# On the predictive power of sentiment

# Why institutional investors are worth their pay

Bernhard Zwergel Christian Klein

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**Keywords:** Asset Pricing, Sentiment, Institutional Investors, Private Investors, Investor Behavior, Behavioral Finance

**JEL Classification Code:** G1

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# 1. Introduction

Investor sentiment, a measurement of a given investor or the overall investing public's mood, has been the crux of many academic research papers during the last few decades. The question whether investors influence stock prices simply because they are either bullish or bearish about a stock has been deliberated by both academics and practitioners. A bullish investor believes that the price of an asset will increase, whereas a bearish investor expects prices to decline. If these investors evaluate and trade stocks on other than fundamental information, they are classified as irrational or noise traders. In traditional finance models, noise traders' irrational behavior on stock markets does not influence prices at all because rational investors immediately correct security prices' deviations from their fundamental values. The phenomenon of arbitrage failing to eliminate mispricing in the short run is called "limited arbitrage". De Long et al. (1990), and Shleifer and Vishny (1997) showed that arbitrage could be limited because movements due to investor sentiment are partly unpredictable. Based on this work, Baberis et al. (1998) presented a model of investor sentiment, in which investors' beliefs affect prices and returns.

The latest literature on investor sentiment comes to one conclusion: Sentiment does indeed influence future returns and plays a role in the formation of returns.[1] How strong this influence is seems to depend on how sentiment is measured[2] and on the subgroup of persons used to compute the sentiment measure.[3]

This conclusion is undeniably relevant and interesting from an academic point of view: This outcome contributes to the swiftly growing body of literature that is finding empirical evidence that investors do not behave rationally. These empirical findings challenge the theoretical framework of the efficient market hypothesis.[4] The practically orientated world seems not very surprised by the insight that sentiment affects prices. Market watchers and participants seem to believe in "sentiment." The still unanswered question is: What consequences do these findings have in practice? We know by now that many irrational aspects play a role in the formation of returns: Daily stock returns are correlated with

[1] For example, Baker and Wurgler (2006), Kaniel et al. (2006), Kumar and Lee (2006). Lo and Lin (2005) even denote investor sentiment as "a key factor" on the price formation of assets.
[2] We differentiate between financial-based measures and survey-based measures, see Qui and Welch (2004).
[3] The literature differentiates between professionals and private investors, see e.g. Fisher and Statman (2000).
[4] See Fama (1970) and Fama (1991).

sunshine[5] and sports[6]. No analyst factors weather forecasts into his pricing models (as far as we know). Is the role of investor sentiment economically relevant?[7]

We show that sentiment is indeed economically relevant. We used a unique dataset to obtain sentiment evaluations in order to develop a trading strategy based on sentiment. By applying this strategy on out-of-sample data, we gained excess returns for some markets.

We additionally show that only market professionals' sentiment is economically relevant when scrutinizing index sentiment[8], i.e. professional analysts are certainly able to forecast future price movements in the medium term (approximately 6 months in advance). Private investors are not able to predict price movements; we even find evidence that suggests that their sentiment may be a contra indicator. Neither institutional nor private investors are able to correctly forecast returns up to a month in advance. It seems that for this kind of short-term momentum, private and institutional investors rely heavily on the past week and month's returns. The influence of past returns is much weaker when private or institutional investors try to forecast medium-term price movements.

Institutional investors are what we call "information and home biased"[9], i.e. their forecasts of their home markets do not rely on past returns because they seem to posses better information, whereas foreign market forecasts do depend on past returns. Private investors overestimate the correlation between different indices and have a less differentiated opinion than institutional investors, who do, however, overestimate index return correlations. In this context, it is puzzling that investors clearly underestimate index returns' correlation in the medium term.

The remainder of this paper is organized as follows: Section 2 provides an overview of the relevant literature. In section 3, we describe the dataset and our methodological approach. A descriptive analysis of investors' behavior is carried out in section 4. In section 5, we develop an investment strategy based on sentiment and apply it to an out-of-sample period. Section 6 presents the complete dataset and section 7 concludes this article.

[5] See Hirshleifer and Shumway (2003).
[6] See Edmans, Garcia and Norli (forthcoming).
[7] Economic significance is also the main objection to the study by Lee, Shleifer and Thaler (1991), see e.g. Chen, Kan and Miller (1993a) and (1993b).
[8] This result is in line with Kumar and Lee (2006) who state that retail investor transactions and sentiment are especially important with stocks that show a high retail concentration (i.e. small-cap stocks).
[9] See Kilka and Weber (2000) and Coval and Moskowitz (1999) for a further discussion of the home-bias.

# 2. Former Literature

The literature distinguishes between two methods of measuring investor sentiment: financial-based measures and survey-based measures. The most popular example of a financial-based measure is the closed-end fund discount introduced by Lee, Shleifer and Thaler (1991). They found that closed-end fund discounts are a measure of individual investors' sentiment and that discounts correlate with the prices of other securities affected by the same investor sentiment.[10] Baker and Wurgler (2006) built a sentiment composite index that is based on six known proxies for sentiment (closed-end fund discount, share turnover, dividend premium etc.). They show that sentiment indeed affects stock returns, but that size, volatility and some other effects influence sentiment's impact on prices.

A number of papers use private investors' trade records to measure sentiment. Kaniel, Saar and Titman (2004) used a dataset that contains all the New York Stock exchange's orders between 2000 and 2002 to construct a daily measure of investor sentiment by subtracting the value of the shares sold by individuals from the value of shares bought. They come to the conclusion that individual investors' sentiment and turnover have a significant ability to predict the subsequent week's return. Kumar and Lee (2006) used a database of more than 1.85 million retail investor transactions to show that sentiment plays a role in the formation of returns. Schmitz, Glaser and Weber (2005) deduced a new measure for sentiment from individual investors' warrant transactions. They find that returns have a negative influence on sentiment and the influence of stock market returns on sentiment is stronger than vice versa.

A survey-based measure was used by Solt and Statman (1988) and Clark and Statman (1988). They showed that a sentiment index based on a survey of investment advisory newsletters is useless for predicting forthcoming stock prices and that investment advisors are trend followers. Lee, Jiang and Indro (2002) employed a GARCH model on the same index and found that investor sentiment may explain excess returns and stocks' conditional volatility. Brown and Cliff (2005) used the same sentiment dataset and find evidence that the investment advisors' sentiment predicts market returns over the next 1 to 3 years. High levels of sentiment result in significantly lower returns over the next years.

[10] For further evidence and a discussion on the closed-end fund puzzle, see also DeLong and Shleifer (1992), Bodurtha, Kim and Lee (1995), Swaminathan (1996), Neal and Wheatley (1998), Elton et al. (1998), Ross (2002), Doukas and Milonas (2004).

Chang and Fong (2004) used weekly survey results on individual investors' sentiment published by a newspaper in Hong Kong. They found that the sentiment data failed to predict the coming week's return on large, medium, or small stocks in Hong Kong but affected the daily closing prices of medium and small stocks in the coming week.

Qui and Welch (2004) compare the explaining power of survey-based measures with the explaining power of the closed-end fund discount, and find that the survey-based measure can explain closed-end fund IPO activity, while the measure based on closed-end fund discount cannot.

An empirical study that is related to our own is that of Fisher and Statman (2000). They compare three samples of sentiment data: First, a Merrill Lynch dataset, which includes the allocation of stocks in Wall Street strategists' recommended portfolio as a proxy for "professionals". Then a survey of 130 newsletter writers' sentiment compiled according to "Investor Intelligence" (II) is the surrogate for "medium-sized investors". Lastly, a sentiment survey of the American Association of Individual Investors (AAII) is used for "small investors". The relationship between the "small investors" and "medium-sized investors'" sentiment is strong, whereas the relationship between the "professionals" and the other two groups is not. The level of the "small investors" and the "professionals'" sentiment is a reliable contrary indicator of future S&P500 returns, the "medium-sized investors'" sentiment does not provide any significant information about future stock prices. Stock returns have little effect on "professionals`" sentiment, although a positive and significant relationship was found between S&P 500 returns and future changes in the "small investors" and "medium-sized investors'" sentiment.

Wang (2003) distinguishes between "large speculators", "large hedgers" and "small traders" and examined whether their sentiment is useful to forecast returns in the S&P futures market. The sentiment index is based on net trader positions and historical extreme values.[11] Speculator sentiment is a price continuation indicator, whereas hedger sentiment is a contrary indicator. Small traders' sentiment does not provide any information about future prices. Brown and Cliff (2004) also used the sentiment data from the AAII as proxy for individual sentiment and the sentiment data from II as proxy for institutional sentiment. They show that this sentiment data are related to indirect measures of sentiment (like closed-end funds, IPOs, and liquidity). They find strong evidence of co-movement with the market, but little evidence

[11] Although these measures belong to the group of financial-based measures, they are presented here because they distinguish between large and small investors as most survey-based measures do.

of short-run predictability in returns. Interestingly, it appears that the relations between institutional sentiment measures and large stocks are stronger than the other relationships. The authors, however, doubt whether the results are economically relevant; therefore, a trading strategy does not appear to be profitable.

