Is Sentiment Risk Priced by Stock Market?

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Résumé : This study tests if the financial markets price the investor's sentiment risk. We construct portfolios based upon the stock returns' exposure to sentiment. Our results show that the portfolio returns are positively correlated with the exposure of stocks to sentiment. The strategy that consists of buying stocks with the highest exposure to sentiment and selling stocks with the lowest exposure to sentiment generates a significant raw profit. Exploring the sources of profit, we find that neither the traditional risk factors nor the momentum factor can account for the profit. However, we find that the addition of the sentiment risk premium contributes to explain the profit.

Mots clés : Investor sentiment, Stock returns, Noise trader risk.

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Over the last decade, investor sentiment has become one of the most widely studied theoretical and empirical areas in finance. In fact, the relationship between investor sentiment and the valuation of financial assets has led to many memorable debates. It is highly probable that this relationship will continue to catch the attention of a growing number of academics and professionals.

Several theoretical studies have modeled the role of investor sentiment in the financial markets (Black, 1986; De Long, Shleifer, Summers and Waldmann, 1990; Barberis, Shleifer and Vishny, 1998). In these studies, the economy is characterized by two types of investors: professional investors who rationally anticipate asset prices and noise traders (i.e. individuals) whose expectations lead to periods of over, or undervaluation, of financial assets. Both types of investors are risk adverse and the equilibrium price reflects everyone's expectations. It follows that noise traders' sentiment influences asset prices. The theoretical studies point out to that asset prices can significantly diverge from fundamental values. Moreover, because arbitrage has practical limits, rational investors fail to fully offset the effects of noise trader's sentiment. Thus, the "noise trader risk", also known as the "sentiment risk", becomes a priced factor by financial markets.

The risk introduced by noise traders in the financial markets may not be diversifiable, because their views are correlated and affect many assets. Therefore, assets subject to "noise trader risk" should provide higher returns than those assets not subject to that risk, and their price should be below their fundamental value. As noted by Lee, Shleifer and Thaler (1991, p.81) " *Like fundamental risk, noise trader risk arising from the stochastic investor sentiment will be priced in equilibrium. As a result, assets subject to noise trader risk will earn a higher expected return than assets not subject to such risk. Relative to their fundamental values, these assets will be underpriced* ".

Most empirical studies have explored the predictive ability of investor sentiment on the cross-section of stock returns (Clarke and Statman, 1998; Neal and Wheatley, 1998; Brown and Cliff, 2005). Very few studies have tested the existence of noise trader's systematic risk priced by financial markets. According to Zweig, (1973), this type of tests is essential as the question of whether investor sentiment drives returns is necessary but insufficient condition for the noise trader hypothesis. Additionally, the studies undertaken often led to different conclusions[1]. Some studies show that financial markets do not price psychological factors (Elton, Gruber and Busse, 1998; Sias, Starks and Tinic, 2001; Glushkov, 2006). Others studies find that sentiment is an important factor in the return generating process of common stocks (Lee, Shleifer and Thaler, 1991; Lee, Jiang and Indro, 2002; Kumar and Lee, 2006).

The sentiment risk introduced by noise traders in the financial markets is therefore an open empirical question. The difficulty is that there is no recognized model to estimate the risk premium induces by noise traders. The main purpose of this study is to propose a new approach for studying the link between asset prices and sentiment risk. Specifically, we establish a new measure of sentiment which includes both direct, and indirect, sentiment indicators. The measure is constructed from the principal component analysis (first component) of six measures of sentiment identified in previous literature. This composite index provides a better measure of sentiment by condensing the state of mind of a very large sample of investors (consumer confidence index, investors intelligence index, closed-end funds discounts, mutual funds flows, the average monthly first-day returns on IPOs and the

[1] We refer the reader to a famous exchange of 1993 in the Journal of Finance between Chopra, Lee, Shleifer and Thaler on one side and Chen, Kan and Miller on the other.

number of IPOs). Focusing on the concept of a sentiment risk premium, we implement the trading strategy that consists of buying stocks most impacted by the sentiment factor and selling stocks less impacted by the sentiment factor in the past 36 months. We show that such a strategy can lead to a significant raw profit and we find that the traditional risk factors cannot account for the high profit. The profit of this trading strategy is then analyzed, using a new model of asset pricing. The model takes into account a risk premium linked to investor's psychology.

The article is structured as follows. In the first section, we present the data collected and the proxy used to evaluate the sentiment variable. The methodology used to evaluate the raw profit of the trading strategy, outlined above, is the subject of the second section. In the third section, we study the sources of the profit. In the fourth section, the robustness of our results is presented. Finally, the main results are summarized in the conclusion.

1. Data

The sample includes all common stocks (share codes 10 and 11) listed on the NYSE, AMEX and NASDAQ between July 1981 and December 2008. Stock returns, market capitalizations and book-to market equity (B/M) ratios are collected from the merged CRSP-Compustat database. For a security to be included in the sample, 36-month of consecutive returns must be available. To circumvent the survivor bias, the sample includes the stocks of the failed companies during the period sampled.

Investor sentiment is defined as the component of expectations about asset returns not warranted by fundamentals. A bullish (bearish) investor expects returns to be above (below) those justified by the fundamental indicators. According to Shefrin (2005, p.213) "*In finance, sentiment is synonymous with error*." For the proponents of behavioral finance these errors, when aggregated, are reflected in the asset prices. In the case of the irrational exuberance characterizing technology stocks in the years 2000 for instance, investor sentiment has been regarded as been overly optimistic.

Different kinds of proxy have been proposed in the literature to estimate the unobservable variable sentiment[2]. The sentiment indicators can be grouped into two categories: direct measures and indirect measures. Direct measures of investor sentiment are based on opinion polls that directly ask individuals how they feel about current or future economic and stock market conditions. Indirect measures represent economic and financial variables susceptible to capture the overall investors' state of mind.

This study uses a composite indicator which combines direct and indirect sentiment measures. The strength of the composite indicators is that they take into account multiple sources of information. A composite indicator, thus, reflects better the changes of investors' sentiment than any measure used individually[3]. Following the methodology outlined in Baker and Wurgler (2006), the aggregate index is constructed from a principal component analysis (first component) of six measures of sentiment identified in previous studies: University of Michigan consumer confidence index (UMI), investors intelligence index (II), the average monthly first-day returns on IPOs (RIPO), the number of IPOs in a given month (NIPO), the net new cash flows of US equity mutual funds (FLOW) and finally the closed-end funds

[2] For a detailed description of the various sentiment indicators see Brown and Cliff (2004).
[3] This hypothesis will be revisited in the fourth section.

discount (CEFD). The list of variables and the sources of data used for the construction of the composite sentiment index are presented in appendix 1.

