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# Investor Sentiment and the Closed-end Fund Puzzle: Out-of-sample Evidence

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**Abstract**

*In this paper we examine the proposition that small investor sentiment, measured by the change in the discount/premium on closed-end funds, is an important factor in stock returns. We conduct an out-of-sample test of the investor sentiment hypothesis in a market environment that is more likely to be prone to investor sentiment than the USA. We fail to provide supporting evidence for the claim of Lee et al. (1991) that investor sentiment affects the risk of common stocks. Consistent with Elton et al. (1998), who show that investor sentiment does not enter the return generating process, our tests do not detect investor sentiment in a capital market that is more susceptible to small investor sentiment. Our results provide additional support against the claim that investor sentiment represents an independent and systematic asset pricing risk.*

**Keywords:** *Closed-end-funds*; *discounts/premiums*; *investor sentiment*; *stock returns*

**JEL classification:** *G*12, *G*14

## 1. Introduction

The closed-end fund puzzle has been the focus of several past studies because, on the average, the closed-end fund trades at a discount from the value of its assets it holds, to NAV.[1] Consistent with Zweig's (1973) early explanation for the closed-end fund

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[1] See Malkiel (1977) Lee *et al.* (1991), Chen *et al.* (1993a, b) and Chopra *et al.* (1993a, b).

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puzzle, Lee *et al.* (1991), show that the closed-end fund discount reflects investor sentiment and, therefore, it affects the equity risk premium.[2] Lee *et al.* (1991) also argue that the investor sentiment factor has more bearing on the return pattern of closed-end funds and small cap stocks. In a more recent study, Elton *et al.* (1998) refute the Lee *et al.* (1991) argument that stock prices are influenced by the investor sentiment factor. Elton *et al.* (1998) argue that the investor sentiment explanation for the closed-end fund discount proposed by Lee *et al.* (1991), is based on the misspecification of the return generating process.[3]

In this paper, we use a unique dataset to examine whether the investor sentiment, measured by the change in the discount on closed-end funds, enters the return generating process of common stocks, and especially, if closed-end funds, shown to be very sensitive to this factor by Lee *et al.* (1991), yield a higher return to compensate for the risk associated with the erratic and unpredictable nature of investor sentiment. While Elton *et al.* (1998), provide evidence against the idea that investor sentiment is priced in the US capital market, it cannot be ruled out that this result is limited to the US market. Without testing the robustness of these findings outside the environment in which they were discovered, it remains unclear whether these empirical results are merely spurious correlations that they may not be confirmed outside the US capital market. Especially, in a market with different institutional, trading, maturity, and composition of private and institutional investors than that of the USA. This particular non-US market data set, increases the out-of-sample power of our tests because economic factors, stock return movements or investor biases are unlikely to be the same between the US and the Greek capital market at the period of this investigation and, therefore, allows us to provide more conclusive evidence on the merits of investor sentiment as a source of systematic risk. Fama (1998) in his response to a number of his critiques, who have challenged the rationality of capital markets, argues that studies uncovering market return anomalies should stand up to out-of-sample tests. He also argues that most of capital market anomalies tend to disappear after the publication of the original studies and, therefore, they should stand up to different sample period tests as well. This paper fills a gap in the literature in this respect.

Using Greek data over the period January 1997 to January 2002, we expect to shed more light on whether investor sentiment is an important factor in asset pricing and shun the criticism that observed empirical regularities arise from data mining. The choice of the Greek closed-end funds is also appealing on several other grounds. First, as shown in Figure 1, the Greek capital market experienced both a boom and a bust face during the 1997–2002 period. The unprecedented price run up lasted until August 1999, while stock prices reverted to historical mean levels by January 2002. During the first period the Athens Stock Exchange index (FTSE20) rose from about 550 to more than 3000 points, while by January 2002 was below the 1500 points. Hence, investor sentiment should be more pronounced in such a stock market environment. In

[2] DeLong *et al.* (1990), however, develop a model that explains why closed-end funds sell at discounts even when investors are not, on average, pessimistic.

[3] Ross (2002), in defence of the neoclassical finance view, argues that the closed-end fund discount represents the value of management fees. He states that '... the fees charged by closed-end funds are derivative securities whose value depends on the underlying NAV, and the theory of derivatives, grounded in the neoclassical tradition of no arbitrage, offers a surprisingly precise and robust valuation for managerial fees and, therefore, for the discount'.

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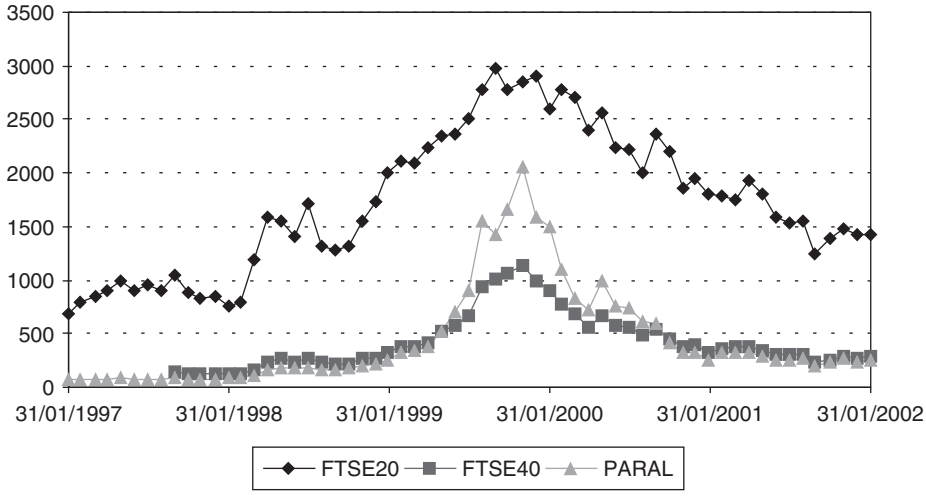



Fig. 1. Stock indices over time during 1/1997–1/2002.

addition, this dataset allows us to examine whether the creation of new closed-end funds was more prevalent during its first face, apparently, characterised by investor optimism.

Second, the Greek capital market is not as mature and sophisticated as the US and/or more developed European capital markets. Consequently, if investor sentiment does play a role in asset pricing, its manifestation should be greater in the Greek capital market than in other developed capital markets. That is, investor sentiment (human emotions) should have a greater bearing on investment decisions and the determination of asset price in this type of financial setting. Third, to the extent that investor sentiment is primarily a trait of small investors, it should also be more pronounced in markets where small investors play a more prominent role than institutional investors. Institutional investors in the Greek capital market environment are far less important than in the more developed capital markets. Institutional investments represented 6% of the total market capitalisation of the Athens Stock Exchange (ASE) over the 1994–2002 period.[4] Moreover, noise traders are expected to be more prevalent in a market with a brief history of strong investor interest in equity investing.

Finally, what is even more interesting and distinct about Greek closed-end funds is that they have been trading at a premium for most of the 1997–2002 period. Figure 2 illustrates that closed-end funds were selling, on the average, 7.55% above their NAV and at 122.86% premium when the stock market peaked in August 1999.[5] Therefore, it would not be an exaggeration to argue that the Greek capital market offers the opportunity to study the investor sentiment phenomenon in an environment where it is more likely to exist. If our tests fail to produce evidence in support of the investor

[4] The restricted presence of pension funds in the stock market, due to regulation that prohibits them from investing more than 23% of their holdings, partly explains the limited role of institutional investors.

[5] While US funds at times sell at premia to their NAV, usually when they start trading, a 10–20% discount has been the norm.

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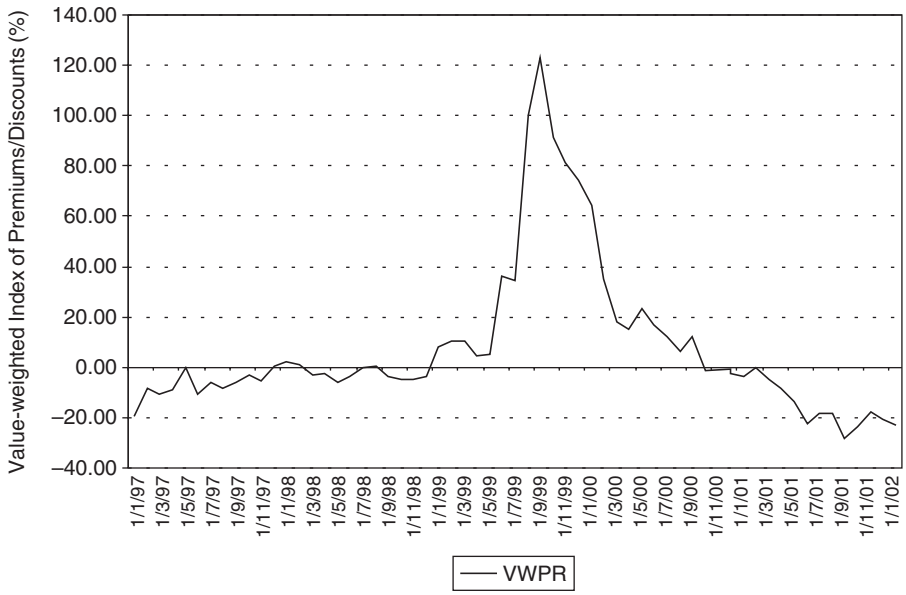



Fig. 2. Percentage discount or premium at the end of the month for all Greek closed-end stock funds during 1/1997–1/2002.

sentiment factor, it would be reasonable to conclude that it is not important in explaining the risk of common stocks.

The main results of the paper are as follows. First, we find no evidence in support of the claim of Lee *et al.* (1991) that investor sentiment affects the risk of common stocks. Our evidence is consistent with the findings of Elton *et al.* (1998) and indicates that investor sentiment does not exist even in a market which was expected to be more prone to investor sentiment than in other developed markets. Second, while we show similar results with those reported by Lee *et al.* (1991) when we use their two-factor model, our evidence reveals that the sentiment factor does not enter the return generating process more frequently than a set of industry return indices constructed in a similar way as the sentiment return index. The industry return indices are used as a benchmark of comparison since they are not considered as systematic asset pricing factors. Third, when we investigate the pattern of return sensitivity to the sentiment return factor (i.e., the change in the discount closed-end funds) across size portfolios using the same two-factor model used by Lee *et al.* (1991), we are able to produce similar results with theirs. When we use a more general multifactor model, this pattern ceases to exist. Finally, we examine whether closed-end funds (i.e., firms that are expected to be more sensitive to the sentiment factor) earn a higher return as expected according to the claim of Lee *et al.* (1991). Our evidence suggests that firms with higher sensitivity to change in the discount on closed-end funds do not associate with higher returns.

The remainder of the paper is organised as follows. Section 2 provides a description of the data sources, portfolio samples, and index construction. In Section 3 we describe the return generating process and the tests. Section 4 presents the results. Section 5 concludes the paper.

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## 2. Data sources, portfolios, and index construction

In this section we describe the data sources, portfolio samples, index construction and define the variables used in the analysis.

### 2.1. *Data sources*

We employ data obtained from several different sources spanning the period from January 1997 to January 2002. The sample consists of all 16 Greek closed-end funds listed in the Athens Stock Exchange since January 1997. Even though most closed-end funds went public before 1997, as shown in the Panel A of the Appendix, our sample is restricted to the post-January 1997 period mainly because NAV data are not available for prior years. All closed-end funds went public prior to 1995, that is generally characterised as a rather dull period for the ASE. This is inconsistent with the investor sentiment hypothesis that predicts that new funds get started when investor sentiment is strong. In fact, not a single new closed-end fund was offered for trading during the post-1997 period when the ASE experienced a remarkable price run up and old funds were selling at hefty premiums.[6] Monthly closed-end fund net asset values are from the Association of Greek Institutional Investors. Closed-end fund, mutual fund and stock prices are all from the *Finance* databank of the EFFECT Corporation. All fund and stock returns used in this study are simple average monthly returns, inclusive of dividends. The risk-free rate is the 1-month interbank offered rate in Greek drachmas (Athibor for the period 1997–2000) and euros (Euribor for the period 2001–2). Prices for the four value-weighted indices (FTSE20, FTSE40, GIASE, and PARALLEL) and the other three size-based portfolios were obtained from the *Finance* databank of the EFFECT Corporation.