# 3. Dataset

In the previous section, we note that Qui and Welch (2004) found evidence that survey-based measures are superior to measures based on closed-end fund discount when trying to forecast prices. This is one of the reasons why we decided to choose a survey-based measure for this study. A survey moreover has the advantage that it is a direct measure of investor sentiment without taking a detour via, e.g., an asset price.

Our dataset is a weekly sentiment survey called sentix (www.sentix.de). It started on February 23, 2001 with about fifty participants. On February 2, 2006 (the last date of our sample) approximately 700 investors participated in the survey. About 25% of the participants were institutional and 75% were private investors. The participants were anonymously asked for their opinion of ten markets. The poll questioned every investor on what he thought the future direction of each market would be for one month (short term) and six months (medium term). Three separate answers are possible to this question for each time horizon: up, unchanged or down. For this study, we chose to limit ourselves to the six stock markets that are included in this survey: Dax30 (DAX), TecDax (TEC), EuroStoxx50 (ESX50), S&P 500 (SP5), NASDAQ 100 (NASDAQ) and Nikkei225 (NIKKEI). Sentix is German-based, but open to international investors. It is, however, probable that most participants are Germans, because the survey questions were only asked in German[12]. This is important for the interpretation of the later findings.

In order to be able to interpret the sentiment data, we calculated a so-called bull/bear spread that can also be found in Brown and Cliff (2004). It is computed as the number of positive ($S^+$) opinions minus the negative opinions ($S^-$), divided by the total number of people who voiced their opinion for which the spread is calculated ($S^0$ denotes the "neutral" investors).

$$S = \frac{S^+ - S^-}{S^+ + S^0 + S^-}$$

[12] After our sample period, the questionnaire was changed to both English and German.

Consequently, four spreads are calculated for each index. One for the private short-term sentiment (*Ps*), one for the private medium-term sentiment (*Psm*) and the same is done with the institutional investors´ sentiment (*Is* and *Ism*).

We also collected weekly (Friday) price data (closing prices) from datastream that we used for the calculation of log returns for the above-mentioned indices. The returns were calculated in respect of each price in week *i* for time horizons spanning 36, 32, 28, 24, … 4 weeks in the past ($(WR\_v36)_i$, $(WR\_v32)_i$, …) to 4,…, 24, 28, 32 and 36 ($(WR\_4)_i$,$(WR\_8)_i$, …) weeks in the future:

$$(\mathrm{WR\_vt})_i = \ln P_i - \ln P_{i-t} \qquad \text{and} \qquad (\mathrm{WR\_t})_i = \ln P_{i+t} - \ln P_i$$

$(WR\_t)_i$ denotes the $i^{th}$ t-weeks return, $P_i$ is the price of the respective index at the end of week *i*.

We used Bravais-Pearson correlation coefficients to examine our dataset. For example, in section 5, using sentiment and returns, we calculated Bravais-Pearson correlation coefficients according to the following formula:

$$r = \frac{\sum_{i=1}^{k}(S_i - \bar{S})((\mathrm{WR\_t})_i - \overline{\mathrm{WR\_t}})}{\sqrt{\sum_{i=1}^{k}(S_i - \bar{S})^2 \sum_{i=1}^{k}((\mathrm{WR\_t})_i - \overline{\mathrm{WR\_t}})^2}}$$

Additionally, we calculated regressions with the returns of the indices as dependent variables, and the sentiment values as independent variables. For example, the corresponding regression to section 5 (table 8) would be

$$(\mathrm{WR\_t})_i = \alpha + \beta S_i,$$

where $S_i$ denotes the private or institutional sentiment (short or medium term) for an index in week *i*. The results are very much like our results derived from our interpretations of the Bravais-Pearson correlation coefficients, and are therefore not reported here. An example of the results' similarity can be found in the appendix.

We use the F-test for testing the significance of $R^2$. The F-test assumes a normal distribution and the data's independence. While the assumption of normality cannot be rejected for almost

all of the sentiment and the price data, we do have a problem with the returns' time series $(WR\_t)_i$. We have overlapping time windows, consequently these data are neither independently nor normally distributed. Working with not-overlapping windows leads to very small samples that make it very difficult to test for significance. We controlled our results with non-overlapping windows, which led to comparable results. Additionally, we calculated Kendall's tau as a nonparametric correlation coefficient for some of the regressions and obtained almost identical results regarding significance.

# 4. Behavior of investors

In this section, we describe some of the attributes of the sentiment data, in order to illustrate the behavior of private and institutional investors. We do not examine the investors' forecasting ability as this is the subject of the following section.

Table 1 contains the Bravais-Pearson correlation coefficients of short- and medium-term sentiments. We see that the correlation between short and medium term is always stronger with private than with institutional investors. We ascribe this to private investors giving a more general forecast, or just voicing their feeling about the market, whereas institutional investors differentiate between short- and medium-term forecasts. All correlations are positive and significant (grey shaded, $\alpha = 0.05$) – except for the DAX and ESX50 – in respect of institutional investors. This is interesting, it seems that institutional investors differentiate between the two time horizons and that they use different information to arrive at their point of view on future price movements – but only for their major home markets (which we presume to be Germany).

| | Dax | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| Ps with Psm | 0,211 | 0,449 | 0,255 | 0,261 | 0,269 | 0,739 |
| Is with Ism | 0,011 | 0,280 | 0,063 | 0,123 | 0,219 | 0,617 |

**Table 1: Correlation of short- and medium-term sentiments. (Ps = Private Sentiment short term; Psm = Private Sentiment medium term; Is = Institutional Sentiment short term; Ism = Institutional Sentiment medium term)**

Table 2 shows the Bravais-Pearson correlation coefficients for private and institutional investors' sentiment values. The correlation between private and institutional sentiment is always strongly significant (exception SP5) and positive. Especially short-term sentiment shows a very high correlation between private and institutional investors. This is not the case with medium-term sentiment: All coefficients are also significant (except for SP5), but the correlations are much weaker than the short-term correlations (except NIKKEI). It seems that private and institutional investors use the same information when doing short-term forecasts, but different information when doing medium-term ones.

| | Dax | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| **Ps with Is** | **0,798** | **0,810** | **0,791** | **0,783** | **0,769** | **0,804** |
| **Psm with Ism** | **0,245** | **0,544** | **0,204** | **0,089** | **0,165** | **0,835** |

**Table 2: Correlation of sentiments between the two investor groups**

Private and institutional investors also differ in their optimism about future returns. Averaged over all indices, private investors' sentiment is only positive in 48.74% of the time for the short-term forecasting horizon, while institutional investors are much more bullish than private investors, with a 62.42% positive forecasts (Table 3). When regarding the medium-term forecasts, we see that (on average) 71.31% of private investors' forecasts and 74.83% of those of institutional investors are positive. Summing up it seems that institutional investors are largely more bullish than private investors, and private investors are slightly bearish when making short-term forecasts and bullish when making medium term ones (during that time period).

| | | Mean | |
|---|---|---|---|
| | | Ps | Is |
| Short term | pos. sentiment | 48,74% | 62,42% |
| | neg. sentiment | 51,26% | 37,58% |
| Medium term | pos. sentiment | 71,31% | 74,83% |
| | neg. sentiment | 28,69% | 25,17% |

**Table 3: Relative frequency of positive and negative sentiments over all indices**

In the following paragraphs, we analyze the connection between sentiment's correlation over different indices and the correlation between different indices' returns (Table 4). The table

shows the mean correlation for the sentiment time series and the return time series. Mean correlation in this context denotes the averaged Bravais-Pearson correlation coefficients for all sentiment time series of all indices. The tables with the single correlation coefficients can be found in the appendix. The mean correlation of the short-term sentiment between the indices is very high with 0.96 for private and 0.94 for institutional investors. The standard deviation (SD) of the correlation coefficients is 0.02 and 0.03, which means that investors estimate nearly equal correlation coefficients for all indices (as shown in the tables in the appendix). The NIKKEI index is an exception here with regard to both sentiment values and returns. This is why the the NIKKEI results have been omitted in Table 4; the results with the NIKKEI are available in the appendix. We want to compare these results with the *real* correlations of the indices – the correlations of the returns. As a first proxy, we take the 4-week returns for short-term outcomes and 24-week returns for medium-term outcomes. In order to compute these returns, we calculate the returns of the respective index for 4 and 24 weeks.[13] We consequently have overlapping time windows, which is (in our opinion) not a problem here, because we are not performing statistical tests with these values. Nevertheless, we also calculate the non-overlapping returns for each index. The results are very similar. We now see that the correlations between the short-term returns are systematically lower than the correlations between the short-term sentiments. This applies to both private and institutional investors (the institutional investors' correlation is slightly lower). For example, private investors' correlation of the DAX and the NASDAQ sentiment time series is 0.96, while the correlation of the (four-week overlapping) returns is only 0.85. One reason for this insight may be that investors systematically overestimate the correlation between the different indices. Another (in our opinion, more likely) reason may be that investors only form their opinion for just one or a few indices, and extrapolate for the others. This behavior can be explained by overconfidence.[14] This behavior results in a type of "home-bias" effect on the sentiment data. We examine this effect in greater detail in the next section.