It is very likely that some of the sentiment proxies described above are related to the current economic situation. To mitigate this possibility, all sentiment measures are orthogonalized with respect to several contemporaneous economics variables. Similarly to previous studies, we use data on growth of industrial production (IP), inflation (INF), term spread (TS), default spread (DS) and growth in durable (DC), nondurable (NDC) and services consumption (SC)[4]. The composite sentiment index (CSI) is as follows:

$$CSI_t = 0.213\,UMI_t^{\perp} + 0.197\,II_{t-1}^{\perp} + 0.201\,NIPO_t^{\perp} + 0.189\,RIPO_{t-1}^{\perp} + 0.238\,FLOW_{t-1}^{\perp} - 0.206\,CEFD_{t-1}^{\perp} \quad (1)$$

The first principal component explains about 58% of the total variation in the macro-adjusted sentiment proxies. We can see that all individual sentiment measures obtain a similar weight (around 0.2) within the overall equation for the CSI. We find that the coefficients of the sentiment indicators have all the expected signs. They are positive for the survey data, the variables related to IPOs and mutual fund flows. The negative sign on the closed-end funds discount is consistent with the interpretation of investor sentiment, the greater the discount, the more investors are bearish.

[INSERT Figure 1]

Figure 1 illustrates the evolution of the composite indicator during the period from July 1981 to December 2008. The indicator drops sharply in the year 1987, it reaches its lowest level in November 1987. This situation coincides with the market crash of October 19, 1987. Significant decreases are also seen during the collapse of the bonds market in 1994 and during the collapse of LTCM in 1998. Moreover, we note an increase of the composite index at the peak of the market in 2000. Over the period 1998-2003, the composite index reaches its highest level in March 2000[5]. This date coincides with the peak of the Dot.com. The composite index starts to decrease in April 2000; this decline accelerates after the attacks of September 11, 2001. As anticipated, the index also shows a large decrease in 2008 during the so-called sub-prime crisis. Overall, the composite sentiment index produces a faithful reproduction of the bubbles and crashes during study period.

2. The sentiment strategy

If the sentiment risk is priced by financial markets, the stocks most sensitive to the sentiment variable should produce higher returns than the stocks less sensitive to the sentiment variable. In other words, the strategy consisting of buying portfolios of stocks with greater exposure to sentiment and selling portfolios of stocks with the lower exposure to sentiment should generate a statistically significant raw profit.

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[4] To ensure that our sentiment measure is free of macroeconomic influences, we conduct our investigation using the residual term from the regression of the sentiment indicators on this set of macroeconomic variables.

[5] The fluctuations of the composite index during the speculative bubble of 2000 (Internet bubble) are much less significant than the fluctuations during the crash of October 1987. One possible explanation is that the fall in prices in 1987 has been more drastic (about 23% in one day) than during the Internet bubble (the decrease took place over several months).

2.1. The development of the strategy

We perform a linear model[6] to estimate the impact of investor sentiment on stock returns. To obtain a time series of sentiment betas, we use the following approach: starting from August 1984[7], we regress the monthly returns of each stock on the variations of composite sentiment indicator over the window [t-1, t-36]. The absolute value of the estimated coefficient[8] is our measure of the sensitivity of stock to sentiment factor in month t. We then proceed by rolling forward by one month all the way to December 2008. The estimated model is as follows:

$$R_{i,\tau} = \alpha_i + \beta_{i,t} \Delta\, CSI_\tau + \varepsilon_i \quad (2) \qquad \tau = \text{t - 36,...t - 1}$$

On the basis of sentiment betas estimated in model (2), we sort all the stocks included in our sample into ten portfolios. Specifically, each month, we rank all the stocks into ten portfolios using the ascending absolute value of the sentiment betas. Portfolio 1 contains the stocks least impacted by investor sentiment and portfolio 10 the stocks the most impacted. As the betas are estimated on a rolling basis of a one month, we investigate the sentiment portfolio returns on a holding horizon of a month[9]. We compute the monthly portfolio return as a value-weighted average of all stocks in the portfolio.

[INSERT TABLE 1]

Panel 1 presents summary statistics for the sentiment betas. The average beta of portfolios comprising stocks the most sensitive to sentiment factor is about 1.110. The average beta of portfolios comprising stocks the least sensitive to sentiment factor is about 0.017. Note that some stocks do not appear to be impacted by the sentiment factor, their average beta is zero. By contrast, others stocks show a strong dependence to the sentiment factor, their sentiment betas reach 12.14.

[INSERT TABLE 2]

Panel table 2 presents summary statistics for the constructed portfolio returns. Results in the table indicate that the stocks most influenced by the sentiment factor earn higher returns than the stocks less impacted by the sentiment factor. The portfolio returns (except portfolio 5) increase when they include the stocks most sensitive to sentiment factor. Portfolio 1 earns an average return of 0.95% and portfolio 10 provides an average return of 1.96%. Results also show that the portfolios 1 and 10 are relatively stable; the average turnover does not exceed 7%.

2.2. The raw profit of the sentiment strategy

[6] We use a model similar to Wang (2004) and Glushkov (2006).
[7] As the sentiment beta is calculated over a period of 36 months, the first estimation starts in August 1984.
[8] In our sample, the vast majority of the stocks have a positive sentiment beta (approximately 92% of the stocks). The negative sentiment betas indicate that some investors are adopting "negative feedback" strategies; i.e. buying stocks when their prices fall and selling when prices rise. Shefrin and Statman (1994) consider that certain behavioral biases are pushing investors to adopt "positive feedback" strategies while other cognitive biases lead them to adopt "negative feedback” strategies.
[9] This strategy can be generalized to periods of k months (3, 6, 9 and 12 months).

To test whether the differences between our portfolio returns are statistically significant, we perform *t* tests for the mean portfolio returns. As the strategy is to buy the stocks most influenced by the sentiment factor and sell the stocks least influenced by the sentiment factor, we use portfolio 1 as a benchmark for the significance tests.

[INSERT TABLE 3]

Table 3 presents the raw profits, *t*-stats and *p*-values for the difference in mean returns tests. Results show that the difference in mean returns between portfolio 10 and portfolio 1 is about equal to 1% per month, for annual raw profit of 12%[10]. This difference is significantly different from zero at 5%. The *t*-stat and *p*-value of the strategy consisting of buying portfolio 10 and selling portfolio 1 are respectively 1.803 and 0.035. Results also show that the difference in mean returns between the portfolio 9 and 1 is significant at 10%. However, for the other portfolios, the differences in mean returns are not significant at conventional levels.

Overall, the stocks that have higher exposure to sentiment factor earn greater returns than stocks with lower exposure to sentiment. Notice however, that the portfolios that generate the highest returns are also those having the highest traditional risk (see Tables 1 and 2). These portfolios are characterized by higher traditional beta coefficients and small market capitalizations. This finding may suggest that high returns observed for these portfolios are just a compensation for traditional risk bearing.

3. The sources of profit

In the previous section, we found that the sentiment strategy generates a raw profit statistically significant. Portfolios of stocks more sensitive to the sentiment factor earn significantly higher returns than portfolios less sensitive to that factor. This section explores the sources of the sentiment strategy's profit.