The portfolio composition of each fund was determined from the quarterly financial statements of the funds. Ownership structure of Greek closed-end funds was collected from a special report published by the ASE. This publication reports the owners of common shares (or voting rights) that hold at least 5% of total shares as of 31 December 2001 for all companies listed in ASE.

### 2.2. *Portfolio samples*

We test the proposition that the investor sentiment (i.e., the index of changes in the value weighted index of premium/discount) enters the return generating process for a set of (a) 6 passive portfolios and an extra 5 size-based portfolios, (b) 23 active portfolios, and (c) 61 industrial stocks and one utility stock. The passive portfolios are the three indices of the Athens Stock Exchange (FTSE20, FTSE40, PARALLEL) and three equally weighted portfolios of industrial stocks sorted by size (LARGE, MEDIUM, SMALL). Consistent with previous work, a more refined set of size-shorted portfolios are constructed (P1(large), P2, P3, P4, and P5 (small)) to allow us to make comparisons with prior studies. FTSE20, is the value-weighted index of 20 blue chips traded in the ASE (i.e., the large-cap stock index). FTSE40, is the value-weighted index of the next 40 companies in the ASE (i.e., the medium-cap stock

[6] During the bull market period of 1995–99 only two non-listed funds emerged but were not listed. Again contrary to the investor sentiment hypothesis, when the bear market begun post-1999, 22 new non-listed funds were established (17 in 2000, 4 in 2001, and one in 2002).

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index). GI-ASE, is the value-weighted portfolio of 60 stocks from the main market traded in the ASE. PARALLEL, is the value-weighted portfolio of 42 stocks traded in the parallel market of the ASE. The LARGE, MEDIUM, and SMALL represent equally-weighted portfolios. These portfolios were constructed by ranking industrial and utility stocks at the end of each year in descending order based on their market capitalisation. The top 20 stocks are used to form the LARGE portfolio, the next 20 stocks the MEDIUM portfolio and the bottom 22 stocks form the SMALL portfolio. Then, equally weighted monthly returns are estimated for each of these portfolios for the sample period. The set of active portfolios consists of 23 equity mutual funds, 61 industrial stocks and one utility stock. (i.e., OTE, a telecommunications company). Appendix A, provides the 16 closed-endfunds, 23 active portfolios and the 62 industrial and utility stocks used in this study.

### 2.3. *Index construction and description of variables*

Following Lee *et al*. (1991), we construct their investor sentiment index using a value-weighted index of premiums ($Prem_{it}$) as follows:[7]

$$VWPR_t = \sum_{i=1}^{n} w_i Prem_{it} \tag{1}$$

where,

$$w_i = \frac{NAV_{it}}{\sum_{i=1}^{n} NAV_{it}},$$

$NAV_{it}$ = Net Asset Value of fund $i$ at end of month $t$.

$$Prem_{it} = \frac{SP_{it} - NAV_{it}}{NAV_{it}} \times 100 \tag{2}$$

$SP_{it}$ = Stock Price of fund $i$ at the end of month $t$
$n$ = the number of funds with available $Prem_{it}$

In addition, we computed the changes in the value-weighted index of monthly premiums:

$$\Delta VWPR_t = VWPR_t - VWPR_{t^{-1}} \tag{3}$$

### 2.4. *Premiums/discounts, closed-end fund returns, and NAV returns*

Table 1 reports descriptive statistics of the sample. Panel A shows that few closed-end funds sell at a discount to their net asset values, mean premiums of about 7.55% has been the norm. Panel B indicates that over the 1997–2002 period closed-end funds outperformed the market by more than 5.3%. The NAV returns reported in Panel C of Table 1, indicate that they are lower in comparison to those realised by the closed-end funds. According to Lee *et al*. (1991), when closed-end funds trade at a discount (premium) they must offer a higher (lower) return to compensate investors

[7] It should be noted here that we estimate closed-end fund premiums rather than discounts, as is the case in Lee *et al*. (1991) and Elton *et al*. (1998), so that we can obtain a positive sentiment index. Other than that the construction of our sentiment index is identical to these studies. Therefore, when the index increases (decreases) indicates investor optimism (pessimism).

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Table 1

Descriptive statistics.

Panel A: Closed-end fund premiums/discounts (%): January 1997–January 2002.

| # | Closed-end fund | # Obs. | Mean | Median | Max | Min | Std. Dev. |
|---|---|---|---|---|---|---|---|
| 1 | Aeolian | 61 | −0.56 | −11.50 | 173.10 | −33.33 | 37.56 |
| | | | (−0.11) | {2.55} | | | |
| | | | [0.90] | [0.12] | | | |
| 2 | Alpha Invest. | 61 | −3.07 | −5.80 | 28.50 | −27.60 | 13.46 |
| | | | (−1.78) | {1.93} | | | |
| | | | [0.07] | [0.05] | | | |
| 3 | Alpha Trust Invest. | 61 | 10.51 | −2.80 | 84.00 | −23.80 | 29.67 |
| | | | (2.76) | {0.82} | | | |
| | | | [0.00] | [0.40] | | | |
| 4 | Alpha Trust Orion | 61 | 2.42 | −10.00 | 155.40 | −32.34 | 38.28 |
| | | | (0.49) | {1.94} | | | |
| | | | [0.62] | [0.05] | | | |
| 5 | Aspis | 61 | 62.99 | −3.10 | 708.30 | −43.72 | 162.05 |
| | | | (3.03) | {2.20} | | | |
| | | | [0.00] | [0.27] | | | |
| 6 | Commercial Invest | 61 | 18.55 | −3.90 | 291.70 | −37.25 | 66.17 |
| | | | (2.18) | {0.70} | | | |
| | | | [0.03] | [0.48] | | | |
| 7 | Inv. Development | 61 | 30.89 | −3.90 | 722.10 | −35.20 | 118.18 |
| | | | (2.04) | {0.16} | | | |
| | | | [0.04] | [0.87] | | | |
| 8 | Dias | 61 | 30.22 | −3.50 | 481.50 | −35.90 | 94.68 |
| | | | (2.49) | {1.54} | | | |
| | | | [0.01] | [0.12] | | | |
| 9 | Ergo Invest. | 61 | −7.92 | −13.10 | 83.80 | −30.24 | 20.56 |
| | | | (−3.00) | {3.47} | | | |
| | | | [0.00] | [0.00] | | | |
| 10 | Exelixi | 61 | 43.52 | 0.20 | 525.60 | −34.64 | 116.79 |
| | | | (2.91) | {1.40} | | | |
| | | | [0.00] | [0.16] | | | |
| 11 | Hellenic Invest. | 61 | −3.03 | 0.40 | 24.70 | −34.71 | 16.08 |
| | | | (−1.47) | {0.95} | | | |
| | | | [0.14] | [0.33] | | | |
| 12 | Interinvest | 61 | 18.50 | −5.95 | 218.50 | −25.71 | 62.28 |
| | | | (2.32) | {0.58} | | | |
| | | | [0.02] | [0.56] | | | |
| 13 | Marfin | 57 | 18.55 | 22.60 | 111.70 | −33.33 | 35.04 |
| | | | (3.99) | {3.55} | | | |
| | | | [0.00] | [0.00] | | | |
| 14 | National | 61 | 6.09 | 2.10 | 68.20 | −35.98 | 22.47 |
| | | | (2.11) | {1.66} | | | |
| | | | [0.03] | [0.09] | | | |
| 15 | Piraeus Investments | 61 | 7.88 | 2.70 | 139.30 | −38.69 | 30.35 |
| | | | (2.06) | {0.93} | | | |
| | | | [0.04] | [0.34] | | | |
| 16 | Proodos | 61 | −14.23 | −17.20 | 30.10 | −26.27 | 10.98 |
| | | | (−10.11) | {5.90} | | | |
| | | | [0.00] | [0.00] | | | |

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Table 1

Continued.

Panel B: Closed-end funds and portfolio returns (%): January 1997–January 2002.

| # | Closed-end fund | # Obs. | Mean | Median | Max | Min | Std. Dev. |
|---|---|---|---|---|---|---|---|
| 1 | Aeolian | 60 | 6.71 | 3.53 | 161.35 | −30.57 | 27.98 |
| | | | (1.85) | {1.38} | | | |
| | | | [0.06] | [0.16] | | | |
| 2 | Alpha Invest. | 60 | 2.70 | 2.48 | 49.56 | −25.78 | 14.02 |
| | | | (1.48) | {1.12} | | | |
| | | | [0.14] | [0.26] | | | |
| 3 | Alpha Trust Invest. | 60 | 2.96 | 3.13 | 73.21 | −59.60 | 19.05 |
| | | | (1.20) | {1.12} | | | |
| | | | [0.23] | [0.26] | | | |
| 4 | Alpha Trust Orion | 60 | 7.94 | 3.93 | 119.70 | −34.05 | 27.57 |
| | | | (2.23) | {1.35} | | | |
| | | | [0.02] | [0.17] | | | |
| 5 | Aspis | 60 | 2.68 | 2.02 | 54.74 | −38.11 | 19.59 |
| | | | (1.06) | {0.71} | | | |
| | | | [0.29] | [0.47] | | | |
| 6 | Commercial Invest | 60 | 6.15 | 0.14 | 101.14 | −34.67 | 26.67 |
| | | | (1.78) | {0.75} | | | |
| | | | [0.07] | [0.44] | | | |
| 7 | Inv. Development | 60 | 8.70 | −0.79 | 134.85 | −25.70 | 31.09 |
| | | | (2.16) | {0.98} | | | |
| | | | [0.03] | [0.32] | | | |
| 8 | Dias | 60 | 6.80 | −0.75 | 166.52 | −36.44 | 32.09 |
| | | | (1.64) | {0.82} | | | |
| | | | [0.10] | [0.40] | | | |
| 9 | Ergo Invest. | 60 | 3.58 | −0.34 | 57.98 | −26.94 | 19.08 |
| | | | (1.45) | {0.60} | | | |
| | | | [0.15] | [0.54] | | | |
| 10 | Exelixi | 60 | 12.48 | 0.00 | 181.89 | −31.80 | 39.71 |
| | | | (2.43) | {1.31} | | | |
| | | | [0.01] | [0.18] | | | |
| 11 | Hellenic Invest. | 60 | 2.69 | 0.96 | 53.87 | −19.82 | 13.68 |
| | | | (1.52) | {1.09} | | | |
| | | | [0.13] | [0.27] | | | |
| 12 | Interinvest | 60 | 5.79 | 1.75 | 77.95 | −26.10 | 20.34 |
| | | | (2.20) | {1.62} | | | |
| | | | [0.03] | [0.10] | | | |
| 13 | Marfin | 60 | 4.40 | 1.52 | 77.10 | −35.27 | 20.67 |
| | | | (1.65) | {0.93} | | | |
| | | | [0.10] | [0.35] | | | |
| 14 | National | 60 | 3.75 | −1.54 | 61.82 | −30.40 | 19.81 |
| | | | (1.46) | {0.64} | | | |
| | | | [0.14] | [0.51] | | | |
| 15 | Piraeus Investments | 60 | 5.06 | −1.08 | 76.24 | −37.07 | 21.27 |
| | | | (1.84) | {1.24} | | | |
| | | | [0.07] | [0.21] | | | |
| 16 | Proodos | 60 | 2.82 | 1.22 | 31.15 | −19.73 | 12.04 |
| | | | (1.81) | {1.21} | | | |
| | | | [0.07] | [0.22] | | | |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| P1 | GIASE | 60 | 1.96 | 0.83 | 41.33 | −22.23 | 11.50 |
| | | | (1.32) | {1.02} | | | |
| | | | [0.19] | [0.30] | | | |
| P2 | FTSE20 | 60 | 1.90 | 1.22 | 50.53 | −23.46 | 12.32 |
| | | | (1.19) | {0.89} | | | |
| | | | [0.23] | [0.37] | | | |
| P3 | FTSE40 | 52 | 2.24 | 1.88 | 41.87 | −26.70 | 14.72 |
| | | | (1.09) | {0.88} | | | |
| | | | [0.27] | [0.37] | | | |
| P4 | PARALLEL | 60 | 3.87 | 0.63 | 71.12 | −29.55 | 19.62 |
| | | | (1.52) | {1.13} | | | |
| | | | [0.13] | [0.25] | | | |
| P5 | INDUSTR | 60 | 1.52 | −0.49 | 35.66 | −20.35 | 10.98 |
| | | | (1.07) | {0.79} | | | |
| | | | [0.28] | [0.42] | | | |
| P6 | HOLD | 60 | 2.99 | 2.48 | 30.82 | −29.44 | 13.52 |
| | | | (1.71) | {1.27} | | | |
| | | | [0.09] | [0.20] | | | |
| P7 | CONST | 60 | 2.90 | 0.54 | 74.19 | −29.70 | 18.34 |
| | | | (1.22) | {0.81} | | | |
| | | | [0.22] | [0.41] | | | |
| P8 | BANK | 60 | 2.48 | 1.23 | 57.05 | −26.75 | 14.47 |
| | | | (1.32) | {0.96} | | | |
| | | | [0.18] | [0.33] | | | |
| P9 | VWPR | 61 | 7.55 | −2.18 | 122.86 | −28.09 | 30.85 |
| | | | (1.91) | {0.05} | | | |
| | | | [0.06] | [0.95] | | | |
| P10 | ΔVWPR | 60 | −0.06 | −1.11 | 65.69 | −31.74 | 12.76 |
| | | | (−0.03) | {1.01} | | | |
| | | | [0.97] | [0.30] | | | |