When examining the medium-term data, all tendencies remain, except that the investors now clearly underestimate the correlation of index returns. This is puzzling. One interpretation of this result is that while the investors just extrapolate their forecasts for one index to the other indices when doing short-term forecasts, they have different opinions about the indices' changes in prices when doing medium-term forecasts – and also underestimate the indices' correlation.

[13] All financial Data are from DATASTREAM
[14] See Odean (1998) for a summary of the overconfidence literature

| | mean | | SD | | returns | |
|---|---|---|---|---|---|---|
| | Ps | Is | Ps | Is | mean | SD |
| **Short term** | 0,96 | 0,94 | 0,02 | 0,03 | 0,85 | 0,05 |
| **Medium term** | 0,82 | 0,76 | 0,10 | 0,12 | 0,88 | 0,08 |

**Table 4: Correlation between sentiments of different indices vs. correlation of returns between different indices (without NIKKEI)**

In Table 5, we compare the standard deviations between sentiment and returns. Sentiment's volatility is greater because it fluctuates between -100 and +100, which is quite unlikely for returns. There is no reason to calculate the variation coefficients because the sentiment variables and return variables' mean is about zero (hence, the variation coefficients incline to infinity). The standard deviation of each return period is calculated from the indices' one-week (WR_1), the (overlapping) 4-week (WR_4), and 24-week (WR_24) returns.

| | Standard deviations | | | | | | |
|---|---|---|---|---|---|---|---|
| | Ps | Is | Psm | Ism | WR_1 | WR_4 | WR_24 |
| **Dax** | 0,231 | 0,231 | 0,124 | 0,131 | 0,035 | 0,074 | 0,196 |
| **ESX50** | 0,220 | 0,227 | 0,115 | 0,134 | 0,031 | 0,062 | 0,151 |
| **SP5** | 0,211 | 0,224 | 0,113 | 0,115 | 0,023 | 0,047 | 0,106 |
| **Nikkei** | 0,226 | 0,215 | 0,202 | 0,208 | 0,029 | 0,057 | 0,157 |
| **Tec** | 0,243 | 0,233 | 0,140 | 0,147 | 0,052 | 0,125 | 0,389 |
| **Nasdaq** | 0,222 | 0,227 | 0,119 | 0,121 | 0,035 | 0,073 | 0,195 |
| **Mean:** | 0,226 | 0,226 | 0,136 | 0,143 | 0,034 | 0,073 | 0,199 |
| **Mean.wo.Nikkei:** | 0,226 | 0,228 | 0,122 | 0,130 | 0,035 | 0,076 | 0,207 |

**Table 5: Comparison of standard deviations between sentiment and returns**

Sentiments' standard deviation between private sentiment and institutional sentiment differs very little, no matter which forecast horizon is considered. However, it is interesting to notice that the standard deviation of the short-term sentiment is on average almost twice the standard deviation of the medium-term sentiment. This is not in line with the deviations of the returns' behavior: The standard deviation of the medium-term returns is almost three times that of the short-term ones. This higher volatility of medium-term returns indicates that it should be more complicated to predict medium-term returns than short-term returns. Surprisingly, the volatility of the sentiment data does not confirm this conclusion: Both private and institutional investors' opinion about future price movements differs more when considering a short time

horizon than when considering a long time horizon. This may be due to the fact that investors are subject to overreaction to news etc.[15]

Summing up, we conclude that institutional and private investors' forecasting behavior differs: Institutional investors differentiate more between short-term and medium-term forecasts, and they are more bullish than private investors. Both groups use the same information when doing short-term forecasts and different information when doing medium-term ones. Interestingly, in some points, both groups display the same behavior when doing forecasts: Both groups seem to extrapolate their forecast for one or more indices to other indices when doing short-term forecasts. But both groups underestimate the indices' correlation when doing medium-term forecasts. The volatility of the short-term forecasts is higher than the volatility of the long-term forecasts – it seems that the forecasts for the short time horizon are noisier than for the long time horizon.

# 5. Forecasting ability and out-of-sample evidence

We did not evaluate the investors' forecasting ability in the foregoing section. Our aim in this section is to find out whether the investors' sentiment data can deliver information about future price movements and whether this information is economically significant.

In order to avoid criticism of data mining, we first divided the dataset into two sub-samples. The first sub-sample was used to make a first evaluation of investors` forecasting skill. We then developed an investment strategy, based on the sentiment data, and checked whether it was possible to implement this strategy successfully on out of sample data, i.e. in the second sub-sample. Our goal was to design the investment process as realistically as possible, which means that we wanted to build an investment strategy that could be easily implemented.

Our first sub-sample consisted of the first 115 weeks of our dataset and ranged from February 23rd, 2001 to June 27th, 2003.

In the questionnaires, the investors were asked to give a forecast for the indices' short- and medium-term trends, with short term being specified as "about 4 weeks" and medium term specified as "about half a year". Table 6 provides a first impression of the investors`

[15] See e.g. DeBondt and Thaler (1985) and Lakonishok, Shleifer and Vishny (1994)

forecasting ability when asked for a short-term forecast. The line WR_1 includes the Bravais-Pearson correlation coefficients for the sentiment values and the corresponding 1-week index return. WR_4 is the four-week returns, while WR_v4 is the computed return of the four weeks before the sentiment value was obtained. We see that both types of investors, private and institutional, rely heavily on past returns when generating their predictions - private investors a little more than institutional investors. All results are significant at $\alpha = 0.05$.[16] We only observe positive correlations, which shows that both types of investors are trend followers. Neither institutional nor private investors are able to correctly forecast returns a month in advance (no positive significant results, alpha 0.05). In the cases of the SP5 and NIKKEI, we see significant results for private investors, but they are negative. Hence, in this case, private investors' forecast can even be used as a contra trend indicator. These results confirm our assumption in the previous section: Short-term forecasts seem to be very noisy.

| | DAX | | TEC | | ESX50 | | SP5 | | NASDAQ | | NIKKEI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Returns** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** |
| **WR_v4** | 0,38 | 0,25 | 0,43 | 0,35 | 0,43 | 0,28 | 0,42 | 0,36 | 0,45 | 0,37 | 0,58 | 0,46 |
| **WR_v1** | 0,60 | 0,57 | 0,63 | 0,64 | 0,57 | 0,55 | 0,54 | 0,51 | 0,60 | 0,55 | 0,51 | 0,44 |
| **WR_1** | -0,01 | 0,07 | 0,05 | 0,06 | -0,06 | 0,01 | -0,09 | 0,02 | -0,04 | 0,01 | -0,02 | -0,02 |
| **WR_4** | -0,12 | -0,03 | -0,04 | 0,03 | -0,17 | -0,12 | -0,20 | -0,07 | -0,16 | -0,01 | -0,27 | -0,18 |

**Table 6: Sub-sample 1: Correlations between returns and short term sentiment (Bravais Pearson r) (WR_t = return of t weeks after sentiment date; WR_vt = return of t weeks before sentiment date)**

Table 7 includes the same information as Table 6, except that the sentiment data now refer to the medium-time horizon. Here, the correlation of sentiment with past returns is generally weaker compared to the short-term results. Yet, in 8 of 12 cases there is a significantly positive correlation (alpha 0.05) between the past month's return and the opinion regarding the 6-month forecast. Interestingly, the correlation between the past month's (and weeks') return and the institutional investors' opinion regarding the following 6 months is no longer significant for the DAX and the ESX50 – their home market. It seems that investors use different information when doing mid-term forecasts, and they no longer (only) rely on the index's trend during the last few days or weeks. Institutional investors specifically no longer rely on past price developments; they obviously use a different model when forecasting their home market.

[16] Our samples are not, of course, independent due to the overlapping return time windows. Using non-overlapping time windows would lead to samples with about 10 data points (regarding 24- week returns), which is insufficient for calculating and interpreting any correlations.