3.1. The impact of the traditional risk

To examine whether the traditional risk explains the high returns of portfolios most sensitive to sentiment, we use the four-factor model of Carhart (1997). The model allows to control for momentum, the only anomaly unexplained by the three-factor model of Fama and French (1993). In addition to momentum, the model allows for the control of the market risk, the risk associated with firm size and the B/M ratio. The model is shown in equation (3):

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{m,t} - R_{f,t}) + s_p SMB_t + h_p HML_t + m_p UMD_t + \varepsilon_p \qquad (3)$$

R_p is the portfolio rate of return, R_f is the risk-free rate of return, R_m-R_f is the market return in excess of the risk-free rate (one-month bill rate), SMB is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of

[10] From an operational perspective, it is important to study the profit of the sentiment strategy with transaction costs. Indeed, a one month investment strategy may lead to very high transaction costs. To account for this limitation, we recalculate the profit of the sentiment strategy using a longer investment horizon of six months. We find that this strategy leads to a significant annual profit of about 11.9%. If portfolios 1 and 10 are rebalanced every six months, they will lead to four trades per year, implying that the transaction costs must be at least 2.975% per trade to absorb the entire profit. This number appears quite high. Jegadeesh and Titman, (1993) found that transaction costs do not exceed 0.5% per trade for institutional investors. In conclusion, the strategy developed in this study remains profitable even with transaction costs.

large stocks, HML is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks, UMD is the difference between the value-weighted return of a portfolio of stocks with high returns during months t-12 to t+2 and the value-weighted return of a portfolio of stocks with low returns during months t-12 to t+2, and ε_p is the residual return on the portfolio. The intercept, $\alpha_{p,}$ measures the average monthly abnormal return. The monthly time series of the factors are obtained from Ken French's data library.

[INSERT TABLE 4]

Table 4 presents the regression results. The adjusted R^2 are high in all cases, although somewhat lower for the tow portfolios most exposed to sentiment factor. These portfolios also exhibit the largest alpha coefficients. The portfolios most (least) exposed to sentiment exhibit a positive and significant excess return of 0.7% (-0.2%) at a threshold of 5%. The F-statistic of Gibbons, Ross and Shanken (1989) is 2.763 and the associated critical probability is 0.0028. The null hypothesis that the ten constants obtained from the estimation of model (3) are equal to zero can be rejected at the usual threshold of 1%. Therefore, we conclude that exposure to traditional risk does not explain the returns of the portfolios most sensitive to the sentiment factor.

Results also show that the portfolios most sensitive to sentiment have higher systematic risk than the portfolios less impacted by sentiment. Sensitivity to the market risk is 0.968 for the portfolio of stocks with lower sensitivity to the sentiment factor, while it is 1.154 for the portfolio with higher sensitivity to sentiment factor. Similarly, we find that the returns of portfolios least exposed to the sentiment factor covary negatively with SMB while the returns of portfolios most exposed to sentiment covary positively with SMB. This result indicates that the portfolios which are most sensitive to sentiment contain more small capitalizations stocks than the other portfolios. This result is consistent with that of most previous studies (Lee, Shleifer and Thaler, 1991, Neal and Wheatley, 1998)[11]. We also note that the returns of portfolios least exposed to the factor sentiment covary positively with the factor HML while the returns of portfolios most exposed to sentiment covary negatively with the factor HML. This indicates that the portfolios most (least) impacted by sentiment include more low (high) B/M stocks.

Findings also indicate that the regression coefficients for the factor momentum are negative for almost all the portfolios although they are significant only for the portfolios less vulnerable to the sentiment factor (portfolios 1 and 2). This result indicates that the portfolios least exposed to sentiment factor include proportionally more stocks with low past performances. A possible explanation is that individual investors are attracted by stocks that have experienced good recent performance. This finding validates previous studies showing that noise traders adopt strategies of "positive feedback", i.e. they buy after prices increase and sell after prices decline (Solt and Statman, 1988; Clarke and Statman, 1998; Kurov, 2008).

Overall, we conclude that neither the three risk factors of Fama and French (1993) nor the momentum factor can explain the abnormal returns of portfolios most sensitive to the

[11] Previous studies found that investor sentiment mainly impact the small capitalizations. The studies justify this result by the fact that individual investors concentrate their holding in small capitalizations stocks, thus creating such a link.

sentiment factor[12]. Thus, a risk premium for the stocks most exposed to sentiment appears justified.

3.2. Impact of the sentiment risk

Through this sub-section, we test the central hypothesis of investor sentiment theory; investor sentiment risk is a priced risk factor and requires a risk premium for any stocks that have an exposure to it. We propose a new asset pricing model to take into account a risk premium linked to investor's psychology. To construct the portfolios mimicking risk factors related to size, B/M ratio and exposure to sentiment factor, we use the Fama-French (1993) portfolio approach. We form portfolios as the intersections of the three independent sorts: size, B/M ratio and exposure to sentiment factor.

3.2.1. Construction of sentiment risk premium

In June of each year *t*, all stocks are ranked by size and are grouped into three portfolios corresponding to the first three deciles (Small, (D1-D3)), the four median deciles (Medium, (D4-D7)) and the last three deciles (Big, (D8-D10)). Independent of the ranking described above, in December of each year t-1, all stocks are also sorted according to their B/M ratio, and again grouped into three portfolios respectively corresponding to: the first three deciles (Low, (D1-D3)), the four median deciles (Medium, (D4-D7)) and the last three deciles (High, (D8-D10)).

Similarly, and independent of the previous rankings, stocks are arranged in June of each year t, according to their sensitivity to the sentiment factor using the absolute value of their sentiment betas. The stocks are then split into three portfolios. The first portfolio includes the stocks not exposed to sentiment factor (N, (D1-D3)). The second includes the stocks moderately exposed to sentiment factor (I, (D4-D7)) and the third portfolio includes the stocks most sensitive to the sentiment factor (E, (D8-D10)).

The intersection of independent sorts of stocks into size, B/M ratio and sensibility to sentiment factor yield to 27 portfolios[13] that are S/L/N, S/L/I, S/L/E, S/M/N, S/M/I, S/M/E, S/H/N, S/H/I, S/H/E, M/L/N, M/L/I, M/L/E, M/M/N, M/M/I, M/M/E, M/H/N, M/H/I, M/H/E, B/L/N, B/L/I, B/L/E, B/M/N, B/M/I, B/M/E, B/H/N, B/H/I and B/H/E. Monthly value-weighted returns for the 27 portfolios are calculated from July of year t to June t+1, and the portfolios are rebalanced in June of t+1. We construct a monthly portfolio return time series from July 1985 to June 2008.

The exposure to sentiment factor may be correlated with other variables that could also affect the relationship between risk and return. For example, we reported earlier that small firms are more sensitive to sentiment than big firms. This implies that a portfolio constructed using the sentiment factor may include a large number of small firms and portfolio returns could be affected by the size effect. To avoid confounding the size effect with the sentiment effect, the factors must be made perfectly orthogonal. This is why we build each factor neutralizing other factors using the procedure described below.

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[12] Model (2) was also estimated including the liquidity factor of Pastor and Stambaugh (2003). This model does not explain the abnormal returns of portfolios 9 and 10. The results are not reported due to space limitation.

[13] The portfolios are indexed according to the following order: size/ B/M ratio/ exposure to sentiment. The descriptive statistics for the portfolios are in appendix 2.