Panel C: NAV returns (%): January 1997–January 2002.

| # | Closed-end Fund | # Obs. | Mean | Median | Max | Min | Std. Dev. |
|---|---|---|---|---|---|---|---|
| 1 | Aeolian | 60 | 3.73 | 1.25 | 167.56 | −54.65 | 24.72 |
| | | | (1.16) | {1.42} | | | |
| | | | [0.24] | [0.15] | | | |
| 2 | Alpha Invest. | 60 | 0.95 | −0.38 | 49.82 | −28.84 | 10.87 |
| | | | (0.67) | {0.49} | | | |
| | | | [0.50] | [0.61] | | | |
| 3 | Alpha Trust Invest. | 60 | 1.27 | 1.18 | 28.79 | −35.32 | 11.03 |
| | | | (0.89) | {0.97} | | | |
| | | | [0.37] | [0.32] | | | |
| 4 | Alpha Trust Orion | 60 | 2.40 | 1.28 | 65.10 | −20.35 | 12.80 |
| | | | (1.45) | {1.13} | | | |
| | | | [0.15] | [0.25] | | | |
| 5 | Aspis | 60 | 5.27 | 1.57 | 311.73 | −80.30 | 44.28 |
| | | | (0.92) | {0.45} | | | |
| | | | [0.36] | [0.65] | | | |
| 6 | Commercial Invest | 60 | 4.01 | 0.79 | 85.58 | −18.86 | 15.30 |
| | | | (2.02) | {1.61} | | | |
| | | | [0.04] | [0.10] | | | |
| 7 | Inv. Development | 60 | 6.72 | 1.12 | 219.53 | −48.99 | 37.17 |
| | | | (1.40) | {0.94} | | | |
| | | | [0.16] | [0.34] | | | |

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Table 1
Continued.

| # | Closed-end Fund | # Obs. | Mean | Median | Max | Min | Std. Dev. |
|---|---|---|---|---|---|---|---|
| 8 | Dias | 60 | 4.66 | 1.66 | 231.73 | −24.38 | 31.59 |
| | | | (1.14) | {1.02} | | | |
| | | | [0.25] | [0.30] | | | |
| 9 | Ergo Invest. | 60 | 1.58 | 1.56 | 37.88 | −18.71 | 11.92 |
| | | | (1.02) | {0.64} | | | |
| | | | [0.30] | [0.51] | | | |
| 10 | Exelixi | 60 | 5.14 | 0.61 | 232.39 | −28.80 | 31.61 |
| | | | (1.26) | {0.90} | | | |
| | | | [0.21] | [0.36] | | | |
| 11 | Hellenic Invest. | 60 | 1.20 | 0.48 | 26.28 | −15.41 | 9.21 |
| | | | (1.01) | {0.64} | | | |
| | | | [0.31] | [0.51] | | | |
| 12 | Interinvest | 60 | 2.12 | 1.92 | 47.21 | −20.30 | 10.42 |
| | | | (1.57) | {1.37} | | | |
| | | | [0.12] | [0.16] | | | |
| 13 | Marfin | 57 | 2.38 | 0.04 | 93.08 | −35.26 | 17.88 |
| | | | (1.00) | {0.31} | | | |
| | | | [0.31] | [0.75] | | | |
| 14 | National | 60 | 1.63 | 1.38 | 26.45 | −21.21 | 10.09 |
| | | | (1.25) | {1.17} | | | |
| | | | [0.21] | [0.24] | | | |
| 15 | Piraeus Investments | 60 | 1.76 | 0.96 | 33.21 | −24.70 | 10.43 |
| | | | (1.30) | {1.16} | | | |
| | | | [0.19] | [0.24] | | | |
| 16 | Proodos | 60 | 1.28 | 2.44 | 26.18 | −18.25 | 8.75 |
| | | | (1.13) | {1.22} | | | |
| | | | [0.26] | [0.22] | | | |

*Note*:
t-statistics in ( ), p-values in [ ], Wilcoxon signed rank test in { }.
GIASE is the General Index of ASE (GIASE). FTSE20 is an index of high capitalisation companies, FTSE40 is an index of medium capitalisation companies, PARALLEL is an index of small capitalisation companies. BANK, INDUST, CONSTR and HOLD represent indices for the Banking, Industrial, Construction, and Holding industries, respectively. VWPR is the index of the monthly premium of Greek closed-end funds and ΔVWPR is the index of changes in the monthly premium of Greek closed-end funds.

for sentiment risk. A comparison between closed-end fund and NAV returns does not seem to corroborate this argument as Greek closed-end funds, on the average, trade at a premium and realise returns greater than the NAV returns.[8]

### 2.5. *Ownership structure and portfolio composition of closed-end funds*

The ownership structure information of closed-end funds, reported in Table 2, shows that all the funds had at least one shareholder with greater than 5% ownership. NATIONAL

[8] If funds trade at a discount (premium), the fund return must be greater (lower) than the NAV return based on $R(\text{fund}) = R(\text{nav}) \pm (\text{dividend} \times \text{discount (premium)})/P_0$ (see Elton *et al.* (1998) for its derivation).

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Table 2

Ownership structure of Greek closed-end funds: 31 December 2001.

| Closed-end fund | Shareholder >5% | %voting rights | %voting rights (cumulative) |
|---|---|---|---|
| Aeolian | Pagidas Ioannis | 5.010 | 5.010 |
| Alpha Invest. | Alpha Bank | 39.860 | 39.860 |
| Alpha Trust Invest. | Orion | 9.714 | 54.487 |
| | Alpha Trust New Comp. | 9.714 | |
| | Alpha Trust Holdings | 35.059 | |
| Alpha Trust Orion | Alpha Trust Orion D.A.E.E.X. | 5.070 | 5.070 |
| Aspis | Aspis Group | 69.023 | 69.023 |
| Commercial Invest | Commercial Bank Group | 52.602 | 59.282 |
| | Tamio Asfalisis Dimosion Ypallilon | 6.680 | |
| Dias | Telesis Group | 19.980 | 19.980 |
| Ergoinvest | Efg Eurobank | 30.790 | 30.790 |
| Exelixi | Getem Sa | 5.601 | 5.601 |
| Hellenic Invest. | Etba | 31.850 | 57.750 |
| | Tap OTE | 9.890 | |
| | Tap ETBA | 8.060 | |
| | Tsay | 7.950 | |
| Interinvest | Kiklos Axe | 21.000 | 34.000 |
| | Nireus SA | 13.000 | |
| Inv. Development | Efg Eurobank | 41.139 | 41.139 |
| Marfin | Marfin A.E.P.E.Y. | 5.753 | 5.753 |
| National | National Bank of Greece | 23.160 | 61.220 |
| | Eteba | 13.140 | |
| | Tahidromiko Tamieytirio | 9.940 | |
| | Tamio Ellhnikis Horofilakis | 9.940 | |
| | Tap OTE | 5.040 | |
| Piraeus | Piraeus Bank | 52.200 | 52.200 |
| Proodos | EFG Eurobank | 15.840 | 20.860 |
| | Marfin Classic A.E.E.X. | 5.020 | |

is the only fund with five shareholders with more than 5% ownership followed by HELLENIC with four shareholders and ALPHA TRUST with three. COMMERCIAL, INTERINVEST and PROODOS each have two shareholders that own more than 5% while the remaining funds have only one large shareholder.

The composition of closed-end funds based on information available as of December 31, 2001, is reported in Table 3. The evidence shows that closed-end funds invest primarily in Greek publicly traded stocks. COMMERCIAL, DIAS, and PIRAEUS hold none of foreign stocks while the remaining funds keep small positions in non-Greek stocks. Only ALPHA TRUST INVESTMENTS maintains a foreign stock portfolio placing 69.2% of it in such stocks. Overall, the composition of Greek closed-end funds did not offer an opportunity for investors to access foreign markets. Also, Greek closed-end funds were virtually stock funds. On an average, funds were invested 85.7% in stocks (Greek and foreign) and the remaining was placed in bonds (3.2%) and in cash or cash equivalents (11.2%). Of the 16 closed-end funds, EXELIXI has the lowest percentage invested in stocks (65.8%) and NATIONAL has the highest (94.5%).

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Table 3

Portfolio composition of Greek closed-end funds: 31 December 2001.

| # | Closed-end Fund | % Greek Stocks | % Foreign Stocks | % Bonds | % Cash & Equivalents | % TOTAL |
|---|---|---|---|---|---|---|
| 1 | Aeolian | 80.74 | 3.61 | 0.00 | 15.65 | 100.00 |
| 2 | Alpha Invest. | 65.00 | 17.20 | 15.00 | 2.80 | 100.00 |
| 3 | Alpha Trust Invest. | 2.44 | 69.20 | 0.00 | 28.36 | 100.00 |
| 4 | Alpha Trust Orion | 83.40 | 8.71 | 0.83 | 7.06 | 100.00 |
| 5 | Aspis | 86.14 | 2.49 | 0.00 | 11.37 | 100.00 |
| 6 | Commercial Invest | 86.40 | 0.00 | 0.00 | 13.60 | 100.00 |
| 7 | Inv. Development | 82.20 | 3.00 | 8.90 | 5.90 | 100.00 |
| 8 | Dias | 94.20 | 0.00 | 0.00 | 5.80 | 100.00 |
| 9 | Ergo Invest. | 90.07 | 3.81 | 0.00 | 6.12 | 100.00 |
| 10 | Exelixi | 53.89 | 11.89 | 19.45 | 14.77 | 100.00 |
| 11 | Hellenic Invest. | 74.40 | 3.90 | 0.00 | 21.70 | 100.00 |
| 12 | Interinvest | 90.90 | 2.67 | 1.75 | 4.68 | 100.00 |
| 13 | Marfin | 87.73 | 6.15 | 0.00 | 6.12 | 100.00 |
| 14 | National | 92.50 | 2.00 | 2.30 | 3.20 | 100.00 |
| 15 | Piraeus Investments | 82.78 | 0.00 | 0.51 | 16.71 | 100.00 |
| 16 | Proodos | 81.63 | 1.82 | 2.39 | 14.16 | 100.00 |

### 2.6. *Correlations in premiums/discounts of closed-end funds*

The investor sentiment hypothesis predicts that the discounts/premiums on closed-end funds should be correlated. Table 4, indeed, illustrates that the premiums of individual funds are highly correlated and are mostly significant at the 5% level. From the 120 coefficients, only 27 are insignificant. Most of the insignificant coefficients are attributed to ASPIS INVESTMENTS (13) and MARFIN (7) closed-end funds. The average pairwise correlation is 0.516. This is similar to the correlation reported in Lee *et al.* (1991). The correlation between the VWPR and the individual premiums of each individual fund is also very high an indication of the strong comovement among premiums in individual closed-end funds.

Table 5 presents monthly correlations of changes in premiums for all 16 funds during 1977–2002. The average correlation is 0.287. The co-movement between $\Delta VWPR$ and the premiums of each individual fund is fairly strong. The correlation between each of the four other indices and the premiums of each individual fund is much weaker than the one between $\Delta VWPR$ and the premiums of each individual fund. The correlation between $\Delta VWPR$ and the returns on the value-weighted market index GIASE is 0.3329, and with the FTSE20 is 0.2090, respectively. While these correlations are not statistically insignificant, the correlation between $\Delta VWPR$ and the returns on the value-weighted index FTSE40 is 0.5019 and the returns on the value-weighted index from the PARALLEL market is 0.5577. This indicates that closed-end fund premiums are correlated more with medium capitalisation stocks included in the FTSE40 index and with small cap stocks traded in the PARALLEL market where investor sentiment is more likely to exist than in the other segments of the ASE. Overall, these movements do not clearly support the existence of investor sentiment.