As mentioned above, the investors were asked to forecast the price development of the next 6 months, i.e. 24 weeks. Table 7 shows that they are not very successful in doing so (WR_24). When institutional investors forecast the SP5 and NASDAQ, we see significant values. Private investors do have significant values when forecasting a 24-week period, but the coefficients are negative. Private investors make significantly wrong forecasts.

| | DAX | | TEC | | ESX50 | | SP5 | | NASDAQ | | NIKKEI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Returns** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** |
| **WR_v24** | 0,22 | -0,32 | 0,17 | 0,28 | 0,18 | -0,23 | -0,01 | -0,01 | -0,11 | 0,29 | 0,59 | 0,52 |
| **WR_v4** | 0,18 | -0,08 | 0,47 | 0,45 | 0,20 | 0,04 | 0,17 | 0,23 | 0,23 | 0,33 | 0,49 | 0,38 |
| **WR_4** | 0,11 | 0,14 | -0,02 | 0,19 | 0,13 | 0,14 | -0,09 | 0,08 | -0,05 | 0,24 | -0,32 | -0,14 |
| **WR_24** | -0,23 | 0,09 | -0,36 | 0,11 | -0,33 | 0,17 | -0,44 | 0,20 | -0,48 | 0,24 | -0,67 | -0,38 |

**Table 7: Sub-sample 1: Correlations between returns and medium-term sentiment (Bravais Pearson r)**

As mentioned in section 3, the participants were asked their opinion of the markets for a short-term and medium-term time horizon. In this context, short term was defined as "about one month", and medium term as "about six months". The participants were not able to define their own time horizons. It could therefore be that an investor's own interpretation of "medium term" could be shorter (or longer) than six months for example because he has a feeling about market movements during the next two months, but feels absolutely unable to make a forecast half a year in advance. This is why we tested different time horizons for medium-term forecasts. In fact, the picture changes when we look at other time horizons (Table 8). Institutional investors' forecasts are pretty good with regard to 8- and 12-week returns. 8 out of 10 correlation coefficients are significant and positive (except for the NIKKEI). Private investors are again mostly wrong with regard to these returns. There is no significant ($\alpha = 0,05$) positive correlation at all. Instead, the correlation tends to turn increasingly negative the further the returns expand into the future. At WR_24 (6 months), the correlation is negative and significant for all indices.

| | DAX | | TEC | | ESX50 | | SP5 | | NASDAQ | | NIKKEI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Psm | Ism | Psm | Ism | Psm | Ism | Psm | Ism | Psm | Ism | Psm | Ism |
| **WR_1** | 0,07 | 0,06 | 0,11 | 0,11 | 0,04 | 0,07 | 0,00 | 0,05 | 0,00 | 0,09 | -0,19 | -0,05 |
| **WR_4** | 0,11 | 0,14 | -0,02 | 0,19 | 0,13 | 0,14 | -0,09 | 0,08 | -0,05 | 0,24 | -0,32 | -0,14 |
| **WR_8** | 0,09 | 0,23 | -0,17 | 0,21 | 0,01 | 0,20 | -0,20 | 0,08 | -0,16 | 0,30 | -0,48 | -0,20 |
| **WR_12** | -0,02 | 0,24 | -0,28 | 0,17 | -0,13 | 0,21 | -0,28 | 0,19 | -0,31 | 0,31 | -0,58 | -0,27 |
| **WR_16** | -0,19 | 0,14 | -0,38 | 0,06 | -0,29 | 0,16 | -0,41 | 0,18 | -0,42 | 0,24 | -0,62 | -0,36 |
| **WR_20** | -0,28 | 0,04 | -0,43 | 0,04 | -0,38 | 0,07 | -0,48 | 0,09 | -0,49 | 0,16 | -0,67 | -0,36 |
| **WR_24** | -0,23 | 0,09 | -0,36 | 0,11 | -0,33 | 0,17 | -0,44 | 0,20 | -0,48 | 0,24 | -0,67 | -0,38 |
| **WR_28** | -0,27 | 0,15 | -0,35 | 0,23 | -0,37 | 0,26 | -0,40 | 0,35 | -0,41 | 0,42 | -0,65 | -0,33 |
| **WR_32** | -0,26 | 0,15 | -0,42 | 0,21 | -0,35 | 0,23 | -0,39 | 0,30 | -0,41 | 0,40 | -0,71 | -0,42 |
| **WR_36** | -0,26 | 0,22 | -0,47 | 0,27 | -0,34 | 0,30 | -0,48 | 0,24 | -0,50 | 0,35 | -0,73 | -0,39 |

**Table 8: Sub-sample 1: Correlations between medium-term sentiment and future returns.**

On the basis of these results, we then designed a trading strategy to verify the identified conclusions (i.e., professional investors are able to forecast future price movements). We will discuss the outcome of such investments with regard to economic relevance.

We invested in indices, which means that we bought one index certificate when receiving a buy signal and held it for a fixed period. If we obtained another buy signal during this period, we extended our investment period by the same time period. This investment horizon was determined by identifying the "maximum" r-value. As found above, institutional investors are best at forecasting 8- or 12-week time horizons. Consequently, we used these two alternative time horizons for our strategy. For example, we bought a SP5 certificate when we saw high positive institutional sentiments concerning this index, and held this certificate for 12 weeks. If we observed a signal (high positive institutional sentiment) with regard to the SP5 during this time, we continued holding the certificate for another 12 weeks from this day onward.

The signal is a certain level of positive sentiment. We wanted to have a minimum of transactions per index, so we chose the best sentiment parameter with more or at least 20 realizations (in the first sub-sample) for each index. The benchmark is a simple buy-and-hold index strategy. Table 9 and Table 10 show the strategy's performance in the first dataset (the "in-sample period"). The row "strategy" describes the trading strategy for the particular index, i.e. "Is > 0.25" (column DAX) means that we invested in a DAX certificate when the institutional investors' medium-term sentiment was larger than 0.25, and we held the certificate for 8 weeks (Table 9), or for 12 weeks (Table 10).

Examining the indices' charts (appendix), we see that during the time of the first sample (February 2001 to June 2003), returns were negative most of the time. It is therefore not surprising that both the strategies, buy and hold, as well as our investment strategy produced negative returns in 9 out of 12 times.

The first row ("Bravais Pearson r") denotes the correlation between sentiment and (8-week) returns. The rows "returns per week" (Table 9 and Table 10) show the average return of our investment strategy, or the buy-&-hold strategy per week, i.e. as far as our investment strategy is concerned: the cumulated return divided by the number of weeks invested. For example, when applying an 8-week holding period trading strategy to the DAX index, we obtained 5 trades and were invested in 68 (out of 115) weeks. Our cumulated return for the whole investment period was -0.2676 (i.e. -26.76%), which led to an average return per week of -0.2676/68 = -0.0039. Except for the SP5, this strategy beat the buy-&-hold strategy in terms of returns with regard to the 8-week holding period. With a holding period of 12 weeks, the strategy won in 4 out of 6 cases. The rows "standard deviation" includes the standard deviation of the buy & hold's weekly returns and the investment strategy's weekly returns for the complete sub-sample. During the periods when we were not invested, the returns were "0". The strategy's standard deviation is smaller than the standard deviation of the buy-&-hold strategy. This is not surprising – we are not in the market all the time.

| | **DAX** | **TEC** | **ESX50** | **SP5** | **NASDAQ** | **NIKKEI** |
|---|---|---|---|---|---|---|
| | WR_8 | WR_8 | WR_8 | WR_8 | WR_8 | WR_8 |
| **Bravais Pearson r** | 0,2280 | 0,2136 | 0,1991 | 0,0849 | 0,3007 | -0,1970 |
| **Returns per week (buy&hold)** | -0,0055 | -0,0132 | -0,0049 | -0,0020 | -0,0027 | 0,0028 |
| **Returns per week (strategy)** | -0,0039 | -0,0099 | -0,0042 | -0,0030 | 0,0003 | 0,0040 |
| **Std. deviation (strategy)** | 0,0351 | 0,0574 | 0,0330 | 0,0212 | 0,0340 | 0,0240 |
| **Std. deviation (buy&hold)** | 0,0460 | 0,0687 | 0,0413 | 0,0303 | 0,0457 | 0,0332 |
| **Strategy** | Is > 0.25 | Is > 0.05 | Is > 0.25 | Is > 0.15 | Is > 0.15 | Is > 0.2 |

**Table 9: Performance of investing strategy in-sample, holding period 8 weeks.**

| | **DAX** | **TEC** | **ESX50** | **SP5** | **NASDAQ** | **NIKKEI** |
|---|---|---|---|---|---|---|
| | WR_12 | WR_12 | WR_12 | WR_12 | WR_12 | WR_12 |
| **Bravais Pearson r** | 0,2394 | 0,1742 | 0,2085 | 0,1904 | 0,3104 | -0,2667 |
| **Returns per week (buy&hold)** | -0,0055 | -0,0132 | -0,0049 | -0,0020 | -0,0027 | 0,0028 |
| **Returns per week (strategy)** | -0,0061 | -0,0126 | -0,0053 | -0,0016 | -0,0011 | 0,0057 |
| **Std. deviation (strategy)** | 0,0372 | 0,0600 | 0,0351 | 0,0236 | 0,0360 | 0,0245 |
| **Std. deviation (buy&hold)** | 0,0460 | 0,0687 | 0,0413 | 0,0303 | 0,0457 | 0,0332 |
| **Strategy** | Is > 0.25 | Is > 0.05 | Is > 0.25 | Is > 0.15 | Is > 0.15 | Is > 0.2 |

**Table 10: Performance of investing strategy in-sample, holding period 12 weeks.**

The investment strategy was thereafter applied to our out-of-sample dataset. Our second sub-sample consisted of the remaining 135 weeks of our dataset and ranged from July 4th, 2003 to February 10th, 2006. The indices' charts in the appendix show that most of the indices had positive returns during that time. The attributes of the first sample's returns were therefore very different from the attributes of the second sample's returns. This was not our aim – it was pure coincidence. Consequently, it was hardly possible for the investment strategy to beat the buy-&-hold strategy in terms of returns. Besides the returns, we addressed the topic of risk. Our question was: Can our strategy beat the buy-&-hold strategy after risk adjustment?