The SMB factor corresponding to the difference between the monthly returns of the small capitalization portfolios and the big capitalization portfolios is given by the following equation:

$$SMB = \frac{1}{9}[R_{S/L/N} + R_{S/L/I} + ... + R_{S/H/E}] - \frac{1}{9}[R_{B/L/N} + R_{B/L/I} + ... + R_{B/H/E}]$$

Similarly, the HML factor which corresponds to the difference between the monthly returns of the portfolios with high B/M ratio and the portfolios with low B/M ratio is calculated as follows:

$$HML = \frac{1}{9}[R_{S/H/N} + R_{S/H/I} + ... + R_{B/H/E}] - \frac{1}{9}[R_{S/L/N} + R_{S/L/I} + ... + R_{B/L/E}]$$

The EMN factor dedicated to replicate the sentiment risk premium is the difference between the monthly returns of the portfolios with higher exposure to sentiment factor and the portfolios with lower exposure to the sentiment factor:

$$EMN = \frac{1}{9}[R_{S/L/E} + R_{S/M/E} + ... + R_{B/H/E}] - \frac{1}{9}[R_{S/L/N} + R_{S/M/N} + ... + R_{B/H/N}]$$

Finally, our proxy for the market factor in stock returns is the excess market return, (R_m-R_f). R_m is the return on the value-weighted portfolios of all stocks in our sample.

[INSERT TABLE 5]

The results depicted in Table 5 show that the risk premium linked to sentiment is positive: it is 0.46% per month over the period from July 1985 to June 2008. This factor is significant at 5%. The market portfolio records a monthly average return in excess of the risk free rate of 0.61%. The monthly premium associated with the risk factor SMB is 1.08%. It is significant at 1%. As to the factor UMD, it shows a significant average return of 0.89% at the 1%. In contradiction with previously reported results, the factor HML exhibits a negative average return of -0.94%.

[INSERT TABLE 6]

The correlation matrix among the factors presented in Table 6 shows that the risk premium related to the sentiment factor is correlated with the premiums for HML and UMD. The correlations between the factors EMN and SMB and the factors EMN and R_m-R_f are moderate, averaging 0.372 and 0.379 respectively. These low correlations appear to confirm the hypothesis that the information contained in the factor sentiment is not connected to other risk factors. The correlation between the other factors is also quite low with the exception of that recorded between size and B/M ratio. The correlation reaches the value of -0.498[14].

3.2.2. Towards a model incorporating a sentiment risk premium

[14] This correlation is very similar to that calculated using the database of Kenneth French. On the same period, it reaches -0.423.

To test the hypothesis of a sentiment risk premium, we add the sentiment risk premium in the multi-factor model presented in the previous section. Our main interest concerns the sign and the significance level of abnormal return. If the risk sentiment is valued by the financial markets, abnormal returns should disappear or at least should be reduced. Abnormal returns are estimated with the constant from the following multi-factor model:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{m,t} - R_{f,t}) + s_p SMB_t + h_p HML_t + m_p UMD_t + e_p EMN_t + \varepsilon_p \quad (4)$$

[INSERT TABLE 7]

Table 7 presents the results of the estimation of the multi-factor model (4). The EMN variable is significant for the three portfolios the most sensitive to sentiment. The addition of the EMN variable in the model increases the explanatory power of these portfolio returns between 2 to 4%. Overall, the portfolios most exposed to sentiment are those have been the most impacted by the EMN variable. The returns of stocks the least exposed to sentiment (portfolio 1) covary negatively with EMN variable. In contrast, the returns of stocks most sensitive to sentiment covary positively with the sentiment risk premium.

It is important to observe that the addition of a sentiment risk premium contributes to offset the abnormal returns of portfolios 9 and 10. The alpha coefficients for these portfolios are not significant at 5% level. The F-statistic of Gibbons, Ross and Shanken (1989) confirms this result. The null hypothesis, that the ten constants obtained after estimating the model (4) are equal to zero at the 5% level, is not rejected. The addition of the EMN factor helps to better explain the returns of portfolios 9 and 10.

These results are consistent with the claims of the investor sentiment theory. The stocks most sensitive to sentiment earn greater returns than stocks less sensitive to sentiment as a compensation for bearing sentiment risk.

4. Robustness tests

In this section, we conduct an analysis of the robustness of our results. First, we evaluate the relevance of the performance measure of sentiment portfolios. Second, we focus on studying the behavior of the stocks with a negative sentiment beta. Finally, we investigate the impact of using other sentiment indicators on profit of the sentiment strategy.

4.1. Relevance of the performance measure of sentiment portfolios

- **Relevance of the asset pricing model**

Until now, the Carhart (1997) four-factor model has been used to evaluate the portfolio returns. To ensure that the observed abnormal returns on the portfolios most impacted by sentiment factor are not the result of a model misspecification, we conduct a robustness test using another asset pricing model. In a recent study, Chen, Novy-Marx and Zhang (2011) propose an asset pricing model based on the q-theory of investment. This model explains anomalies such as momentum, failure probability, O-score, earnings surprises, accruals, net stock issues and stock valuation ratios. According to this model, the return on a portfolio in excess of the risk free rate would be based on its sensitivity to three risk factors:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p \,(R_{m,t} - R_{f,t}) + i_p R_{INV,t} + o_p R_{ROE,t} + \varepsilon_p \quad (5)$$

With: R_m-R_f is the market return in excess of the risk-free rate. R_{INV} is the difference between the return on a portfolio of low-investment stocks and the return on a portfolio of high-investment stocks. R_{ROE} is the difference between the return on a portfolio of stocks with high returns on equity and the return on a portfolio of stocks with low returns on equity.

The results of the time-series regressions for the model (5)[15] show that the returns of portfolios least sensitive to sentiment are well explained by the model. In contrast the portfolios most sensitive to sentiment continue to generate significant positive abnormal returns. We obtain significant abnormal returns of about 0.009 (t = 3.427) for portfolio 9 and 0.010 (t = 5.046) for portfolio 10. This finding suggests again that the traditional risk identified in the literature does not explain high returns of stocks with higher exposure to the sentiment factor.

- **Reliability of the asset pricing model on the returns of industry portfolios**

Lewellen, Nagel and Shanken (2010) consider the results of empirical tests from models of asset pricing ambiguous. Indeed, since asset pricing models produce an artificially high explanatory power of stock returns (a high R-squared), their soundness is questionable. The authors suspect a high correlation between portfolio returns ranked by size and B/M ratio, and risk factors constructed according to the same criteria (SMB and HML). We believe that our empirical tests are not subject to this criticism because our main question relates to the sign and significance level of the abnormal return (regression constant). Nevertheless, the authors recommend to reconsider the reliability of the valuation models by using the portfolio returns formed according to characteristics other than those used for the construction of risk factors such as the industry portfolios.

[INSERT TABLE 8]

The results of the estimation of various asset pricing models on the returns of the ten industry portfolios are summarized in table 8. Results show that the CAPM explain the return of ten industry portfolios. Indeed, we do not reject the null hypothesis that the ten abnormal returns are jointly and significantly equal to zero at a 5% level. The F-statistic of Gibbons, Ross and Shanken amount to 1.567 (*p*-value = 0.116). In contrast, all multi-factor models are rejected by the F-statistic at 5%. Note also that the abnormal returns of multi-factor model are higher than those obtained in the CAPM. The average magnitude of the abnormal return is: 0.11% in the CAPM, 0.21% in the Carhart four-factor model, 0.12% in Chen, Novy-Marx and Zhang's model and 0.14% in our model.

