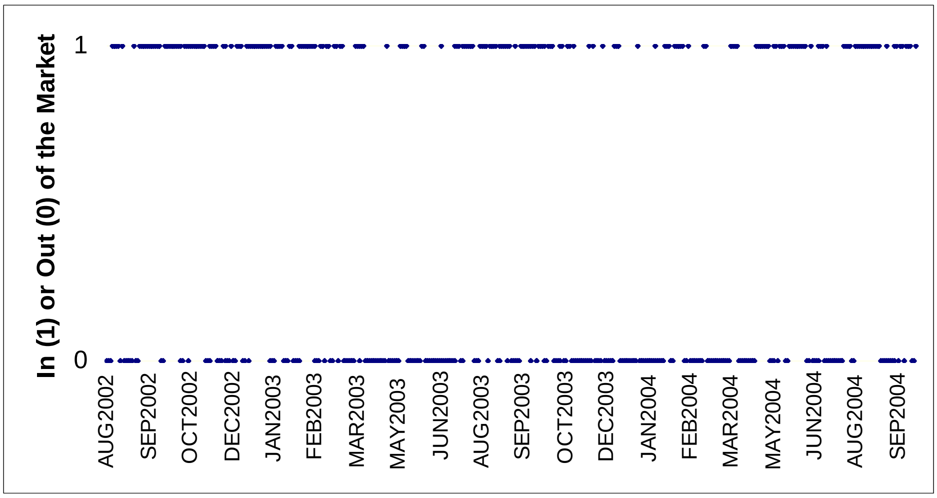



Figure 4 depicts the dynamics of the investment based on lags 3 and 4 of the flows. If the sum of lags 3 and 4 of Flows (the net aggregate flows to the TA25 equity funds) is negative, the investment decision is to invest in the stock market (and obtain its return Ret which is the return of TA25). If the sum is positive the investment decision is to invest in risk-free asset – $R_f$ (Bank of Israel interest rate). Stock investing is presented with the score 1, and investment in the risk free asset is presented by the score 0

**Figure 5 – The Accumulated Return of a Trading Strategy**

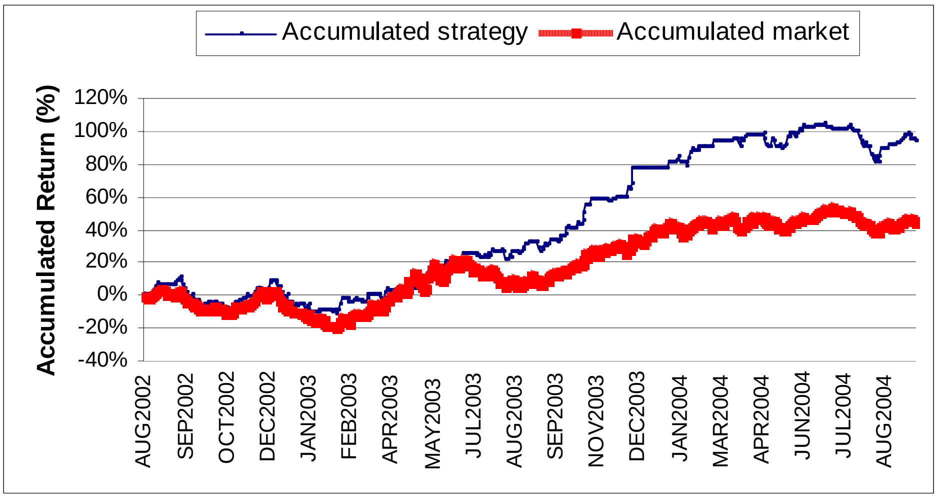



Figure 5 depicts the accumulated return of two trading strategies. Strategy (3) which is depicted with the red bold line is a simple investing in the TA25 index (and getting its return Ret). Strategy (4) is depicted by the blue line. It invests -47.5% or 147.5% in TA25 index (the complementary is investing in the risk-free rate - the Bank of Israel rate) based on lags 3 and 4 of the flows. If the sum of lags 3 and 4 of Flows (the net aggregate flows to the TA25 equity funds) is negative, the investment decision is to invest in the stock market (and obtain its return Ret which is the return of TA25). If the sum is positive, the investment decision is to invest in risk-free asset.