We used the Sharpe ratio[17] as the strategies' performance measure:

$$SR = \frac{\sum_{i=1}^{k} WR_i - R_f}{\sigma_{WR} \cdot \sqrt{k}}$$

$WR_i$ represents the log return of week $i$ of the index and $R_f$ the return of a riskless investment for the sample period. $\sigma_{WR}$ denotes the standard deviation of the weekly returns, and we look at $k$ weeks (with $k$ = 115 or 135 weeks). We chose 4% as a riskless interest rate, which is not important at all for the interpretation of our findings.

Table 11 and Table 12 show the results of the strategy when applied to the out-of-sample dataset. We see that for both time horizons we received higher average returns per (invested) week when using the strategy on the DAX index. Returns with regard to the German TEC index were about the same; we obtained higher returns on the ESX50 when investing with an 8-week holding period and lower returns when investing with a 12-week holding period. The strategy outdoes buy-and-hold on the NASDAQ index and does worse on the SP5 index. The results of the NIKKEI are the same for buy-&-hold and our strategy because in this case we were invested all 135 weeks.

The standard deviations were (of course) always higher or equal for the buy-&-hold strategy. Nevertheless, regarding the Sharpe ratios, the investment strategy exceeded or was equal to the buy-&-hold strategy in only 6 out of 12 cases, because for the calculation of the Sharpe ratio, the cumulated returns over the whole period were used. Due to the indices' exceptionally positive development during that time period, beating the performance of a buy-&-hold strategy was almost impossible.

[17] See Sharpe (1994)

To sum up, despite a disadvantageous market, the investment strategy performed quite well. Although the trading strategy was created and parameterized during a market downtrend, it turned out well during the ex ante period, which was a market uptrend. Institutional investor sentiment seems to have some kind of predictive power. However, the question of economic relevance cannot be satisfactorily answered unless the dataset is enlarged.

| | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| | WR_8 | WR_8 | WR_8 | WR_8 | WR_8 | WR_8 |
| **Returns per week (strategy)** | 0,0057 | 0,0035 | 0,0036 | 0,0012 | 0,0036 | -0,0039 |
| **Returns per week (buy&hold)** | 0,0042 | 0,0036 | 0,0032 | 0,0019 | 0,0023 | -0,0039 |
| **Std. deviation (stragtey)** | 0,0184 | 0,0283 | 0,0160 | 0,0108 | 0,0166 | 0,0239 |
| **Std. deviation (buy&hold)** | 0,0211 | 0,0284 | 0,0176 | 0,0144 | 0,0225 | 0,0239 |
| **Sharpe R. (Strategy)** | 2,33 | 1,27 | 1,90 | 0,38 | 0,92 | 1,78 |
| **Sharpe R. (buy&hold)** | 2,14 | 1,37 | 1,90 | 1,26 | 1,02 | 1,78 |
| **Strategy** | Is > 0.25 | Is > 0.05 | Is > 0.25 | Is > 0.15 | Is > 0.15 | Is > 0.2 |

**Table 11: Performance of investing strategy out-of-sample, holding period 8 weeks.**

| | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| | WR_12 | WR_12 | WR_12 | WR_12 | WR_12 | WR_12 |
| **Returns per week (strategy)** | 0,0046 | 0,0036 | 0,0025 | 0,0017 | 0,0043 | -0,0039 |
| **Returns per week (buy&hold)** | 0,0042 | 0,0036 | 0,0032 | 0,0019 | 0,0023 | -0,0039 |
| **Std. deviation (stragtey)** | 0,0189 | 0,0284 | 0,0171 | 0,0112 | 0,0174 | 0,0239 |
| **Std. deviation (buy&hold)** | 0,0211 | 0,0284 | 0,0176 | 0,0144 | 0,0225 | 0,0239 |
| **Sharpe R. (Strategy)** | 2,08 | 1,37 | 1,37 | 0,68 | 1,40 | 1,78 |
| **Sharpe R. (buy&hold)** | 2,14 | 1,37 | 1,90 | 1,26 | 1,02 | 1,78 |
| **Strategy** | Is > 0.25 | Is > 0.05 | Is > 0.25 | Is > 0.15 | Is > 0.15 | Is > 0.2 |

**Table 12: Performance of investing strategy out-of-sample, holding period 12 weeks.**

# 6. Overall forecasting ability

In this section we present the overall correlation of sentiment values and returns, when combining both sub-samples to the full dataset.

Table 13 includes the correlation between short term sentiment and returns for the full data sample. What we see is that neither institutional nor private investors are able to correctly forecast returns up to a month (no positive significant results, alpha 0.05). In the cases of SP5 and NASDQ private investors can even be used as a contra trend indicator (significant results,

alpha 0.05). Instead both, private and institutional investors, heavily rely on the past week's and past month's returns (very significant results, alpha 0.05). They are trend followers (only positive correlations). The above is true for all Indices.

| | DAX | | TEC | | ESX50 | | SP5 | | NASDAQ | | NIKKEI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Returns** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** | **Ps** | **Is** |
| **WR_v4** | 0,43 | 0,25 | 0,45 | 0,33 | 0,47 | 0,29 | 0,48 | 0,36 | 0,47 | 0,36 | 0,60 | 0,49 |
| **WR_v1** | 0,58 | 0,56 | 0,57 | 0,58 | 0,55 | 0,54 | 0,53 | 0,49 | 0,56 | 0,52 | 0,56 | 0,55 |
| **WR_1** | 0,01 | 0,03 | 0,08 | 0,05 | -0,02 | -0,01 | -0,10 | -0,04 | -0,07 | -0,05 | 0,05 | 0,04 |
| **WR_4** | -0,03 | -0,04 | 0,06 | 0,04 | -0,07 | -0,10 | -0,15 | -0,10 | -0,14 | -0,06 | 0,00 | 0,02 |

**Table 13: Correlations between returns and short term sentiment – full dataset**

Our insight regarding institutional traders' forecasting ability proves true when examining Table 14. Contrary to private investors, institutional investors are able to forecast price movements over a longer time period. The sentiment of private investors can be used as contra indicator – it seems that private investors systematically misinterpret information about future price movements.

In section 4, we clarified that private investors rely on past price movements when doing their medium forecasts, and that institutional investors use different information. This may be the reason for the results derived in Table 14.

| | DAX | | TEC | | ESX50 | | SP5 | | NASDAQ | | NIKKEI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** | **Psm** | **Ism** |
| **WR_1** | 0,08 | 0,11 | 0,14 | 0,18 | 0,05 | 0,10 | -0,03 | 0,01 | -0,02 | 0,05 | 0,02 | 0,11 |
| **WR_4** | 0,10 | 0,17 | 0,08 | 0,25 | 0,11 | 0,16 | -0,12 | 0,03 | -0,09 | 0,14 | 0,05 | 0,15 |
| **WR_8** | 0,09 | 0,29 | 0,01 | 0,33 | 0,04 | 0,25 | -0,22 | 0,07 | -0,20 | 0,24 | 0,06 | 0,21 |
| **WR_12** | 0,02 | 0,30 | -0,03 | 0,35 | -0,03 | 0,28 | -0,31 | 0,14 | -0,34 | 0,25 | 0,06 | 0,22 |
| **WR_16** | -0,09 | 0,27 | -0,07 | 0,32 | -0,11 | 0,28 | -0,40 | 0,17 | -0,42 | 0,24 | 0,03 | 0,20 |
| **WR_20** | -0,16 | 0,26 | -0,10 | 0,34 | -0,17 | 0,27 | -0,45 | 0,17 | -0,47 | 0,24 | -0,02 | 0,18 |
| **WR_24** | -0,16 | 0,30 | -0,08 | 0,40 | -0,18 | 0,33 | -0,44 | 0,26 | -0,46 | 0,31 | -0,02 | 0,17 |
| **WR_28** | -0,24 | 0,31 | -0,11 | 0,44 | -0,24 | 0,38 | -0,46 | 0,33 | -0,46 | 0,38 | -0,05 | 0,17 |
| **WR_32** | -0,27 | 0,29 | -0,17 | 0,43 | -0,28 | 0,35 | -0,48 | 0,30 | -0,47 | 0,37 | -0,10 | 0,12 |
| **WR_36** | -0,30 | 0,31 | -0,23 | 0,43 | -0,30 | 0,36 | -0,52 | 0,28 | -0,50 | 0,35 | -0,11 | 0,12 |

**Table 14: Correlations between returns and medium-term sentiment – full dataset**

Table 15 shows the correlation of past returns and sentiment. Interestingly, it seems that institutional investors are increasingly better at forecasting the less they rely on past prices.