Also, note that only one industry portfolio shows a significant positive abnormal return in the CAPM against two in Chen, Novy-Marx and Zhang's model and in our model. The Carhart model generates three cases of significant positive abnormal returns in the ten analyzed. Overall, we consider that our multifactor model has better performance than the Carhart model and a performance close to that displayed by the Chen, Novy-Marx and Zhang model.

[15] The data are collected from Lu Zhang's website. The results are not reported due to space limitation

4.2. The behavior of stocks with a negative sentiment beta

Regressions conducted on our sample show that each month approximately 92% of the stocks have a positive beta sentiment. While the largest proportion of the stocks is evidenced by a positive sentiment beta, it is important to analyze the behavior of stocks with a negative sentiment beta. For this, we again use model (2) for the stocks having a negative sentiment beta.

[INSERT Figure 2]

Figure 2 shows the portfolio returns based on their sensitivity to the sentiment factor. In general, we observe a positive relationship between portfolio returns and their exposure to the sentiment factor. On average, the portfolios most sensitive to sentiment have higher returns than the portfolios less sensitive to sentiment. The monthly returns of portfolio 10 are twice as large as those of portfolio 1. We conclude that stocks with negative sentiment betas have the same behavior as the positive beta stocks.

4.3. Relevance of the synthetic sentiment indicator

To measure investor sentiment, we used a composite index that summarizes the information contained in six individual measures previously identified in the literature (direct and indirect measures). This index has been preferred to a direct or indirect measure. This section investigates the relevance of this choice.

One way is to compare the raw profit of our sentiment strategy with that obtained on the basis of direct or indirect measures. This analysis allows us to check whether our synthetic sentiment index is a better indicator than the individual measures traditionally presented in the literature. In addition, we study the raw profit of the strategy using two synthetic sentiment indicators frequently cited in the literature: (i) the Brown and Cliff (2004) composite sentiment index and (ii) the Baker and Wurgler (2006) composite sentiment index[16]. To this end, we re-estimate model (2) using a sentiment individual indicator or a sentiment synthetic indicator.

[INSERT TABLE 9]

Table 9 presents the raw profits of strategies based on each of six individual sentiment indicators used for the construction of the composite sentiment index. We find that the profits of strategies based on individual sentiment indicators are very low and not significant at 5%. Only the strategy based on the closed-end fund discount generates a statistically significant profit. This strategy records a profit of around 0.4% per month, a profit well below that of strategy based on our sentiment synthetic indicator. The last two columns of Table 9 depict the results of the two alternative synthetic sentiment indicators. When these synthetic measures are used, the profits are higher than those obtained on the basis of individual sentiment measures. Both strategies generate a raw profit statistically significant. Combining several sentiment indicators provide a better of investor's sentiment than each individual indicator. The superiority of our composite measure seems to come from the simultaneous effect of the combination of both the direct and the indirect indicators.

[16] Brown and Cliff's data are available for the period July 1998 to December 1998. As far as Baker and Wurgler's composite sentiment index is concerned, data are available for the period July 1981 to December 2007.

Conclusion

Previously published finance literature has focused primarily on the ability of sentiment indicators to predict the cross-section of stock returns. Unlike most previous works, we proposed a new approach linking the sentiment risk factor to asset prices. This approach provides a better understanding of investor's sentiment role in the return generating process for common stocks.

Using a composite sentiment index which includes several direct and indirect indicators identified in the previous literature, we constructed portfolios based on the exposure of stocks to sentiment factor. We found that the portfolio returns increases when they include the stocks most sensitive to the sentiment factor. The strategy consisting of buying portfolios of stocks most sensitive to sentiment and selling portfolios of stocks less sensitive to sentiment generates a raw profit statistically significant. Exploring the sources of profit, we found that conventional risk does not explain the high returns of portfolios most affected by the sentiment factor. However, the addition of a new risk factor- dedicated to replicate the sentiment risk- contributes to better explain the returns of these portfolios.

Our results, validated by several robustness tests, provide convincing support to the thesis of a sentiment risk premium priced by stock market. We conclude that investor sentiment should be considered as a factor influencing asset prices. Fund managers should be advised to take investor sentiment into account in the asset valuation models.

Appendix 1: Description of the variables used for the construction of the composite sentiment index

Code	Variables	Measures	Sources
Investor sentiment indicators			
UMI	Consumer sentiment index	Five questions making up the consumer sentiment index	University of Michigan Survey Research Center
II	Investors Intelligence index	Bull minus Bear spread	Investors Intelligence
NIPO	Number of IPOs	Number of IPOs in a given month	http://bear.cba.ufl.edu/ritter
RIPO	First-day returns on IPOs	Average monthly first-day returns on IPOs	http://bear.cba.ufl.edu/ritter
FLOW	Net new cash flows of US equity mutual funds	(Inflows-outflows)/Total asset	Investment Company Institute http://www.ici.org/index.html
CEFD	Closed-end fund discount	Equal-weighted average difference between the market price and the NAV of closed-end stock fund shares	Wall Street Journal
CSI	Composite sentiment index	First component from the principal component analysis of six measures of sentiment	
Macroeconomics variables			
IP	Industrial production	Change in the natural logarithm of industrial production index	Federal reserve system
INF	Inflation	Change in the natural logarithm of the Consumer Price Index	Federal reserve system
TS	Term spread	Difference between the yields on 10-year U.S. government bonds and 3-month Treasury bills	Federal reserve system
DS	Default spread	Moody's Baa-rated corporate bond yield less the Aaa-rated corporate bond yield	Datastream
DC, NDC and SC	Growth of durable goods, non-durable goods and services consumption expenditures	Change in the natural logarithm of durable goods, non-durables and services consumption expenditures	Federal reserve system

Appendix 2: Summary statistics for monthly returns of portfolios ranked on size, B/M ratio and exposure to sentiment factor, July 1985 to June 2008

We form 27 portfolios as the intersections of the three independent sorts: size, B/M ratio and exposure to sentiment factor. Monthly value-weighted returns for the 27 portfolios are calculated from July of year t to June t+1, and the portfolios are rebalanced in June of t+1. This table presents summary statistics of the 27 portfolios. Panel A presents the average monthly returns. Panel B reports the standard deviation of returns.

			B/M ratio			
		Low	**Medium**	**High**		
		Panel A : Mean				
Market capitalization	**Small**	0.033	0.028	0.015	**Low**	**Exposure to sentiment factor**
		0.030	0.029	0.017	**Moderate**	
		0.032	0.032	0.019	**High**	
	Medium	0.037	0.015	0.001	**Low**	
		0.010	0.018	0.050	**Moderate**	
		0.039	0.021	0.006	**High**	
	Big	0.010	0.010	0.009	**Low**	
		0.020	0.018	0.019	**Moderate**	
		0.026	0.009	0.016	**High**	
			B/M ratio			
		Low	**Medium**	**High**		
		Panel B : Standard deviation				
Market capitalization	**Small**	0.149	0.106	0.058	**Low**	**Exposure to sentiment factor**
		0.123	0.104	0.065	**Moderate**	
		0.109	0.237	0.068	**High**	
	Medium	0.096	0.055	0.048	**Low**	
		0.093	0.067	0.052	**Moderate**	
		0.088	0.051	0.049	**High**	
	Big	0.081	0.039	0.079	**Low**	
		0.062	0.051	0.063	**Moderate**	
		0.055	0.052	0.058	**High**	