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Table 4

Correlation of monthly premiums/discounts of individual closed-end funds.

Panel A: Correlation between levels of monthly premiums/discounts at month end for 16 individual funds and the premium on a value-weighted portfolio of all closed-end stock funds (VWPR).

| | Aeolian | Alpha | Alpha Trust | Orion | Aspis | Com | Devel | Dias | Ergasias | Exelixi | Hellenic | Interinv | Marfin | National | Piraeus | Proodos |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aeolian | | | | | | | | | | | | | | | | |
| Alpha | 0.2013* | | | | | | | | | | | | | | | |
| Alpha Trust | 0.6450 | 0.1639* | | | | | | | | | | | | | | |
| Orion | 0.7994 | 0.2921 | 0.5930 | | | | | | | | | | | | | |
| Aspis | 0.2057* | −0.1028* | 0.5124 | 0.1419* | | | | | | | | | | | | |
| Commercial | 0.6770 | 0.2839 | 0.6065 | 0.8154 | 0.0546* | | | | | | | | | | | |
| Development | 0.7744 | 0.2347* | 0.4145 | 0.8872 | 0.0256* | 0.6902 | | | | | | | | | | |
| Dias | 0.7569 | 0.2173* | 0.6295 | 0.8887 | 0.2277* | 0.7591 | 0.7976 | | | | | | | | | |
| Ergasias | 0.7005 | 0.4336 | 0.6661 | 0.8716 | 0.1618* | 0.8743 | 0.7261 | 0.8330 | | | | | | | | |
| Exelixi | 0.7196 | 0.3031 | 0.7334 | 0.7495 | 0.1695* | 0.8836 | 0.5877 | 0.7712 | 0.8070 | | | | | | | |
| Hellenic | 0.3688 | 0.7038 | 0.3106 | 0.4403 | −0.1076* | 0.5224 | 0.3785 | 0.2094* | 0.4975 | 0.4259 | | | | | | |
| Interinvest | 0.7963 | 0.2988 | 0.7048 | 0.8128 | 0.1284* | 0.8897 | 0.6565 | 0.7893 | 0.8541 | 0.9432 | 0.4714 | | | | | |
| Marfin | 0.2025* | −0.0118* | 0.3498 | 0.2678 | 0.3787 | 0.1354* | 0.1308* | 0.2702 | 0.2766 | 0.2485* | −0.0216* | 0.2177* | | | | |
| National | 0.5209 | 0.6688 | 0.5008 | 0.6099 | 0.0424* | 0.6506 | 0.4569 | 0.4738 | 0.7051 | 0.6108 | 0.7621 | 0.6391 | 0.1595* | | | |
| Piraeus | 0.5934 | 0.5119 | 0.5943 | 0.7611 | 0.0404* | 0.8299 | 0.6087 | 0.6920 | 0.8674 | 0.7657 | 0.6169 | 0.8327 | 0.0815* | 0.7531 | | |
| Proodos | 0.7089 | 0.2986 | 0.7390 | 0.6307 | 0.3533 | 0.6939 | 0.4345 | 0.7056 | 0.7311 | 0.8513 | 0.3583 | 0.8487 | 0.3421 | 0.5853 | 0.6186 | |
| VWPrem | 0.8333 | 0.3971 | 0.7715 | 0.9282 | 0.2472* | 0.8942 | 0.7931 | 0.8780 | 0.9330 | 0.8925 | 0.5375 | 0.9229 | 0.3236 | 0.7210 | 0.8512 | 0.8069 |

*Denotes statistically insignificant correlation at 5% level. From the 120 correlation coefficients, only 27 are not statistically significant.

Panel B: Descriptive statistics of correlation coefficients of monthly premiums/discounts of individual closed-end funds.

| Range | Mean 0.516<br>Frequency | Min −0.108<br>Relative frequency | Max 0.943<br>Cum. frequency | Std. dev.<br>0.270 | # Obs.<br>120 |
|---|---|---|---|---|---|
| −1–0 | 4 | 0.03 | 0.03 | | |
| 0–0.1 | 5 | 0.04 | 0.08 | | |
| 0.1–0.2 | 8 | 0.07 | 0.14 | | |
| 0.2–0.3 | 16 | 0.13 | 0.28 | | |
| 0.3–0.4 | 9 | 0.08 | 0.35 | | |
| 0.4–0.5 | 9 | 0.08 | 0.43 | | |
| 0.5–0.6 | 10 | 0.08 | 0.51 | | |
| 0.6–0.7 | 18 | 0.15 | 0.66 | | |
| 0.7–0.8 | 24 | 0.20 | 0.86 | | |
| 0.8–0.9 | 16 | 0.13 | 0.99 | | |
| 0.9–1 | 1 | 0.01 | 1.00 | | |

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Table 5

Correlation of changes in the monthly premiums/discounts of individual closed-end funds.

Panel A: Correlation of changes in the monthly premiums/discounts between 16 individual funds, a value-weighted portfolio of all closed-end stock funds (ΔVWPR) the monthly return on the GIASE, FTSE20, FTSE40 and PARALLEL indices.

| | Aeolian | Alpha | Alpha Trust | Orion | Aspis | Com. | Devel | Dias | Ergasias | Exelixi | Hellenic | Interinv | Marfin | National | Piraeus | Proodos | ΔVWPR | GIASE | FTSE20 | FTSE40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aeolian | | | | | | | | | | | | | | | | | | | | |
| Alpha | –0.1858* | | | | | | | | | | | | | | | | | | | |
| Alpha Trust | 0.1102* | 0.3724 | | | | | | | | | | | | | | | | | | |
| Orion | 0.3799 | 0.4722 | 0.2110* | | | | | | | | | | | | | | | | | |
| Aspis | –0.0352* | 0.0632* | 0.0550* | –0.0306* | | | | | | | | | | | | | | | | |
| Commercial | –0.2738 | 0.3888 | 0.4051 | 0.1798* | 0.0993* | | | | | | | | | | | | | | | |
| Development | 0.7142 | 0.1133* | 0.2482* | 0.6313 | –0.0093* | –0.1692* | | | | | | | | | | | | | | |
| Dias | 0.1781* | 0.3903 | 0.2291* | 0.6235 | 0.0420* | 0.4400 | 0.3762 | | | | | | | | | | | | | |
| Ergasias | –0.2932 | 0.5998 | 0.3954 | 0.4554 | 0.0533* | 0.5623 | 0.0315* | 0.3787 | | | | | | | | | | | | |
| Exelixi | 0.0304* | 0.4535 | 0.3866 | 0.2919 | 0.1094* | 0.7532 | 0.0800* | 0.5180 | 0.2962 | | | | | | | | | | | |
| Hellenic | –0.0093* | 0.5430 | 0.4685 | 0.3572 | –0.0048* | 0.4252 | 0.1178* | 0.2772 | 0.4501 | 0.3746 | | | | | | | | | | |
| Interinvest | 0.2297* | 0.4111 | 0.3106 | 0.4861 | 0.0082* | 0.4360 | 0.1726* | 0.6216 | 0.4034 | 0.5859 | 0.2424* | | | | | | | | | |
| Marfin | –0.0991* | 0.1437* | 0.0465* | 0.1682* | 0.0154* | 0.1486* | 0.0115* | 0.1110* | 0.2432* | 0.1242* | 0.0131* | 0.0301* | | | | | | | | |
| National | –0.0557* | 0.4843 | 0.2159* | 0.5144 | 0.0225* | 0.3577 | 0.0190* | 0.2770 | 0.4591 | 0.2471* | 0.6937 | 0.3064 | 0.1816* | | | | | | | |
| Piraeus | –0.2815 | 0.5429 | 0.2553 | 0.4436 | –0.0052* | 0.4562 | –0.0187* | 0.4068 | 0.7263 | 0.2373* | 0.3674 | 0.5073 | 0.0173* | 0.4427 | | | | | | |
| Proodos | 0.0721* | 0.2956 | 0.1634* | 0.1837* | 0.1348* | 0.2960 | –0.0418* | 0.4414 | 0.2077* | 0.4344 | 0.4433 | 0.5362 | 0.1818* | 0.3608 | 0.0381* | | | | | |
| ΔVWPR | 0.2679 | 0.6448 | 0.5538 | 0.8068 | 0.0854* | 0.5659 | 0.5430 | 0.7293 | 0.6376 | 0.6313 | 0.5664 | 0.6815 | 0.2451* | 0.5423 | 0.5442 | 0.4153 | | | | |
| GIASE | 0.1191* | 0.1290* | 0.2111* | 0.3083 | 0.1582* | 0.1743* | 0.1292* | 0.2649 | 0.1973* | 0.1118* | 0.3619 | 0.2367* | 0.0175* | 0.4990 | 0.2652 | 0.3304 | 0.3329 | | | |
| FTSE20 | 0.0294* | 0.0807* | 0.1517* | 0.2149* | 0.1527* | 0.0994* | 0.0479* | 0.1852* | 0.1451* | 0.0181* | 0.3298 | 0.1271* | –0.0095* | 0.4542 | 0.2159* | 0.2795 | 0.2090* | 0.9777 | | |
| FTSE40 | 0.3108 | 0.1063* | 0.2675* | 0.4729 | 0.1215* | 0.2310* | 0.3047 | 0.3445 | 0.2459* | 0.2523* | 0.2791 | 0.4092 | 0.1059* | 0.4547 | 0.2866 | 0.3488 | 0.5019 | 0.8675 | 0.7634 | |
| PARAL | 0.5112 | 0.0881* | 0.3245 | 0.5069 | 0.1438* | 0.1843* | 0.4465 | 0.3803 | 0.1809* | 0.3166 | 0.1474* | 0.5148 | 0.0747* | 0.2616 | 0.1848* | 0.3331 | 0.5577 | 0.6391 | 0.4967 | 0.9045 |

*Denotes statistically insignificant correlation at 5% level. From the 210 correlation coefficients, only 97 are not statistically significant.

Panel B: Descriptive statistics of correlation coefficients of changes in monthly premiums/discounts of individual closed-end funds.

| Range | Mean 0.287<br>Frequency | Min –0.293<br>Relative frequency | Max 0.807<br>Cum. Frequency | Std. dev. 0.240 | # Obs. 136 |
|---|---|---|---|---|---|
| –1–0 | 16 | 0.12 | 0.12 | | |
| 0–0.1 | 20 | 0.15 | 0.26 | | |
| 0.1–0.2 | 17 | 0.13 | 0.39 | | |
| 0.2–0.3 | 17 | 0.13 | 0.51 | | |
| 0.3–0.4 | 15 | 0.11 | 0.63 | | |
| 0.4–0.5 | 23 | 0.17 | 0.79 | | |
| 0.5–0.6 | 14 | 0.10 | 0.90 | | |
| 0.6 0.7 | 9 | 0.07 | 0.96 | | |
| 0.7–0.8 | 4 | 0.03 | 0.99 | | |
| 0.8–0.9 | 1 | 0.01 | 1.00 | | |
| 0.9–1 | 0 | 0.00 | 1.00 | | |

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## 3. Investor sentiment and the return generating process

To examine whether investors require an extra return because they are exposed to small investor sentiment risk, the sentiment factor should be priced (i.e., enter the return generating process with a significant coefficient) and the average alpha on traded securities should be different from zero. We test the Lee *et al.* (1991) investor sentiment hypothesis using two different models. As in Lee *et al.* (1991), the first model (1) examines the relation between returns (for individual stocks and portfolios) against the market return and the change in the value-weighted index of premium:

$$R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it} \tag{4}$$

where
$R_{it}$ = the return of a stock or portfolio $i$ in month $t$ minus the one-month interbank offered rate
$R_{mt}$ = the return on the market portfolio $m$ in month $t$ minus the one-month interbank offered rate
$\Delta VWPR_t$ = the change in the value-weighted index of premiums in month $t$
$\beta_{im}$ = the sensitivity of stock or portfolio $i$ to market portfolio $m$
$\beta_{i0}$ = the sensitivity of stock or portfolio $i$ to the index of changes of premiums
$\alpha_i$ = the non-systematic mean return of stock or portfolio $i$
$\varepsilon_{it}$ = the residual of stock or portfolio $i$ in month $t$.