| | DAX | | TEC | | ESX50 | | SP5 | | NASDAQ | | NIKKEI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Psm | Ism | Psm | Ism | Psm | Ism | Psm | Ism | Psm | Ism | Psm | Ism |
| **WR_v36** | 0,20 | 0,04 | 0,35 | 0,56 | 0,19 | 0,10 | -0,17 | -0,06 | -0,29 | 0,03 | 0,78 | 0,74 |
| **WR_v32** | 0,20 | 0,05 | 0,36 | 0,55 | 0,20 | 0,12 | -0,14 | -0,01 | -0,25 | 0,07 | 0,78 | 0,74 |
| **WR_v28** | 0,20 | 0,06 | 0,38 | 0,56 | 0,21 | 0,14 | -0,09 | 0,01 | -0,17 | 0,11 | 0,78 | 0,75 |
| **WR_v24** | 0,19 | 0,05 | 0,39 | 0,54 | 0,19 | 0,10 | -0,10 | -0,02 | -0,13 | 0,11 | 0,77 | 0,73 |
| **WR_v20** | 0,19 | 0,04 | 0,41 | 0,53 | 0,18 | 0,07 | -0,05 | -0,02 | -0,04 | 0,12 | 0,76 | 0,71 |
| **WR_v16** | 0,19 | 0,06 | 0,42 | 0,52 | 0,19 | 0,10 | 0,02 | 0,07 | 0,02 | 0,16 | 0,76 | 0,72 |
| **WR_v12** | 0,10 | -0,01 | 0,39 | 0,47 | 0,14 | 0,04 | 0,03 | 0,09 | 0,03 | 0,13 | 0,72 | 0,69 |
| **WR_v8** | 0,08 | -0,04 | 0,38 | 0,44 | 0,13 | 0,05 | 0,06 | 0,09 | 0,07 | 0,16 | 0,66 | 0,59 |
| **WR_v4** | 0,21 | 0,05 | 0,47 | 0,50 | 0,23 | 0,13 | 0,21 | 0,22 | 0,24 | 0,31 | 0,55 | 0,47 |
| **WR_v1** | 0,11 | 0,05 | 0,30 | 0,37 | 0,13 | 0,12 | 0,12 | 0,17 | 0,16 | 0,27 | 0,29 | 0,31 |

**Table 15: Correlations between past returns and medium-term sentiment – full dataset**

# 7. Conclusion and outlook

The literature shows that sentiment does indeed play a role in the formation of returns.[18] We have seen that it is necessary to differentiate between private and institutional investors in respect of the predictive power of sentiment. This finding is in line with Fisher and Statman (2000), Wang (2003), and Brown and Cliff (2004).

Besides the already known effects that influence sentiment's impact on prices[19], we found that you have to distinguish between short- and medium-term forecasts with regard to sentiment's predictive power. Sentiment that refers to short time horizons is very noisy, and both private and institutional investors make economically incorrect forecasts. Both investor groups seem to make common mistakes when creating this kind of forecast because there is a high correlation between their sentiments. Both groups also rely on past prices.[20]

When forecasting a medium time horizon, institutional investors do surprisingly well, while private investors make systematically wrong predictions. Private investors are still orientated towards historic price movements, while institutional investor seem to have other information.

[18] Fisher and Statman (2000), Lee, Jiang and Indro (2002), Wang (2003) , Kaniel, Saar and Titman (2004), Brown and Cliff (2005), Baker and Wurgler (2006), Kumar and Lee (2006)
[19] See e.g. Baker and Wurgler (2006)
[20] This is in line with Solt and Statman (1988), Clark and Statman (1988) and Fisher and Statman (2000) and Schmitz, Glaser and Weber (2005)

The less they adjust their forecasts with regard to past prices, the better their prediction becomes. This tendency to extrapolate past prices differ from index to index. Professional investors obviously possess better information regarding their home markets. Consequently, the trading strategy developed from the sentiment data works best when using professional traders' sentiment on their home market.

The relevance of our results is obvious: Institutional investors' sentiment can be used to predict future stock market returns and institutional investors' sentiment measures may consequently serve as a support for investment decisions. Asset-pricing models should also consider the influence of (professional) investor sentiment.

# Appendix:

## Correlation between sentiments of different indices vs. correlation of returns between different indices:

**Sentiment Ps with sentiment Ps (short term)**
Bravais Pearson r

| Ps | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,96 | 0,99 | 0,97 | 0,96 | 0,75 |
| TEC | | 1,00 | 0,95 | 0,92 | 0,95 | 0,78 |
| ESX50 | | | 1,00 | 0,97 | 0,96 | 0,77 |
| SP5 | | | | 1,00 | 0,97 | 0,74 |
| NASDAQ | | | | | 1,00 | 0,73 |
| NIKKEI | | | | | | 1,00 |
| Mean and STD with NIKKEI | | | **0,89** | **0,10** | | |
| Mean and STD without NIKKEI | | | **0,96** | **0,02** | | |

**Sentiment Is with sentiment Is (short term)**
Bravais Pearson r

| Is | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,93 | 0,99 | 0,96 | 0,93 | 0,64 |
| TEC | | 1,00 | 0,92 | 0,90 | 0,91 | 0,69 |
| ESX50 | | | 1,00 | 0,96 | 0,93 | 0,65 |
| SP5 | | | | 1,00 | 0,96 | 0,60 |
| NASDAQ | | | | | 1,00 | 0,58 |
| NIKKEI | | | | | | 1,00 |
| Mean and STD with NIKKEI | | | **0,84** | **0,15** | | |
| Mean and STD without NIKKEI | | | **0,94** | **0,03** | | |

**Return X with return Y (four weeks overlapping)**
Bravais Pearson r

| Returns 4 weeks | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,82 | 0,95 | 0,85 | 0,81 | 0,58 |
| TEC | | 1,00 | 0,83 | 0,79 | 0,85 | 0,53 |
| ESX50 | | | 1,00 | 0,88 | 0,81 | 0,60 |
| SP5 | | | | 1,00 | 0,91 | 0,53 |
| NASDAQ | | | | | 1,00 | 0,54 |
| NIKKEI | | | | | | 1,00 |
| Mean and STD with NIKKEI | | | **0,75** | **0,15** | | |
| Mean and STD without NIKKEI | | | **0,85** | **0,05** | | |

**Return X with return Y (four weeks non-overlapping)**

Bravais Pearson r

| Returns | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,82 | 0,94 | 0,85 | 0,79 | 0,44 |
| TEC | | 1,00 | 0,87 | 0,81 | 0,82 | 0,39 |
| ESX50 | | | 1,00 | 0,87 | 0,81 | 0,51 |
| SP5 | | | | 1,00 | 0,91 | 0,48 |
| NASDAQ | | | | | 1,00 | 0,52 |
| NIKKEI | | | | | | 1,00 |

| | | |
|---|---|---|
| Mean and STD with NIKKEI | **0,72** | **0,19** |
| Mean and STD without NIKKEI | **0,85** | **0,05** |

**Sentiment Ps with sentiment Ps (medium term)**

Bravais Pearson r

| Ps | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,83 | 0,98 | 0,82 | 0,80 | 0,47 |
| TEC | | 1,00 | 0,82 | 0,65 | 0,69 | 0,63 |
| ESX50 | | | 1,00 | 0,84 | 0,81 | 0,46 |
| SP5 | | | | 1,00 | 0,94 | 0,24 |
| NASDAQ | | | | | 1,00 | 0,22 |
| NIKKEI | | | | | | 1,00 |

| | | |
|---|---|---|
| Mean and STD with NIKKEI | **0,68** | **0,23** |
| Mean and STD without NIKKEI | **0,82** | **0,10** |

**Sentiment Is with sentiment Is (medium term)**

Bravais Pearson r

| Is | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,77 | 0,97 | 0,77 | 0,71 | 0,56 |
| TEC | | 1,00 | 0,78 | 0,57 | 0,59 | 0,74 |
| ESX50 | | | 1,00 | 0,81 | 0,73 | 0,56 |
| SP5 | | | | 1,00 | 0,87 | 0,27 |
| NASDAQ | | | | | 1,00 | 0,21 |
| NIKKEI | | | | | | 1,00 |

| | | |
|---|---|---|
| Mean and STD with NIKKEI | **0,66** | **0,21** |
| Mean and STD without NIKKEI | **0,76** | **0,12** |

**Return X with return Y (24 weeks overlapping)**

Bravais Pearson r

| Ps | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,83 | 0,97 | 0,88 | 0,72 | 0,83 |
| TEC | | 1,00 | 0,87 | 0,90 | 0,94 | 0,72 |
| ESX50 | | | 1,00 | 0,92 | 0,77 | 0,79 |
| SP5 | | | | 1,00 | 0,91 | 0,70 |
| NASDAQ | | | | | 1,00 | 0,62 |
| NIKKEI | | | | | | 1,00 |

| | | |
|---|---|---|
| Mean and STD with NIKKEI | **0,82** | **0,10** |
| Mean and STD without NIKKEI | **0,87** | **0,08** |