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Table 1: Sentiment betas and firm characteristics

This table presents summary statistics of sentiment betas (mean, minimum and maximum) and some characteristics of the sentiment portfolios. The sentiment portfolios are formed each month by sorting stocks based on their exposure to the sentiment factor. The last two columns correspond to the time series average of the cross-section mean of market capitalization and the time series average of the cross-section mean of book-to-market equity ratio. The last line contains the difference between the characteristics of portfolio 10 and 1 and the corresponding t-stat. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

Portfolios	Mean	Min	Max	Market capitalization ($mil)	Book-to-market ratio
1. Low exposition	0.017	0.000	0.18	2076.53	0.725
2	0.056	0.000	0.55	2052.12	0.700
3	0.097	0.000	0.93	2060.48	0.704
4	0.142	0.01	1.36	2021.67	0.684
5	0.193	0.01	1.88	2034.12	0.634
6	0.254	0.01	2.58	1923.37	0.675
7	0.322	0.02	3.48	1900.88	0.655
8	0.435	0.02	4.66	1729.65	0.671
9	0.601	0.04	6.51	1342.46	0.688
10. High exposition	1.110	0.07	12.14	487.89	0.698
10-1 (t-stat)				-1588.64 (-6.623)***	-0.0277 (-0.857)

Table 2: Summary statistics of the sentiment portfolio returns

Each month from August 1984 to December 2008, all stocks are ranked in ascending order on the basis of their exposure to sentiment factor and assigned to one of ten portfolios. Portfolio 1 contains the stocks least impacted by investor sentiment and portfolio 10 the stocks the most impacted. The average monthly return of each portfolio is presented in this table. The column titled Market beta represents the time series average of the cross-section of the mean of traditional beta coefficient of each portfolio. The column, turnover rate, is the time series average of the cross-section mean of the number of stocks removed from a specific portfolio divided by the initial number of stocks in the portfolio. August 1984 is used as reference to identify the initial number of stocks in each portfolio.

Portfolios	Mean	Market beta	Min	Max	Turnover rate
1. Low exposition	0.0095	0.903	-0.186	0.140	5.85 %
2	0.0102	0.902	-0.232	0.118	7.65 %
3	0.0103	0.934	-0.256	0.133	7.42 %
4	0.0114	0.897	-0.245	0.120	14.45 %
5	0.0104	0.943	-0.218	0.128	23.34 %
6	0.0116	0.949	-0.211	0.126	14.65 %
7	0.0152	1.002	-0.238	0.228	14.67 %
8	0.0159	1.112	-0.279	0.154	8.56 %
9	0.0189	1.379	-0.331	0.249	7.45 %
10. High exposition	0.0196	1.366	-0.246	0.185	6.45 %

Table 3: The raw profits for sentiment strategies

Each month from August 1984 to December 2008, all stocks are ranked in ascending order on the basis of their exposure to sentiment factor and assigned to one of ten portfolios. Portfolio 1 contains the stocks least impacted by investor sentiment and portfolio 10 the stocks the most impacted. This table presents the raw profits for sentiment strategies which consist of buying a portfolio exposed to the sentiment factor and selling the portfolio the least exposed to this factor. The portfolio 1 is used as a benchmark for the significance tests. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

Strategies	Mean	t-stat	P-value
Portfolio 10 - Portfolio1	0.010	**1.803****	**0.035**
Portfolio 9- Portfolio1	0.009	**1.606***	**0.054**
Portfolio 8- Portfolio1	0.006	0.892	0.186
Portfolio 7 - Portfolio1	0.005	0.823	0.205
Portfolio 6 - Portfolio1	0.002	0.817	0.207
Portfolio 5 - Portfolio1	0.000	0.754	0.225
Portfolio 4 - Portfolio1	0.001	0.664	0.253
Portfolio 3 - Portfolio1	0.000	0.400	0.344
Portfolio 2 - Portfolio 1	0.000	0.264	0.395

Table 4: Regression of monthly excess returns on portfolio risk factors of Carhart (1997)

This table reports the factor model estimates for the ten sentiment portfolios. The multi-factor model is as follows:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{m,t} - R_{f,t}) + s_p SMB_t + h_p HML_t + m_p UMD_t + \varepsilon_p$$

R_p is the portfolio rate of return, R_f is the risk-free rate of return, R_m-R_f is the market return in excess of the risk-free rate (one-month bill rate), SMB is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks, HML is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks, UMD is the difference between the value-weighted return of a portfolio of stocks with high returns during months t-12 to t+2 and the value-weighted return of a portfolio of stocks with low returns during months t-12 to t+2, and ε_p is the residual return on the portfolio. The Newey-West adjusted *t*-values of the coefficient estimates are reported in the parentheses. The F_{GRS} is the F-statistic of Gibbons, Ross and Shanken (1989) testing the null hypothesis that the intercepts are jointly zero.

Portfolios	Alpha	R_m-R_f	SMB	HML	UMD	Adjusted R^2
1. Low exposition	-0.002 (-0.987)	0.968 (29.425)	-0.097 (-2.412)	0.022 (0.542)	-0.091 (-3.329)	0.846
2	-0.002 (-0.826)	0.911 (31.542)	-0.089 (-2.615)	0.292 (6.627)	-0.037 (-1.767)	0.852
3	-0.0001 (-0.995)	0.993 (31.763)	-0.062 (-1.409)	0.129 (2.652)	-0.067 (-1.428)	0.842
4	-0.0006 (-0.289)	0.983 (28.129)	-0.077 (-1.973)	0.167 (3.181)	0.015 (0.409)	0.812
5	-0.0004 (-0.365)	0.969 (34.983)	-0.123 (-3.873)	0.298 (4.442)	-0.094 (-1.434)	0.898
6	0.0001 (0.876)	0.912 (32.124)	-0.159 (-3.987)	0.065 (0.934)	-0.017 (-0.946)	0.866
7	0.002 (1.407)	1.099 (33.176)	-0.186 (-5.098)	-0.051 (-0.105)	-0.123 (-3.983)	0.868
8	0.003 (1.498)	1.076 (30.567)	0.013 (0.248)	-0.185 (-3.743)	0.005 (1.638)	0.852
9	**0.006** **(2.412)**	1.221 (20.454)	0.321 (5.192)	-0.287 (-3.098)	-0.019 (-0.389)	0.765
10. High exposition	**0.007** **(3.156)**	1.154 (21.121)	0.187 (1.965)	-0.322 (-4.165)	0.010 (0.323)	0.782
		F_{GRS} =2.763		**P-value $_{GRS}$ = 0.0028**		

Table 5: Summary statistics for monthly returns of portfolio risk factors, July 1985 to June 2008

This table reports the basic statistics of portfolio risk factors over the period July 1985 to June 2008. R_m-R_f is the market return in excess of the risk-free rate (one-month bill rate), SMB is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks, HML is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks, UMD is the difference between the value-weighted return of a portfolio of stocks with high returns during months t-12 to t+2 and the value-weighted return of a portfolio of stocks with low returns during months t-12 to t+2. EMN is the difference between the monthly returns of the portfolios with higher exposure to sentiment factor and the portfolios with lower exposure to sentiment factor. ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	Mean	**Std**	**t stat**	**Minimum**	**Maximum**
R_m-R_f	0.0061	0.0412	2.459**	-0.235	0.129
SMB	0.0108	0.0516	3.076***	-0.125	0.387
HML	-0.0094	0.0462	-3.380**	-0.283	0.133
UMD	0.0089	0.0468	3.159***	-0.2500	0.183
EMN	0.0046	0.0332	2.301**	-0.0899	0.412

Table 6: The correlations of portfolio risk factors, July 1985 to June 2008

This table presents the correlations among monthly returns of portfolio risk factors. R_m-R_f is the market return in excess of the risk-free rate (one-month bill rate), SMB is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks, HML is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks, UMD is the difference between the value-weighted return of a portfolio of stocks with high returns during months t-12 to t+2 and the value-weighted return of a portfolio of stocks with low returns during months t-12 to t+2. EMN is the difference between the monthly returns of the portfolios with higher exposure to sentiment factor and the portfolios with lower exposure to sentiment factor.