Moreover, if the investor sentiment is systematic, we need to compare its importance in the return generating process to a set of factors that most researchers believe that are not priced. As in Elton *et al.* (1998), we consider industry return indices as the natural candidates. Hence, the second test is designed to examine the relevance of sentiment in the return generating process by comparing how often it is significant in time-series estimates of this process relative to a set of sector-return indices. This test is conducted using model (2). The returns of four sectoral indices of the ASE (i.e., banking, industrial, construction and holding) are included along with the market and sentiment factors.[9] These indices were selected because they (1) represent the largest number of firms in our stock sample, (2) were available for the entire period of the study and (3) stand for the mainstream of companies in the Greek economy traded in the ASE:

$$R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it} \tag{5}$$

where
$R_{jt}$ = the market-value weighted return on sectoral index $j$ in month $t$ minus the one-month interbank offered rate
$\beta_{ij}$ = the sensitivity of stock or portfolio $i$ to the sectoral index $j$.

The change in the value-weighted index of premium is used as a proxy for the investor sentiment factor. In our empirical tests we examine if the index of changes in the value-weighted index of premium enters in the return generating process of (a) a

[9] The holding sector consists of companies whose assets are made up of shares of other companies. These companies do not have any industrial or commercial activity and are known as 'symmetoxon' in Greek.

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set of 6 passive portfolios, (b) a set of 23 active portfolios, and (c) a set of 62 stocks. The set of passive portfolios includes three indices of the ASE (i.e., FTSE20, FTSE40, PARALLEL) and three equally-weighted portfolios of industrial stocks sorted by size (i.e., LARGE, MEDIUM, SMALL). The set of active portfolios consists of 23 equity mutual funds, 61 industrial stocks and one utility stock.[10] All returns used in this study are simple average monthly returns inclusive of dividends. The risk-free rate is the one-month interbank offered rate denominated in Greek drachmas (i.e., Athibor rate) for the 1997–2000 period and in euros (i.e., Euribor rate) for the 2001–2002 period due to the adoption of the Euro in 2001.

## 4. Empirical evidence

### 4.1. *The significance of sentiment in portfolio returns*

Table 6 presents regression results for models (4) and (5). Consistent with Lee *et al.* (1991) all three portfolios (i.e., FTSE20, FTSE40, PARALLEL) have market betas close to 1 and the value-weighted premium enters in all first three regressions with a significant coefficient at the 5% level. Interestingly, all alphas are statistically insignificant. However, the second set of regressions based on model (2) show that none of the coefficients of the $\Delta VWPR$ are significant at any conventional level. In contrast, 10 out of the 12 betas of the four sectoral indices are significant at the 5% level. The alphas are considerably lower relative to the previous set of regressions while market betas remain significant in all regressions. The values of the adjusted $R^2$ are all higher with a noticeable increase in the last regression for the PARALLEL portfolio which represents mostly small cap stocks. The results based on these four portfolios strongly suggest that the $\Delta VWPR$ does not enter the return generating process. Consistent with Elton *et al.* (1998), non-US evidence fails to support the view that investor sentiment represents a systematic risk.

### 4.2. *Sentiment and size*

To assess the contribution of a set of industry returns to the return generating process requires to examine whether they influence the returns of size sorted stock portfolios.[11] Lee *et al.* (1991) argue that focusing on portfolios of firms with different capitalisations permits a more accurate testing of the sentiment hypothesis. Specifically, they argue that sentiment should affect mostly stocks held by individual investors. Small cap stocks and mutual funds are the perfect candidates to test the sentiment hypothesis. In this subsection, we present evidence based on size sorted portfolios. The portfolios of stocks we consider are three size-ranked portfolios (LARGE CAP, MEDIUM CAP and SMALL CAP). The LARGE CAP portfolio consists of one third of all stocks with the largest equity value on ASE, the MEDIUM CAP portfolio is made up of the next one third of stocks while the SMALL CAP portfolio represents the remaining fraction of small capitalisation stocks. Consistent with previous work, a more refined set of

[10] The OTE stock is the only utility stock traded in the ASE during the entire time period of the study.

[11] Size sorted portfolios have been used by Gibbons *et al.* (1989), Fama and French (1992), Lee *et al.* (1991) and Elton *et al.* (1998) among others.

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Table 6

Regression results using widely used stock market indices.

Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$

Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$

Model 1: The time series relationship between monthly excess returns on three indices of ASE (FTSE20, FTSE40 and PARALLEL), changes in the monthly premium on a value–weighted portfolio of closed–end fund premiums ($\Delta VWPR$), and the monthly excess return on the General Index of ASE (GIASE), which is used as a proxy for the market return ($R_{mt}$). FTSE20 is an index of large capitalisation companies, FTSE40 is an index of medium capitalisation companies and PARALLEL is an index of small capitalisation companies.
Model 2: The time series relationship between monthly excess returns on three indices of ASE, an index of changes in the monthly premium of Greek Closed–end funds ($\Delta VWPR$), the monthly excess market return (GIASE), and excess returns on four sectoral indices of ASE (i.e., Banking (BANK), Industrial (INDUST), Construction (CONSTR), and Holding (HOLD)). The number of observations is 60 except for the second regression (FTSE40) where only 52 observations were available because the FTSE40 index was introduced September 1997 (i.e., 8 observations less). T-statistics are shown in parentheses. *Denotes statistical significance at the 5% level.

| | Intercept | ΔVWPR | GIASE | BANK | INDUST | CONSTR | HOLD | Adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | | |
| *FTSE20* | −0.185 | −0.119* | 1.094* | – | – | – | – | 96.8 |
| | (−0.68) | (−3.49) | (30.32) | | | | | |
| *FTSE40* | 0.831 | 0.329* | 1.060* | – | – | – | – | 80.4 |
| | (1.56) | (5.57) | (9.94) | | | | | |
| *PARALLEL* | 2.923 | 0.628* | 0.835* | – | – | – | – | 54.4 |
| | (1.30) | (4.43) | (5.59) | | | | | |
| Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | | |
| *FTSE20* | −0.070 | −0.013 | 0.881* | 0.282* | −0.029 | −0.052* | −0.081* | 99.2 |
| | (−0.79) | (−0.75) | (11.79) | (8.21) | (−0.62) | (−3.80) | (−4.22) | |
| *FTSE40* | −0.065 | −0.000 | 1.667* | –0.593* | −0.527 | 0.240* | 0.265* | 85.6 |
| | (−0.08) | (0.01) | (2.88) | (–2.19) | (−1.91) | (3.04) | (2.36) | |
| *PARALLEL* | 0.996 | 0.026 | 2.258* | –1.255* | −0.877* | 0.531* | 0.487* | 72.8 |
| | (0.79) | (0.18) | (3.08) | (–2.93) | (−2.54) | (3.21) | (2.48) | |

size-shorted portfolios is constructed (P1(large), P2, P3, P4, and P5 (small)) to allow us to make comparisons with prior studies.

Table 7 presents the results of time series regressions of returns of each size portfolio on the change in the premium of closed-end funds ($\Delta VWPR$) and the market excess return (*GIASE*) (model 1). In this table we also report results for the six-index regression (model 2). As shown in Panel A, the relationship between the $\Delta VWPR$ and returns on size portfolios is significant at the 5% level in all first three regressions. The sensitivity of the small cap portfolio on the $\Delta VWPR$ is much greater than that of the large cap portfolio. However, the goodness of fit is much smaller for small stocks (31.7%) than large stocks (82.6%). Interestingly, the alpha of the small cap portfolio is statistically significant. Moreover, all size portfolios have positive loadings on the value-weighted premium. This is inconsistent with the

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Table 7

Time-series regression results based on returns of size-shorted portfolios against the market index, industry indices and the sentiment index.

$$\text{Model 1: } R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$$
$$\text{Model 2: } R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$$

Model 1: The time series relationship between monthly excess returns on five equally weighted portfolios of industrial stocks sorted by market capitalisation, changes in the monthly premium on a value weighted portfolio of closed-end fund premiums ($\Delta VWPR$), and the monthly excess return on the General Index of ASE (GIASE) which is used as a proxy for the market return ($R_{mt}$).
Model 2: The time series relationship between monthly excess returns on five equally weighted portfolios of industrial stocks sorted by market capitalisation, an index of changes in the monthly premium of Greek closed-end funds ($\Delta VWPR$), the monthly excess market return (GIASE), and excess returns on four sectoral indices of ASE (i.e., Banking (BANK), Industrial (INDUST), Construction (CONSTR), and Holding (HOLD)). The number of observations is 60. t-statistics are shown in parentheses. *Denotes statistical significance at the 5% level.

Panel A: Regression results using 3 size-shorted portfolios of industrial stocks.

| | Intercept | ΔVWPR | GIASE | BANK | INDUST | CONSTR | HOLD | Adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Portfolios | | | Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | |
| *LARGE* | 0.330 | 0.157* | 0.873* | – | – | – | – | 82.6 |
| *CAP* | (0.50) | (2.84) | (14.19) | | | | | |
| *MEDIUM* | 1.964 | 0.420* | 0.801* | – | – | – | – | 64.3 |
| *CAP* | (1.68) | (4.29) | (7.35) | | | | | |
| *SMALL* | 4.47* | 0.495* | 0.711* | – | – | – | – | 31.7 |
| *CAP* | (2.03) | (2.68) | (3.45) | | | | | |
| Portfolios | | | Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | |
| *LARGE* | 0.123 | −0.012 | 0.094 | 0.022 | 0.548* | 0.166* | 0.144 | 89.3 |
| *CAP* | (0.23) | (−0.24) | (0.23) | (0.11) | (3.00) | (3.18) | (1.89) | |
| *MEDIUM* | 1.075 | 0.073 | 1.234 | −0.538 | −0.501 | 0.354* | 0.403* | 78.6 |
| *CAP* | (1.15) | (0.78) | (1.73) | (−1.59) | (−1.54) | (3.80) | (2.96) | |
| *SMALL* | 2.853 | −0.237 | 2.144 | −1.350* | −1.170* | 0.835* | 0.577* | 69.4 |
| *CAP* | (1.87) | (−1.55) | (1.84) | (−2.44) | (−2.20) | (5.49) | (2.59) | |

Panel B: Regression results using 5 size-shorted portfolios of industrial stocks.

| | Intercept | ΔVWPR | GIASE | BANK | INDUST | CONSTR. | HOLD. | Adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Portfolios | | | Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | |
| *P1(LARGE)* | 0.656 | 0.116* | 0.854* | – | – | – | – | 82.4 |
| | (1.05) | (2.23) | (14.71) | | | | | |
| *P2* | 2.405* | 0.274* | 0.881* | – | – | – | – | 70.3 |
| | (2.53) | (2.64) | (10.52) | | | | | |
| *P3* | 3.114* | 0.435* | 0.829* | – | – | – | – | 70.3 |
| | (2.15) | (4.83) | (8.40) | | | | | |
| *P4* | 3.268 | 0.549* | 0.697* | – | – | – | – | 44.5 |
| | (1.86) | (3.73) | (4.24) | | | | | |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *P5(SMALL)* | 6.408 | 0.302 | 0.739* | – | – | – | – | 25.8 |
| | (1.90) | (0.98) | (3.00) | | | | | |
| Portfolios | Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | |
| *P1(LARGE)* | 0.644 | −0.019 | 0.196 | 0.127 | 0.832* | 0.136* | 0.055 | 91.5 |
| | (1.44) | (−0.44) | (−0.57) | (0.78) | (5.35) | (3.06) | (0.85) | |
| *P2* | 1.631* | −0.027 | 1.021 | −0.396 | −0.283 | 0.287* | 0.391* | 82.6 |
| | (2.08) | (−0.35) | (1.71) | (−1.39) | (−1.04) | (3.68) | (3.42) | |
| *P3* | 2.182* | 0.159 | 0.985 | −0.357 | −0.349 | 0.324* | 0.302* | 76.1 |
| | (2.22) | (1.62) | (1.31) | (−1.00) | (−1.02) | (3.31) | (2.11) | |
| *P4* | 2.280 | 0.038 | 1.262 | −0.838 | −0.413 | 0.562* | 0.373* | 65.9 |
| | (1.60) | (0.27) | (1.16) | (−1.62) | (−0.83) | (3.96) | (1.79) | |
| *P5(SMALL)* | 4.094* | −0.436* | 2.753 | −1.685* | −1.737* | 0.979* | 0.813* | 65.9 |
| | (2.23) | (−2.38) | (1.96) | (−2.53) | (−2.72) | (5.36) | (3.04) | |

*Note*: Portfolio, P1(LARGE) includes the 13 largest stocks of our sample, P2 includes the next 12 stocks, P3 includes the next 12 stocks, P4 includes the next 12 stocks and finally, P5 (SMALL) includes the smallest 13 stocks.

sentiment hypothesis that predicts that investor sentiment should be more pronounced in small stocks.