**Return X with return Y (24 weeks non-overlapping)**

Bravais Pearson r

| Ps | DAX | TEC | ESX50 | SP5 | NASDAQ | NIKKEI |
|---|---|---|---|---|---|---|
| DAX | 1,00 | 0,86 | 0,99 | 0,94 | 0,76 | 0,89 |
| TEC | | 1,00 | 0,87 | 0,88 | 0,96 | 0,79 |
| ESX50 | | | 1,00 | 0,95 | 0,76 | 0,88 |
| SP5 | | | | 1,00 | 0,86 | 0,85 |
| NASDAQ | | | | | 1,00 | 0,73 |
| NIKKEI | | | | | | 1,00 |

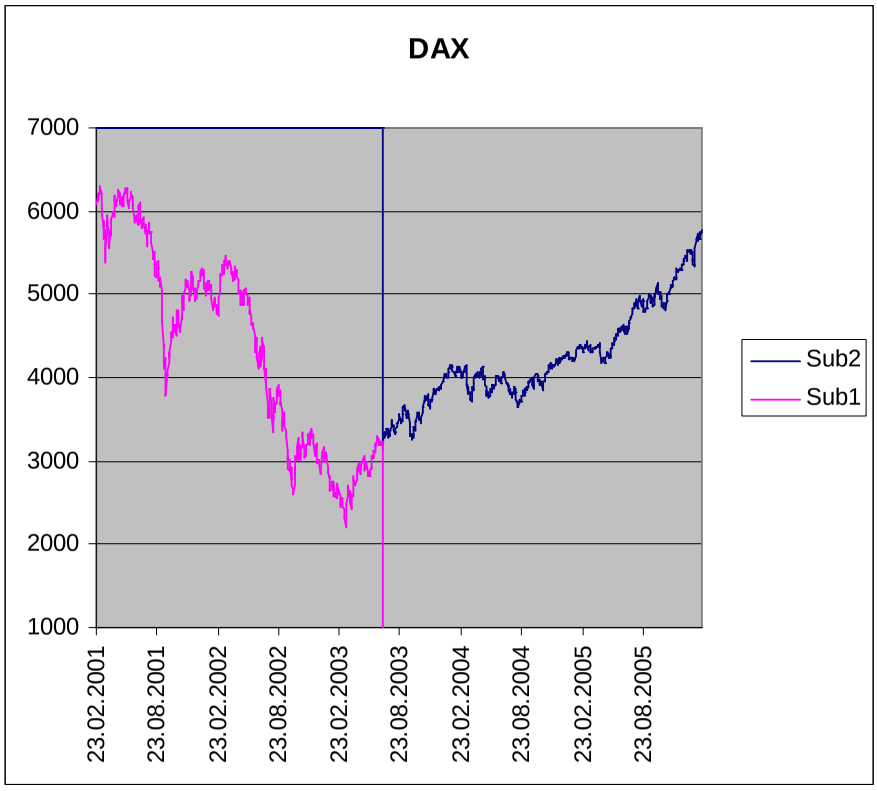
| | | |
|---|---|---|
| Mean and STD with NIKKEI | **0,86** | **0,08** |
| Mean and STD without NIKKEI | **0,88** | **0,08** |

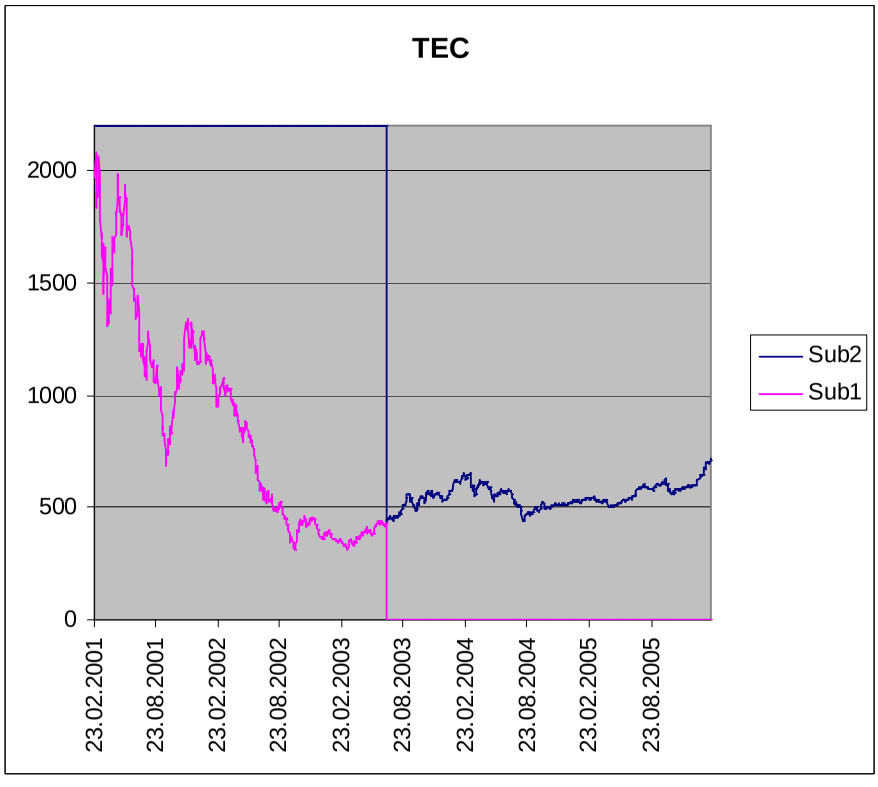
| | **Bravais-P.** | | **Regression** | |
|---|---|---|---|---|
| | **Ism** | **Psm** | **Psm** | **Ism** |
| **WR_1** | 0,08 | 0,11 | 0,02 | 0,03 |
| **WR_4** | 0,10 | 0,17 | 0,06 | 0,09 |
| **WR_8** | 0,09 | 0,29 | 0,07 | 0,23 |
| **WR_12** | 0,02 | 0,30 | 0,02 | 0,31 |
| **WR_16** | -0,09 | 0,27 | -0,11 | 0,33 |
| **WR_20** | -0,16 | 0,26 | -0,23 | 0,36 |
| **WR_24** | -0,16 | 0,30 | -0,28 | 0,46 |
| **WR_28** | -0,24 | 0,31 | -0,47 | 0,54 |
| **WR_32** | -0,27 | 0,29 | -0,58 | 0,54 |
| **WR_36** | -0,30 | 0,31 | -0,70 | 0,62 |

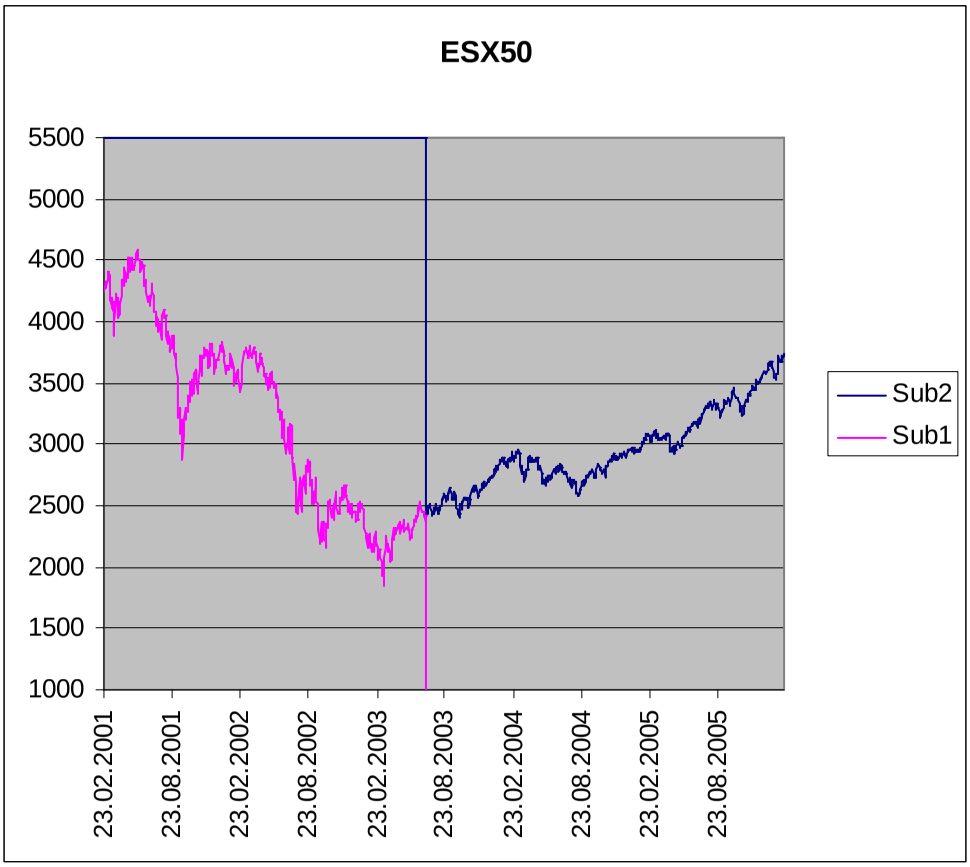
Bravais-Pearson r and estimated β of the regression $(WR\_t)_i = \alpha + \beta Qsm_i$ , $Q = \{s, m\}$.