	R_m-R_f	**SMB**	**HML**	**UMD**	**EMN**
R_m-R_f	1				
SMB	0.024	1			
HML	-0.345	-0.498	1		
UMD	-0.072	0.109	-0.151	1	
EMN	0.379	0.372	-0.276	0.019	1

Table 7: Regression of monthly excess returns on portfolio risk factors of Carhart (1997) including a risk sentiment factor

This table reports the factor model estimates for the ten sentiment portfolios. The multi-factor model is as follows:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{m,t} - R_{f,t}) + s_p SMB_t + h_p HML_t + m_p UMD_t + e_p EMN_t + \varepsilon_p$$

R_p is the portfolio rate of return, R_f is the risk-free rate of return, (R_m-R_f) is the market return in excess of the risk-free rate (one-month bill rate), SMB is the difference between the value-weighted return of a portfolio of small stocks and the value-weighted return of a portfolio of large stocks, HML is the difference between the value-weighted return of a portfolio of high B/M stocks and the value-weighted return of a portfolio of low B/M stocks, UMD is the difference between the value-weighted return of a portfolio of stocks with high returns during months t-12 to t+2 and the value-weighted return of a portfolio of stocks with low returns during months t-12 to t+2. EMN is the difference between the monthly returns of the portfolios with higher exposure to sentiment factor and the portfolios with lower exposure to sentiment factor and ε_p is the residual return on the portfolio. Δ Adjusted R^2 shows the improvement of the adjusted R^2 after the addition of the sentiment factor. The Newey-West adjusted *t*-values of the coefficient estimates are reported in the parentheses. The F_{GRS} is the F-statistic of Gibbons, Ross and Shanken (1989) testing the null hypothesis that the intercepts are jointly zero.

Portfolios	**Alpha**	**R_m-R_f**	**SMB**	**HML**	**UMD**	**EMN**	**Adjusted R^2**	**Δ Adjusted R^2**
1. Low exposition	0.003 (1.109)	0.899 (28.768)	-0.025 (-0.815)	0.099 (2.165)	-0.047 (-1.879)	-0.006 (-0.345)	0.855	0%
2	0.002 (1.167)	0.856 (27.983)	-0.023 (-0.733)	0.129 (3.136)	-0.045 (-2.267)	0.004 (0.298)	0.824	0%
3	-0.002 (-1.298)	0.918 (30.982)	-0.076 (-1.287)	-0.045 (-1.976)	-0.027 (-1.374)	0.031 (1.588)	0.856	0%
4	0.003 (1.245)	1.032 (31.230)	0.124 (0.989)	0.103 (2.809)	-0.134 (-5.101)	-0.043 (-0.997)	0.864	0.1%
5	0.001 (0.897)	1.111 (31.098)	0.126 (2.029)	-0.019 (-0.222)	0.034 (0.293)	0.047 (1.699)	0.726	0.2%
6	0.002 (0.876)	1.098 (18.209)	0.163 (1.983)	-0.187 (-2.109)	-0.035 (-0.548)	0.031 (0.983)	0.779	0%
7	-0.001 (-0.657)	1.189 (19.987)	0.049 (1.289)	-0.109 (-1.837)	-0.056 (-0.653)	0.019 (0.726)	0.687	0.2%
8	-0.002 (-1.423)	0.871 (25.078)	-0.055 (-1.892)	-0.004 (-0.087)	-0.165 (-3.987)	***0.055*** ***(1.856)***	0.808	1.98%
9	0.003 (1.098)	0.966 (26.526)	-0.09 (-1.923)	0.098 (1.321)	-0.027 (-0.562)	***0.086*** ***(2.113)***	0.786	2.28%
10. High exposition	0.002 (0.982)	0.927 (29.728)	-0.033 (-1.546)	0.076 (2.565)	-0.077 (-2.879)	***0.097*** ***(2.657)***	0.837	3.98%
F_{GRS} =1.487 P-value $_{GRS}$ = 0.143								

Table 8: Regressions of monthly excess returns on ten industry portfolios, July 1985 to June 2008

This table reports the factor model estimates for ten industry portfolios. The asset pricing models used are the following:

(i) The CAPM:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{m,t} - R_{f,t}) + \varepsilon_p$$

(ii) The Carhart model :

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + m_p UMD_t + \varepsilon_p$$

(iii) The Chen, Novy-Marx and Zhang model:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p\ (R_{m,t} - R_{f,t}) + i_p R_{INV,t} + o_p R_{ROE,t} + \varepsilon_p$$

(iv) The Carhart model including the risk sentiment factor :

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + m_p UMD_t + e_p EMN_t + \varepsilon_p$$

R_p is the industry rate of return (NoDur, Durbl, Manuf, Enrgy, Hitec, Telcm, Shops, Health, Utils and Other). R_f is one-month T-bill rate. The Fama-French three factors, UMD and ten industry portfolio returns are from Kenneth French's Web site. The Chen, Novy-Marx and Zhang factors are from Lu Zhang's Web site .The F_{GRS} is the F-statistic of Gibbons, Ross and Shanken (1989) testing the null hypothesis that the intercepts are jointly zero. Number in bold indicates that the variable is significant at the conventional levels. All the t-statistics are adjusted for heteroscedasticity and autocorrelations.