Results based on the six-index regressions (model 2), show that portfolio return sensitivities on $\Delta VWPR$ are statistically insignificant. Specifically, none of the regression coefficients of the closed-end fund premium is significant at any conventional level. However, the return of each size portfolio is significantly sensitive to at least two industry returns. In contrast with the prediction of the sentiment hypothesis, small stocks have insignificant loadings on the $\Delta VWPR$ while they exhibit significant sensitivities on all industry excess returns. The negative sign of the sentiment effect indicates that small stocks do poorly when the premiums increase. The investor sentiment hypothesis predicts the reverse relationship. That is, small stocks are expected to do better when investor optimism (closed-end fund premium) increases. The goodness of fit for small stocks in model 2 jumps from 31.7% in the two-factor model to 69.4% in the six-factor model. Contrary to the prediction of Lee *et al.* (1991), the evidence again fails to show that the $\Delta VWPR$ has a systematic influence in the return generating process. Most importantly, is that we cannot trace any small investor sentiment even in small stocks where investor sentiment is expected to be more prevalent than in any other class of stocks.

In general, similar results are obtained based on the 5 size-shorted portfolios. These results are reported in Panel B of Table 7. The coefficient of the $\Delta VWPR$ is mostly insignificant and with the wrong sign in all regressions with the exception of the P5 (SMALL)) portfolio as shown in the last regression of model 2. It is interesting to note here that the P5 regression has the lowest explanatory power (with an adjusted $R^2 = 65.9$) while almost all the other 5 indices are statistically significant. The intercept is also statistically, significant (with a t-statistic = 2.23).

### 4.3. *Sentiment in mutual fund returns*

According to Lee *et al.* (1991) investor sentiment is expected to be related to the return on mutual funds because both closed-end funds and mutual funds have low

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institutional ownership. Hence, additional evidence on whether the investor sentiment enters the return generating process can be inferred from mutual funds which typically, like small stocks, have high individual ownership. We replicate the previous regression analysis for 23 Greek equity mutual funds.[12]

The regression results are reported in Table 8. In general, the pattern of mutual fund return sensitivities on the $\Delta VWPR$ is broadly consistent with that of the size portfolio regressions. When we use the two-factor model the beta estimates of the sentiment are significant at the 5% level in 9 out of the 23 regressions, indicating that the relationship between mutual fund returns and sentiment is much weaker relative to the one we found for the size portfolios. However, the results are strikingly similar to the size sorted portfolios. Regressions based on model (2), that makes use of six-index returns, show once again that the coefficients of the $\Delta VWPR$ are statistically insignificant in all 23 regressions. The explanatory power of these regressions is much higher than that of the two-index model while the alphas are insignificant with one exception (i.e., mutual fund (MF21)). These results are not consistent with the view that individual ownership drives investor sentiment. Mutual fund returns show considerably greater sensitivity to the four industry return factors than to the sentiment factor.

Overall, the size and mutual fund regression results are not consistent with the view that sentiment has a systematic influence on the return generating process of portfolios of traded assets. Moreover, our findings do not support the notion that sentiment stems from individual ownership concentration.

### 4.4. *Sentiment in individual stock returns*

We now turn our focus on the return generating process of individual stocks. Lee *et al.* (1991) argue that investors require a higher return because they are subject to the small investor sentiment. If sentiment does play a systematic role in explaining the time series of returns on assets, we should detect that individual stock returns have significant loadings on the $\Delta VWPR$. As shown in Table (9), when we employ the two-index model the sensitivity of individual asset returns to sentiment is significant in 28 out of the 62 regressions. The explanatory power of this model is quite low. In the case of the six-index model, while the goodness of fit improves substantially, the beta associated with sentiment is fewer times significant than in the two-index model. In fact, only 10 out of the 62 regression coefficients associated with the $\Delta VWPR$ are statistically significant. The betas for the other factors not affected by investor sentiment are more often significant than $\Delta VWPR$. Consistent with our previous results, the betas associated with the four industry returns are more often significant than the beta associated with investor sentiment.

Table 10 presents the number of times mutual fund and individual stock sensitivities are significant at the 5% level in regressions of the excess returns of portfolios and assets in the 2- and 6-factors models, respectively. The evidence clearly suggests that investor sentiment does not have a systematic influence on both industrial stock and mutual fund returns when industry return indices are included in the regressions. The industry return indices appear to have considerably greater importance in the

[12] While additional equity mutual funds were introduced after 1 January 1997, complete information was available only for 23 funds.

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Table 8

Regression results using equity mutual funds.

Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$

Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$

Model 1: The time series relationship between monthly excess returns on 23 Greek equity Mutual Funds, changes in the monthly premium on a value-weighted portfolio of closed-end fund premiums ($\Delta VWPR$), and the monthly excess return on the General Index of ASE (GIASE), which is used as a proxy for the market return ($R_{mt}$).
Model 2: The time series relationship between monthly excess returns on 23 Greek equity Mutual Funds, an index of changes in the monthly premium of Greek Closed-end funds ($\Delta VWPR$), the monthly excess market return (GIASE), and excess returns on four sectoral indices of ASE (i.e., Banking (BANK), Industrial (INDUST), Construction (CONSTR), and Holding (HOLD)). The number of observations is 60. t-statistics are shown in parentheses. *Denotes statistical significance at the 5% level.

| Mutual Fund | Intercept | ΔVWPR | GIASE | BANK | INDUST | CONSTR | HOLD | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | | |
| MF1 | 0.015 | 0.018 | 0.945* | – | – | – | – | 98.7 |
| MF2 | 0.225 | 0.052 | 0.888* | – | – | – | – | 95.6 |
| MF3 | 0.706 | 0.078 | 0.833* | – | – | – | – | 83.9 |
| MF4 | −0.040 | 0.086 | 0.870* | – | – | – | – | 89.2 |
| MF5 | 0.676 | 0.041 | 0.852* | – | – | – | – | 82.0 |
| MF6 | 0.012 | 0.108* | 0.818* | – | – | – | – | 92.9 |
| MF7 | −0.120 | −0.057* | 0.934* | – | – | – | – | 97.8 |
| MF8 | 0.124 | 0.164* | 0.813* | – | – | – | – | 87.7 |
| MF9 | 0.369 | 0.034 | 0.880* | – | – | – | – | 96.1 |
| MF10 | −0.149 | 0.084* | 0.839* | – | – | – | – | 92.3 |
| MF11 | 0.292 | 0.087 | 0.884* | – | – | – | – | 88.5 |
| MF12 | 0.483 | 0.158 | 0.706* | – | – | – | – | 87.7 |
| MF13 | 0.083 | 0.006 | 0.836* | – | – | – | – | 93.2 |
| MF14 | 0.672 | 0.052 | 0.780* | – | – | – | – | 89.9 |
| MF15 | 0.212 | 0.092* | 0.839* | – | – | – | – | 94.9 |
| MF16 | 1.230 | 0.064 | 0.795* | – | – | – | – | 84.8 |
| MF17 | 1.049 | 0.078 | 0.700* | – | – | – | – | 85.4 |
| MF18 | 1.369 | 0.213* | 0.875* | – | – | – | – | 85.2 |
| MF19 | 0.473 | 0.077 | 0.876* | – | – | – | – | 91.2 |
| MF20 | −0.761 | 0.095 | 0.712* | – | – | – | – | 74.5 |
| MF21 | −0.574 | 0.098* | 0.640* | – | – | – | – | 89.9 |
| MF22 | −0.169 | 0.138* | 0.740* | – | – | – | – | 78.9 |
| MF23 | 2.032 | 0.187* | 0.744* | – | – | – | – | 79.5 |
| Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | | |
| MF1 | −0.074 | 0.013 | 0.399* | 0.239* | 0.194* | 0.040* | 0.044* | 99.1 |
| MF2 | −0.058 | −0.024 | 0.642* | 0.026 | 0.040 | 0.086* | 0.125* | 96.6 |
| MF3 | 0.437 | −0.045 | 0.764* | −0.104 | −0.035 | 0.161* | 0.091 | 87.1 |
| MF4 | −0.252 | −0.011 | 0.921* | −0.162 | −0.028 | 0.061 | 0.140 | 90.8 |
| MF5 | 0.202 | −0.109 | 0.581 | 0.016 | −0.127 | 0.242* | 0.152 | 88.0 |
| MF6 | −0.235 | 0.007 | 0.688* | −0.072 | 0.017 | 0.092* | 0.139* | 95.3 |
| MF7 | −0.076 | −0.012 | 0.317 | 0.280* | 0.301* | 0.011 | −0.021 | 98.0 |
| MF8 | −0.189 | −0.000 | 0.688* | −0.169 | 0.058 | 0.165* | 0.156* | 93.9 |

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Table 8
Continued.

| Mutual Fund | Intercept | ΔVWPR | GIASE | BANK | INDUST | CONSTR | HOLD | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|
| MF9 | 0.197 | −0.007 | 0.553* | 0.101 | 0.074 | 0.059* | 0.091 | 96.6 |
| MF10 | −0.393 | −0.021 | 0.628* | −0.056 | 0.085 | 0.085* | 0.124* | 94.5 |
| MF11 | 0.085 | −0.022 | 0.964* | −0.200 | −0.013 | 0.073 | 0.136 | 90.7 |
| MF12 | 0.176 | 0.059 | 0.373 | 0.084 | −0.017 | 0.185* | 0.077 | 91.6 |
| MF13 | −0.040 | −0.055 | 0.546 | 0.031 | 0.145 | 0.071* | 0.068 | 94.2 |
| MF14 | 0.488 | −0.070 | 1.067* | −0.244 | −0.081 | 0.106* | 0.029 | 90.8 |
| MF15 | −0.006 | 0.042 | 0.500 | 0.108 | 0.046 | 0.068* | 0.114 | 95.5 |
| MF16 | 0.968 | −0.031 | 0.843* | −0.215 | 0.022 | 0.080 | 0.149* | 87.3 |
| MF17 | 0.697 | −0.010 | 0.900* | −0.240 | −0.137 | 0.091* | 0.183* | 87.9 |
| MF18 | 0.588 | 0.021 | 0.490 | −0.044 | 0.010 | 0.142* | 0.345* | 88.9 |
| MF19 | 0.099 | −0.024 | 0.722* | 0.013 | −0.152 | 0.161* | 0.134* | 94.1 |
| MF20 | −1.275 | −0.054 | 0.481 | −0.012 | −0.151 | 0.200* | 0.220* | 80.7 |
| MF21 | −0.941* | 0.009 | 0.367 | −0.027 | 0.042 | 0.131* | 0.162* | 95.1 |
| MF22 | −0.784 | −0.004 | 0.316 | 0.142 | −0.213 | 0.255* | 0.219* | 86.3 |
| MF23 | 1.181 | 0.010 | 0.499 | −0.246 | 0.124 | 0.156* | 0.278* | 83.8 |

return generating process than investor sentiment. If sentiment is related to small investor irrationality then mutual funds should be the most affected assets by sentiment. Perhaps, the more interesting result that emerges from this table is that mutual funds that are generally expected to have high individual investor ownership have insignificant loadings on investor sentiment. These findings coupled with the lack of sentiment effect in small stocks and other portfolios, presented earlier, provide strong support against the view that investors require to be compensated for investor sentiment. Overall, whether we focus on individual stocks or portfolios, the evidence corroborates the view that sentiment is not important in holding and trading individual stocks or stock portfolios when we control for the market and industry effects. The $\Delta VWPR.$ is not a factor with independent influence on returns. This is inconsistent with the prediction of the investor sentiment hypothesis. Industry return indices, however, seem to explain returns more often than investor sentiment.

## 5. Conclusion

Lee *et al.* (1991) argue that small investor sentiment has a distinct influence on the equity risk premium. Elton *et al.* (1998), however, are the first to refute the findings of Lee *et al.* (1991). Without testing the robustness of these findings outside the environment in which they were found, it remains unclear whether these empirical results are merely spurious correlations that they may not be confirmed outside the US capital market. In this paper we examine the importance of investor sentiment in the return generating process outside the US capital market since it cannot be ruled out that these results are limited to the USA. Specifically, we use a unique dataset, drawn from the Greek capital market that has sharply different institutional, trading, maturity, and composition of private and institutional investors characteristics in comparison to the US market, to investigate whether investor sentiment, measured

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Table 9

Regression results using industrial and utility stocks.