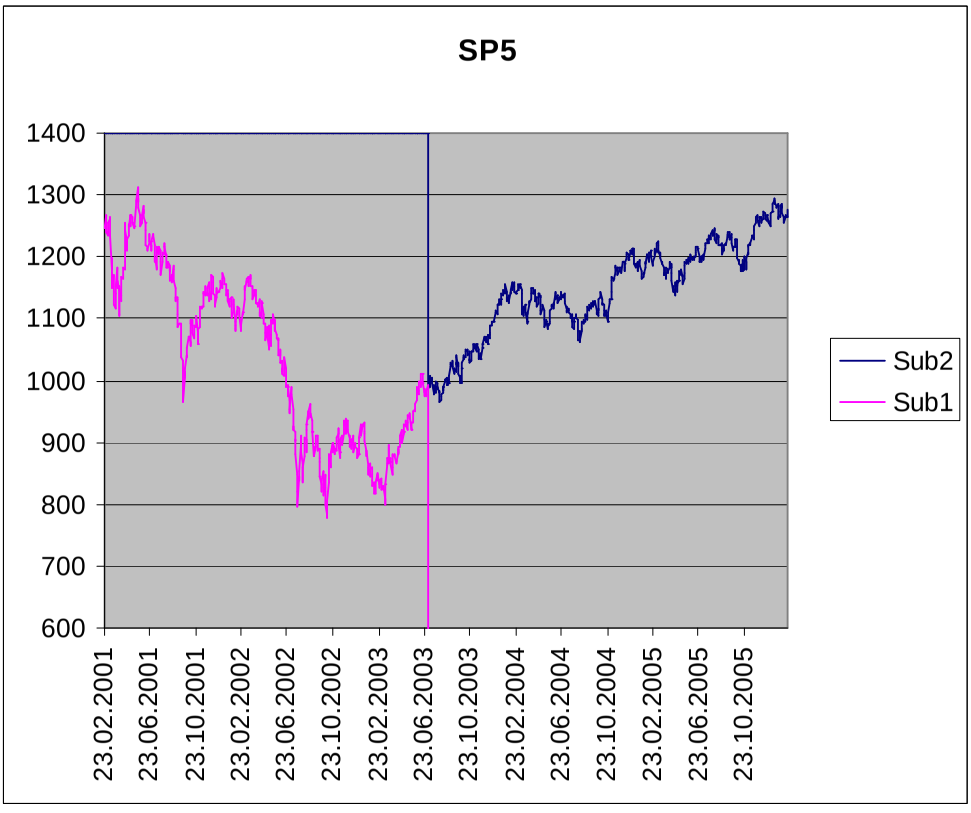
Significant (α=0,05/0,01) Bravais-Pearson and Regression coefficients are grey shaded (medium-grey/dark-grey)

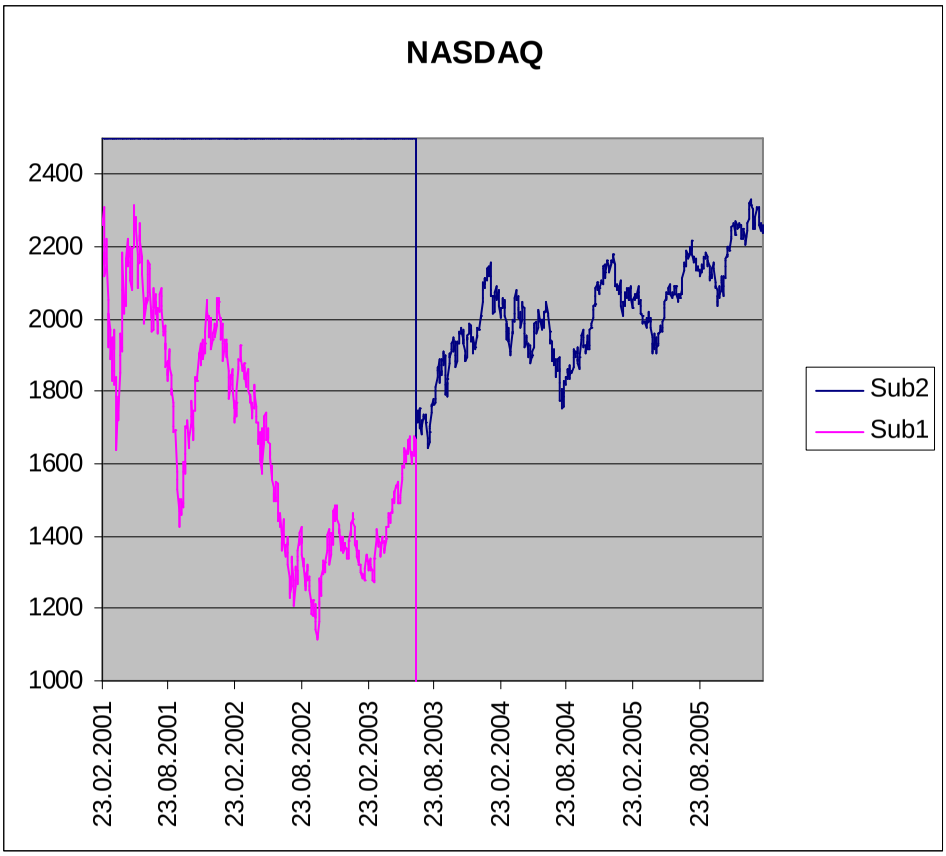
## Charts of the stock market indices:

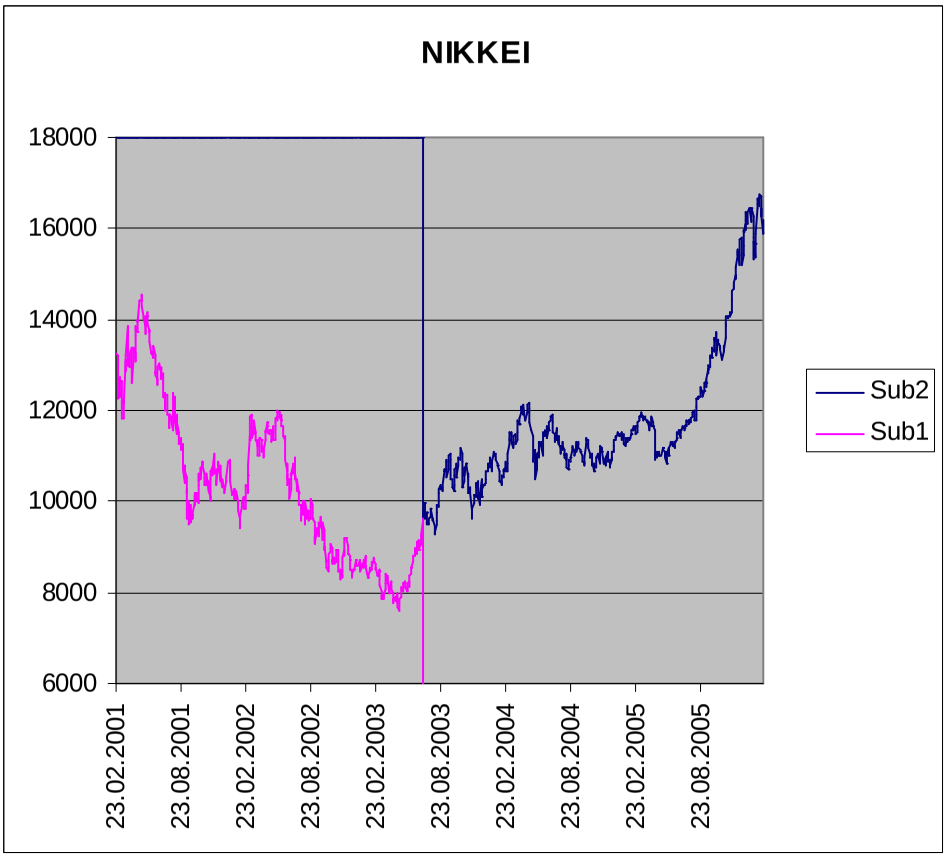



ESX50
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
23.02.2001
23.08.2001
23.02.2002
23.08.2002
23.02.2003
23.08.2003
23.02.2004
23.08.2004
23.02.2005
23.08.2005
Sub2
Sub1


SP5
1400
1300
1200
1100
1000
900
800
700
600
23.02.2001
23.06.2001
23.10.2001
23.02.2002
23.06.2002
23.10.2002
23.02.2003
23.06.2003
23.10.2003
23.02.2004
23.06.2004
23.10.2004
23.02.2005
23.06.2005
23.10.2005
Sub2
Sub1


NASDAQ
2400
2200
2000
1800
1600
1400
1200
1000
23.02.2001
23.08.2001
23.02.2002
23.08.2002
23.02.2003
23.08.2003
23.02.2004
23.08.2004
23.02.2005
23.08.2005
Sub2
Sub1


NIKKEI
18000
16000
14000
12000
10000
8000
6000
23.02.2001
23.08.2001
23.02.2002
23.08.2002
23.02.2003
23.08.2003
23.02.2004
23.08.2004
23.02.2005
23.08.2005
Sub2
Sub1

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