	NoDur	Durbl	Manuf	Enrgy	HiTec	Telcm	Shops	Hlth	Utils	Other	F_{GRS}
Mean	0.011	0.007	0.011	0.013	0.010	0.008	0.010	0.011	0.009	0.009	
t stat	**4.464**	**2.113**	**4.167**	**4.334**	**2.327**	**2.638**	**3.257**	**3.896**	**4.115**	**3.202**	
The CAPM											
α	0.003	-0.002	0.002	0.005	-0.002	-0.000	0.000	0.002	0.003	-0.000	
β	0.732	1.078	0.971	0.630	1.468	0.924	0.993	0.791	0.392	1.007	1.567 (0.116)
t_α	1.663	-0.974	1.645	**2.455**	-0.828	-0.408	0.204	1.378	1.655	-0.195	
The Carhart four-factor model											
α	0.002	-0.002	0.003	0.003	0.006	0.003	0.003	0.002	0.003	-0.002	
β	0.858	1.268	1.070	0.827	1.131	0.930	1.043	0.779	0.651	1.158	
s	-0.194	0.191	0.001	-0.023	0.204	-0.278	0.028	-0.342	-0.138	-0.096	2.138
h	0.271	0.715	0.296	0.059	-0.850	-0.085	0.171	-0.217	0.680	0.439	(0.022)
m	0.062	-0.250	-0.013	0.050	-0.214	-0.081	-0.039	0.113	0.090	-0.061	
t_α	0.797	**-1.972**	0.674	1.017	**2.526**	0.038	0.082	0.170	0.792	**-1.987**	
The Chen, Novy-Marx and Zhang model											
α	0.002	0.003	0.002	0.003	0.006	-0.001	-0.001	0.004	-0.003	-0.003	
β	0.965	1.073	1.057	0.677	1.127	0.965	1.063	0.904	0.518	1.116	
i	0.243	-0.034	-0.001	0.193	-0.905	0.510	-0.419	-0.039	0.237	0.108	1.894 (0.046)
o	0.396	0.115	0.226	0.084	-0.413	-0.121	0.310	0.219	0.224	0.244	
t_α	1.472	0.848	1.223	0.012	**3.234**	-0.424	-0.723	0.557	-0.901	**-2.201**	
The Carhart model augmented by risk sentiment factor											
α	0.006	-0.003	0.001	0.003	0.002	0.001	-0.003	0.005	0.001	0.001	
β	0.797	1.194	0.982	0.710	1.055	0.908	0.981	0.681	0.601	1.113	
s	-0.138	0.083	-0.078	-0.074	0.087	0.047	-0.066	-0.203	-0.129	-0.029	
h	0.351	0.714	0.288	0.485	-0.900	0.064	0.170	-0.103	0.713	0.526	1.982 (0.035)
m	0.076	-0.229	-0.027	-0.034	-0.264	-0.084	-0.028	0.131	0.076	-0.041	
e	0.304	0.316	0.299	0.266	0.353	0.224	0.311	0.368	0.211	0.311	
t_α	**2.280**	-1.120	1.512	1.062	1.541	0.027	-1.247	**3.956**	0.843	0.485	

Table 9: Raw profits of the strategy using a sentiment individual measure or a sentiment synthetic measure

This table presents the raw profits of strategies based on each of six individual sentiment indicators used for the construction of our composite sentiment index and for two alternative composite sentiment indexes. II is the investors intelligence index; UMI is the consumer confidence index; NIPO are RIPO are the average monthly first-day returns on IPOs and the number of IPOs, respectively; FLOW is the mutual funds flows; CEFD is the closed-end funds discount. BC is the Brown and Cliff composite sentiment index and BW is the Baker and Wurgler composite sentiment index. The strategy consists of buying the portfolio the most sensitive to sentiment (portfolio 10) and of selling the portfolio the least sensitive to sentiment (portfolio 1). ***, **, * indicate significance at the 1%, 5% and 10% levels, respectively.

	II	**UMI**	**NIPO**	**RIPO**	**FLOW**	**CEFD**	**BC**	**BW**
Raw profit of the strategy : (Portfolio 10- Portfolio 1)	0.001	-0.004	0.004	0.000	0.002	**0.004***	**0.009****	**0.006***
t-stat	0.298	-0.542	0.454	0.099	0.463	**1.298**	**1.706**	**1.342**

Figure 1: Composite sentiment index, July 1981 to December 2008

This figure shows the development of the composite sentiment index over time. The composite sentiment index is the first principal component of six sentiment proxies: the consumer confidence index, the investors intelligence index, the average monthly first-day returns on IPOs, the number of IPOs, the mutual funds flows and the closed-end funds discount. The composite sentiment index is based on sentiment proxies adjusted for growth of industrial production, inflation, term spread, default spread and growth in durable, nondurable and services consumption. The sentiment proxies are standardized to have a mean of zero and a standard deviation of one.

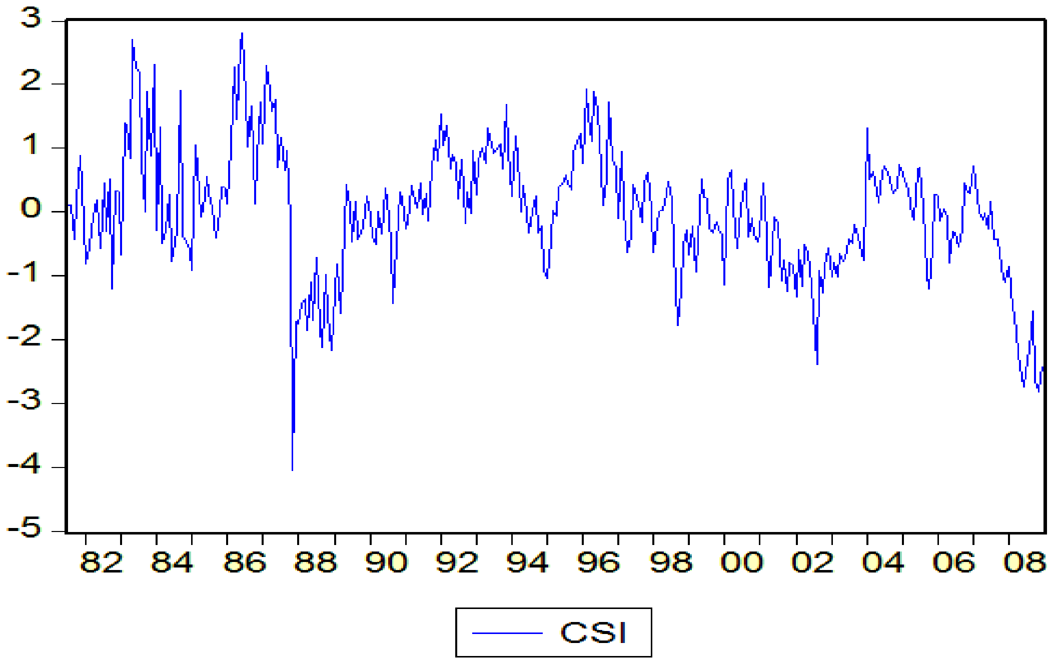
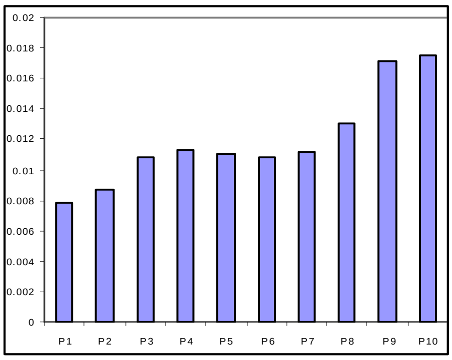


Figure 2: Returns distribution of the portfolios based on their sensibility to the sentiment factor

Theses graphs represent the evolution of the returns of portfolios based on their sensibility to the sentiment factor. Panel A shows the evolution of the returns of portfolios with negative sentiment beta. Panel B shows the returns of portfolios with positive sentiment beta. P_1 (P_{10}) represents the portfolios of stocks with the lowest (highest) exposure to the sentiment factor.

Panel A: Portfolios with negative sentiment beta



Panel B: Portfolios with positive sentiment beta