Model 1: The time series relationship between monthly excess returns on 62 Greek Industrial stocks, changes in the monthly premium on a value-weighted portfolio of closed-end fund premiums ($\Delta VWPR$), and the monthly excess return on the General Index of ASE (GIASE), which is used as a proxy for the market return ($R_{mt}$).
Model 2: The time series relationship between monthly excess returns on 26 Greek Industrial Stocks, an index of changes in the monthly premium of Greek closed-end funds ($\Delta VWPR$), the monthly excess market return (GIASE), and excess returns on four sectoral indices of ASE (i.e., Banking (BANK), Industrial (INDUST), Construction (CONSTR), and Holding (HOLD)). The number of observations is 60. t-statistics are shown in parentheses. *Denotes statistical significance at the 5% level.

| Industrial Stock | INTERCEPT | ΔVWPR | GIASE | BANK | INDUST | CONSTR | HOLD | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Model 1: $R_{it} = \alpha_i + \beta_{im} R_{mt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | | |
| IS1 | 2.615 | 0.099 | 1.488* | – | – | – | – | 50.0 |
| IS2 | 1.440 | 0.229 | 0.856* | – | – | – | – | 34.4 |
| IS3 | 1.853 | 0.613* | 0.542* | – | – | – | – | 24.4 |
| IS4 | 2.683 | 0.403 | 0.776* | – | – | – | – | 21.5 |
| IS5 | 1.089 | 0.489* | 0.663* | – | – | – | – | 23.7 |
| IS6 | 9.051 | −0.026 | 0.977 | – | – | – | – | 0.5 |
| IS7 | 3.484 | 0.680* | 0.865* | – | – | – | – | 26.8 |
| IS8 | 7.391 | 1.054* | 0.531* | – | – | – | – | 31.0 |
| IS9 | 6.428 | 1.732* | 0.405 | – | – | – | – | 55.8 |
| IS10 | 0.833 | 0.470* | 0.745* | – | – | – | – | 38.7 |
| IS11 | 1.929 | 0.275 | 0.475* | – | – | – | – | 18.6 |
| IS12 | 0.787 | 0.541* | 0.462* | – | – | – | – | 50.9 |
| IS13 | 0.461 | 0.108 | 1.344* | – | – | – | – | 49.4 |
| IS14 | −0.021 | −0.037 | 0.901* | – | – | – | – | 46.6 |
| IS15 | −0.469 | −0.123 | 0.803* | – | – | – | – | 45.1 |
| IS16 | 3.512 | 0.767* | 0.508* | – | – | – | – | 26.6 |
| IS17 | 1.951 | 0.497* | 0.818* | – | – | – | – | 45.0 |
| IS18 | 1.115 | 0.149 | 0.508* | – | – | – | – | 20.5 |
| IS19 | 2.187 | 0.687* | 0.951* | – | – | – | – | 38.4 |
| IS20 | 1.710 | 0.129 | 0.484* | – | – | – | – | 35.8 |
| IS21 | 1.380 | 0.554* | 0.849* | – | – | – | – | 32.4 |
| IS22 | 1.457 | 0.275 | 0.681* | – | – | – | – | 28.5 |
| IS23 | 5.231 | 1.062* | 0.652 | – | – | – | – | 18.0 |
| IS24 | 3.107 | 0.425* | 0.554* | – | – | – | – | 28.4 |
| IS25 | 1.829 | 0.125 | 0.625* | – | – | – | – | 32.2 |
| IS26 | 0.829 | 0.629* | 0.336* | – | – | – | – | 45.1 |
| IS27 | 3.449 | 0.963* | 0.956* | – | – | – | – | 43.7 |
| IS28 | 0.130 | 0.262* | 0.692* | – | – | – | – | 47.4 |
| IS29 | 2.687 | −0.030 | 1.235* | – | – | – | – | 57.7 |
| IS30 | 4.748 | 0.385 | 0.586* | – | – | – | – | 17.8 |
| IS31 | 0.460 | 0.233 | 0.954* | – | – | – | – | 44.8 |
| IS32 | 0.408 | −0.100 | 1.079* | – | – | – | – | 48.4 |
| IS33 | −0.145 | 0.097 | 0.759* | – | – | – | – | 58.8 |

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Table 9
Continued.

| Industrial Stock | INTERCEPT | ΔVWPR | GIASE | BANK | INDUST | CONSTR | HOLD | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|
| IS34 | 0.678 | −0.143 | 0.981* | – | – | – | – | 65.7 |
| IS35 | 5.240 | 0.502 | 0.871* | – | – | – | – | 21.1 |
| IS36 | 2.263 | 0.459* | 0.270 | – | – | – | – | 10.5 |
| IS37 | 2.132 | 0.214 | 0.667* | – | – | – | – | 19.8 |
| IS38 | 2.619 | 0.365 | 1.667* | – | – | – | – | 42.3 |
| IS39 | 2.696 | 0.483* | 0.454 | – | – | – | – | 14.3 |
| IS40 | 4.462 | 0.249 | 0.487* | – | – | – | – | 5.4 |
| IS41 | 5.002 | 0.314 | 0.602 | – | – | – | – | 5.1 |
| IS42 | 0.351 | 0.367* | 0.748* | – | – | – | – | 32.8 |
| IS43 | 4.563 | 0.487 | 1.230* | – | – | – | – | 23.7 |
| IS44 | 1.593 | 0.149 | 0.827* | – | – | – | – | 24.2 |
| IS45 | 1.281 | 0.256 | 0.941* | – | – | | – | 51.4 |
| IS46 | −0.106 | 0.271* | 0.962* | – | – | – | – | 63.8 |
| IS47 | 4.377 | −0.144 | 0.983* | – | – | – | – | 9.0 |
| IS48 | 5.321 | 0.193 | 1.359* | – | – | – | – | 23.9 |
| IS49 | 0.627 | 0.479* | 0.589* | – | – | – | – | 50.2 |
| IS50 | 0.403 | 0.508* | 0.817* | – | – | – | – | 50.8 |
| IS51 | 1.415 | 0.366* | 0.776* | – | – | – | – | 42.3 |
| IS52 | 1.690 | 0.033 | 0.866* | – | – | – | – | 48.3 |
| IS53 | 1.925 | 0.607* | 0.572* | – | – | – | – | 28.9 |
| IS54 | 3.282 | 0.603* | 0.774* | – | – | – | – | 26.1 |
| IS55 | 3.001 | 0.063 | 0.865* | – | – | – | – | 34.5 |
| IS56 | 3.041 | 0.412 | 0.875* | – | – | – | – | 27.4 |
| IS57 | 3.187 | 0.638* | 0.617* | – | – | – | – | 19.8 |
| IS58 | 3.441* | 0.775* | 0.883* | – | – | – | – | 58.1 |
| IS59 | 2.597 | 0.880* | 0.495* | – | – | – | – | 37.6 |
| IS60 | 4.136 | 0.243 | 0.622* | – | – | – | – | 24.9 |
| IS61 | 4.125 | 0.061 | 1.141* | – | – | – | – | 10.4! |
| IS62 | −0.313 | −0.206 | 0.700* | – | – | – | – | 45.6 |
| Model 2: $R_{it} = \alpha_i + \beta_m R_{mt} + \sum_j \beta_{ij} R_{jt} + \beta_{i0} \Delta VWPR_t + \varepsilon_{it}$ | | | | | | | | |
| IS1 | 2.347 | −0.102 | −0.730 | −0.246 | 0.841 | −0.138 | 0.562 | 52.9 |
| IS2 | 0.840 | −0.054 | 3.945* | −1.715* | −1.486* | −0.080 | 0.506 | 45.0 |
| IS3 | 0.299 | −0.067 | 1.199 | −1.169 | −0.509 | 0.504* | 0.919* | 47.3 |
| IS4 | 1.064 | −0.379 | 4.036* | −2.130* | −2.075* | 0.849* | 0.487 | 55.0 |
| IS5 | 0.158 | −0.036 | 0.877 | −0.842 | −0.008 | 0.445 | 0.515 | 35.1 |
| IS6 | 6.761 | −1.274 | 5.346 | −2.949 | −2.881 | 1.718* | 0.249 | 14.1 |
| IS7 | 3.070 | −0.033 | 1.501 | −1.535 | 0.654 | 0.590* | 0.219 | 44.7 |
| IS8 | 3.029 | −0.181 | 5.420* | −3.545* | −2.205* | 1.126* | 0.632 | 56.6 |
| IS9 | 5.070 | 1.014* | 3.943* | −2.350* | −1.432 | 0.637* | 0.123 | 65.5 |
| IS10 | 0.585 | 0.209 | 1.551 | −0.607 | −0.366 | 0.422* | −0.142 | 44.4 |
| IS11 | 0.792 | −0.150 | −1.027 | 0.181 | 0.219 | 0.483* | 0.659* | 32.1 |
| IS12 | 0.456 | 0.291* | −0.367 | 0.124 | 0.510 | 0.272* | −0.005 | 48.5 |
| IS13 | 0.244 | 0.007 | −1.657 | 0.986 | 1.633* | 0.131 | 0.268 | 51.3 |
| IS14 | −0.977 | −0.427* | −0.712 | 0.181 | 0.612 | 0.455* | 0.503* | 67.6 |
| IS15 | 0.586 | −0.048 | −0.327 | 0.183 | 1.624* | −0.150 | −0.414* | 63.4 |
| IS16 | 2.332 | 0.645* | 0.507 | 0.198 | −1.053* | 0.229 | 0.513 | 26.0 |
| IS17 | 1.432 | 0.274 | 0.462 | −0.022 | −0.063 | 0.392 | 0.081 | 47.0 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IS18 | 0.416 | −0.099 | 0.737 | −0.236 | 0.518 | 0.412* | 0.147 | 28.4 |
| IS19 | 1.011 | 0.290 | 1.877 | −0.615 | −1.108 | 0.265 | 0.629 | 43.6 |
| IS20 | 1.495 | 0.046 | −0.532 | 0.313 | 0.461 | 0.137 | 0.110 | 35.3 |
| IS21 | 0.420 | 0.026 | 0.098 | −0.457 | 0.468 | 0.492* | 0.543 | 43.3 |
| IS22 | 0.305 | −0.029 | 0.357 | 0.038 | −0.705 | 0.527* | 0.427 | 41.8 |
| IS23 | 1.384 | −0.007 | 3.329 | −1.651 | −3.635* | 1.343* | 1.482* | 44.5 |
| IS24 | 2.828 | 0.306 | 0.868 | −0.136 | −0.429 | 0.274 | −0.041 | 26.0 |
| IS25 | 0.066 | −0.272 | −0.914 | 0.163 | 0.258 | 0.624* | 0.683* | 54.3 |
| IS26 | 0.536 | 0.288* | −0.247 | −0.222 | 0.621 | 0.310* | 0.059 | 52.7 |
| IS27 | 3.182 | 0.280 | 4.151* | −2.639* | −0.746 | 0.686* | 0.053 | 66.3 |
| IS28 | 0.033 | 0.070 | 0.332 | −0.101 | 0.319 | 0.346* | −0.130 | 55.9 |
| IS29 | 1.950 | −0.220 | −0.297 | 0.145 | 1.360* | −0.127 | 0.528* | 60.5 |
| IS30 | 2.704 | −0.246 | 5.414* | −2.807* | −2.884* | 0.400 | 1.060* | 48.4 |
| IS31 | −0.704 | −0.270 | 1.819 | −1.011 | −0.586 | 0.353* | 0.686* | 65.1 |
| IS32 | 0.476 | −0.131 | −1.581 | 0.796 | 1.755* | −0.112 | 0.298 | 56.5 |
| IS33 | 0.194 | 0.098 | −0.167 | 0.092 | 1.266* | −0.158 | −0.093 | 65.9 |
| IS34 | 0.945 | −0.113 | −0.076 | 0.289 | 0.906* | −0.139 | 0.053 | 69.0 |
| IS35 | 4.492 | −0.116 | 1.492 | −1.063 | −0.107 | 0.785* | 0.088 | 34.0 |
| IS36 | 1.373 | 0.280 | 0.813 | −0.150 | −1.028 | 0.354 | 0.228 | 10.0 |
| IS37 | 0.244 | −0.594* | 1.396 | −1.142* | −0.541 | 0.204 | 1.191* | 51.6 |
| IS38 | 1.518 | 0.130 | 2.172 | −0.429 | −0.762 | 0.022 | 0.788 | 41.9 |
| IS39 | 2.786 | 0.031 | 3.131 | −2.027* | −0.344 | 0.186 | 0.009 | 24.6 |
| IS40 | 2.331 | −0.552 | 0.319 | −0.627 | −0.814 | 1.084* | 0.747 | 33.9 |
| IS41 | 3.231 | −0.494 | 4.520 | −2.206 | −2.783* | 1.131* | 0.227 | 28.5 |
| IS42 | −1.230 | −0.189 | −0.113 | −0.261 | −0.069 | 0.556* | 0.853* | 55.7 |
| IS43 | 2.592 | −0.114 | 1.670 | −0.440 | −1.474 | 1.001* | 0.513 | 32.2 |
| IS44 | −0.194 | −0.440* | 1.111 | −0.674 | −0.864 | 0.591* | 0.883* | 47.4 |
| IS45 | 1.239 | 0.133 | −1.415 | 0.780 | 1.313 | 0.344 | −0.095 | 58.2 |
| IS46 | −0.570 | 0.141 | −1.141 | 0.707* | 0.894* | 0.203 | 0.293 | 66.9 |
| IS47 | 1.436 | −1.235* | 2.038 | −1.531 | −1.559 | 1.125* | 1.358* | 42.1 |
| IS48 | 2.036 | −0.718* | −2.173 | 0.967 | −0.191 | 1.545* | 1.190* | 51.1 |
| IS49 | 0.455 | 0.276 | 1.383 | −0.691* | −0.144 | 0.090 | 0.141 | 52.9 |
| IS50 | 0.287 | 0.059 | 2.827* | −1.643* | −0.295 | 0.227 | 0.112 | 70.4 |
| IS51 | 0.681 | 0.039 | 1.520 | −0.742 | −0.444 | 0.207 | 0.445 | 49.4 |
| IS52 | 1.571 | −0.247 | 0.211 | −0.213 | 0.981 | 0.236 | −0.099 | 53.8 |
| IS53 | 1.094 | 0.459 | 1.814 | −0.540 | −1.172 | 0.050 | 0.469 | 29.0 |
| IS54 | 2.465 | 0.071 | 3.715* | −1.860* | −1.565 | 0.654* | 0.221 | 44.3 |
| IS55 | 2.485 | −0.084 | 1.334 | −0.206 | −0.428 | 0.478* | −0.279 | 36.0 |
| IS56 | 3.324 | 0.290 | 3.252 | −1.112 | −0.927 | 0.228 | −0.456 | 27.8 |
| IS57 | 2.462 | 0.126 | 2.962 | −1.396 | −1.317 | 0.645 | −0.115 | 21.8 |
| IS58 | 2.879 | 0.482* | 1.656 | −0.565 | −0.595 | 0.444* | 0.040 | 63.3 |
| IS59 | 0.800 | 0.555 | 1.474 | −0.461 | −1.642* | 0.503* | 0.700 | 47.3 |
| IS60 | 2.011 | −0.207 | −0.171 | −0.175 | −0.407 | 0.809* | 0.516 | 10.8 |
| IS61 | −0.110 | −0.891 | −1.641 | 0.142 | −0.437 | 1.702* | 1.670* | 49.5 |
| IS62 | 0.473 | −0.035 | 1.632 | −0.284 | −0.009 | −0.216 | −0.420* | 52.6 |

by the change in the discount/premium on closed-end funds, is associated with higher returns required by investors as a compensation for being exposed to sentiment risk.

If investor sentiment is primarily a trait of small investors, as argued by Lee *et al.* (1991), it should also be more pronounced in markets where small investors play a more prominent role than institutional investors. The Greek capital market is a

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Table 10

Number of times portfolio sensitivities (betas) to closed-end fund premiums ($\Delta VWPR$), market (*GIASE*) or industry returns (*BANKING, INDUSTRIAL, CONSTRUCTION, HOLDING*) are significant at the 5% level.

| Model | $R_{it}=\alpha_i+\beta_{im}R_{mt}+\beta_{i0}\Delta VWPR_t+\varepsilon_{it}$ | | $R_{it}=\alpha_i+\beta_m R_{mt}+\sum_j \beta_{ij}R_{jt}+\beta_{i0}\Delta VWPR_t+\varepsilon_{it}$ | |
|---|---|---|---|---|
| | (Table 8) | (Table 9) | (Table 8) | (Table 9) |
| | Mutual funds | Industrial stocks | Mutual funds | Industrial stocks |
| Factors | (23) | (62) | (23) | (62) |
| $\Delta VWPR$ | 9 | 28 | 0 | 10 |
| *GIASE* | 23 | 56 | 13 | 8 |
| *BANKING* | – | – | 2 | 12 |
| *INDUSTRIAL* | – | – | 2 | 15 |
| *CONSTRUCTION* | – | – | 19 | 33 |
| *HOLDING* | – | – | 13 | 16 |

This table reports the number of times mutual funds and individual stock sensitivities (betas) are significant at the 5% level in regressions of the excess returns of portfolios and assets in the 2- and 6-factor models, respectively.

natural candidate since institutional investors are far less important than in the US and other more developed capital markets. Moreover, in recent years the Greek capital market has experienced a dramatic price run up that is likely to be associated with strong investor sentiment and, therefore, easier to be detected than in other markets. Another unique aspect associated with the choice of the Greek capital market, as our testing ground for investor sentiment, is that closed-end funds over the 1997–2002 period were trading, on the average, at 7.55% premium and at 122.86% when the Athens stock market peaked in August 1999. Using a new dataset we also avoid the standard criticism that observed empirical regularities arise from data mining and expect to shed new light on whether investor sentiment is an important factor in asset pricing.

We find no evidence in support of the claim of Lee *et al.* (1991) that investor sentiment affects the risk of common stocks. Our results are consistent with the findings of Elton *et al.* (1998) who show that investor sentiment does not enter the return generating process. The fact that we failed to detect that investor sentiment in a capital market whose environment was expected to be more prone to investor sentiment provides additional support against the claim that investor sentiment represents an independent and systematic asset pricing risk. Our findings show that the sentiment factor does not enter the return generating process more frequently than a set of industry return indices, constructed in a similar way as the sentiment return index, which is used as a benchmark of comparison since they are not considered as systematic asset pricing factors.[13] When we examine the pattern of return sensitivity to the sentiment factor across size portfolios and mutual funds (i.e., portfolios and funds that Lee *et al.* (1991) argue are more sensitive to the sentiment factor because they have higher individual than institutional investor ownership) we find that sentiment has no influence on the returns of small stocks and mutual funds.

Overall, we find no evidence supporting sentiment as an independent source of systematic risk in the return generating process. The non-US evidence not only contradicts the claim of Lee *et al.* (1991) that investor sentiment affects the risk of common stocks, it is also consistent with the findings of Elton *et al.* (1998), indicating that investor sentiment does not represent systematic risk even in a market environment that is more likely to be influenced by investors sentiment than the USA. In contrast with the prediction of the investor sentiment hypothesis, our results refute the notion that risk premiums are affected by small investor sentiment.

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[13] See Elton *et al.* (1998) for a similar testing procedure as well.

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## Appendix A

Panel A1: The sample of 16 closed-end funds

| Investment company | IPO date | NAV (31/12/2001) (euro) |
|---|---|---|
| Alpha Investments A.E. | 19/11/1984 | 430.237.322,40 |
| Aioliki Portfolio Investment Co., S.A. | 9/8/1993 | 45.831.932,26 |
| Aspis Portfolio Investment Co., S.A. | 7/4/1995 | 43.131.122,53 |
| Dias Portfolio Investment Co., S.A. | 29/7/1992 | 33.229.689,27 |
| National Investment Co., S.A. | 19/6/1981 | 237.155.975,63 |
| Hellenic Investment Co. | 19/1/1973 | 318.852.714,95 |
| Commercial Investment Co., S.A. | 17/8/1993 | 125.567.799,82 |
| Exelixi Portfolio Investment Co., S.A. | 6/5/1992 | 76.661.529,28 |
| Investment Development Co., S.A. | 12/8/1982 | 83.521.643,43 |
| Ergoinvest S.A. | 11/11/1977 | 280.514.490,49 |
| Interinvest Int'l Portfolio Inv't Co., S.A. | 15/1/1992 | 29.616.976,01 |
| Alpha Trust-Asset Manager Fund Co., S.A. | 3/5/1993 | 18.558.099,95 |
| Marfin Classic Portfolio Investment Co., S.A. | 18/6/1993 | 189.699.087,46 |
| Piraeus Investment Co., S.A. | 6/12/1990 | 106.061.693,84 |
| The Greek Progress Fund S.A. | 3/9/1990 | 129.795.002,37 |
| Alpha Trust Orion Int'l Portfolio Inv't Co., S.A. | 20/12/1994 | 51.950.513,88 |

Panel A2: The sample of 23 open-end mutual funds

| Equity mutual fund | Regression code |
|---|---|
| Alpha Athens Index Fund | MF 1 |
| Delos Blue Chips | MF 2 |
| Alpha Growth | MF 3 |
| Pireaus Domestic | MF 4 |
| Alpha Eurogreek | MF 5 |
| Alico – Eurobank | MF 6 |
| Sigma Domestic Equity FTSE/ASE | MF 7 |
| Allianz Domestic Equity | MF 8 |
| Interamerican Aggressive | MF 9 |

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| | |
|---|---|
| General Domestic Equity | MF10 |
| ABN–AMRO Greek Growth | MF11 |
| Eurobank Value Index | MF12 |
| Aτε Domestic Equity | MF13 |
| Sogen Invest | MF14 |
| European Reliance Growth | MF15 |
| HSBC Growth | MF16 |
| Telesis domestic equity | MF17 |
| Alpha Trust Growth | MF18 |
| Hermes Aggressive | MF19 |
| ETVA P&K Equity Capital | MF20 |
| Aspis Domestic Equity | MF21 |
| Metrolife Growth | MF22 |
| Alpha Trust New Companies | MF23 |

Panel A3: The sample of 61 industrial companies and a telecommunication firm (OTE)

| Industrial company | Regression code |
|---|---|
| Altec | Is 1 |
| Albio | Is 2 |
| Elve-clothing | Is 3 |
| Ellatex | Is 4 |
| Selonta | Is 5 |
| Cor–fil | Is 6 |
| Kreka | Is 7 |
| Agrinion Metal-Plastic | Is 8 |
| Mouriadis | Is 9 |
| Nireas | Is10 |
| Flexopack | Is11 |
| Elais | Is12 |
| Evz | Is13 |
| Delta | Is14 |
| Tria Epsilon | Is15 |
| Elbisco | Is16 |
| Katselis | Is17 |
| Barba Stathis | Is18 |
| Nikas | Is19 |
| Chipita | Is20 |
| Allatini | Is21 |
| Louli Mills | Is22 |
| Sarantopoulos | Is23 |
| Balafas | Is24 |
| Karelia | Is25 |
| Papastratos | Is26 |
| Vis | Is27 |
| Hellas Can | Is28 |
| Maillis | Is29 |
| Xylemporia | Is30 |
| Selman | Is31 |
| Varytinis | Is32 |
| Hercules Cement | Is33 |
| Titan Cement | Is34 |

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| | |
|---|---|
| Esxa Plastics | Is35 |
| Plias | Is36 |
| Petzetakis | Is37 |
| Thracian plastics | Is38 |
| Macedonian plastics | Is39 |
| Hellenic textiles | Is40 |
| Elfico | Is41 |
| Epilektos | Is42 |
| Naoussa Spins | Is43 |
| Mousakis | Is44 |
| Aluminum of Greece | Is45 |
| Elval | Is46 |
| Viosol | Is47 |
| Darig | Is48 |
| Hellenic Cables | Is49 |
| Nexans | Is50 |
| Etem | Is51 |
| Intrakom | Is52 |
| Calpinis | Is53 |
| Leventeris | Is54 |
| Metka | Is55 |
| Bitros | Is56 |
| Radio Athens | Is57 |
| Rokas | Is58 |
| Tzirakian | Is59 |
| Fourlis | Is60 |
| Steel Sheets | Is61 |
| OTE | Is62 |

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