Measuring investor sentiment in equity markets

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Abstract Recently, investor sentiment has become the focus of many studies on asset pricing. Research has demonstrated that changes in investor sentiment may trigger changes in asset prices, and that investor sentiment may be an important component of the market pricing process. Some authors suggest that shifts in investor sentiment may in some instances better explain short-term movement in asset prices than any other set of fundamental factors. This paper develops an Equity Market Sentiment Index from publicly available data, and then demonstrates how this measure can be used in a stock market setting by studying the price movements of a group of firms which represent a stock market index. News events that affect the underlying market studied are quickly captured by changes in this measure of investor sentiment, and the sentiment measure is capable of explaining a significant proportion of the changes in the stock market index.

Keywords: *market sentiment, investor sentiment and risk appetite*

Introduction

Traditional research on asset pricing has focused on fundamental, firm- specific and economy-wide factors that affect asset prices. Recently, however, some researchers have turned to investor psychology to explain asset-price behaviour. It was previously assumed that there is little correlation among the sentiments of investors. The differing sentiments thus offset each other, and there is no resulting effect on market prices. If, however, there is enough of a consensus among investors, their viewpoints will not offset and will instead become an integral part of the price-setting process. In fact, some researchers (eg Eichengreen and Mody, 1998) suggest that a change in one set of asset prices may, especially in the short run, trigger changes elsewhere, because such a change engenders shifts in the market's attitude towards risk (ie because there is a change in investor sentiment).

Table 1 Measures of market sentiment used in prior research

Name	How measured	Studies
1. Optimism/Pessimism about the Economy		
Index of Consumer Confidence	Survey by Conference Board www.conferenceboard.org	Fisher and Statman (2003)
Consumer Confidence Index	Survey by U Mich.- monthly	Charoenrook (2003) Fisher and Statman (2003)
2. Optimism/Pessimism about the Stock Market		
Put/call ratio	Puts outstanding/Calls outstanding	Dennis and Mayhew (2002)
Trin. statistic	Vol Decl issues/# Del/Vol Adv issues/# Adv	NO ACADEMIC REF
Mutual Fund Cash positions	% cash held in MFs	Gup (1973) Branch (1976)
	Net cash flow into MF's	Randall *et al*. (2003)
Mutual Fund redemptions	Net redemptions/Total assets	Neal and Wheatley (1998)
AAII Survey	Survey of individual investors	Fisher and Statman (2000, 2003)
Investors Intelligence Survey	Survey of newsletter writers	Fisher and Statman (2000)
Barron's confidence index	Aaa yield-Bbb yield	Lashgari (2000)
TED Spread	Tbill futures yield - Eurodollar futures yield	Lashgari (2000)
Merrill Lynch Survey	Wall St. sell-side analysts	Fisher and Statman (2000, 2003)
3. Riskiness of the Stock Market		
Issuance %	Gross annual equities issued/Gross ann. debt & equ. issued	Baker and Wurgler (2006)
RIPO	Avg. ann. first-day returns on IPOs	Baker and Wurgler (2006)
Turnover	Reported sh.vol./avg shs listed NYSE (logged & detrended)	Baker and Wurgler (2006)
Closed-end fund discount	Y/E, value wtd. avg. disc. on closed-end mutual funds	Baker and Wurgler (2006) Neal and Wheatley (1998) Lee *et al*. (1991) Chopra *et al*. (1993)
Market liquidity	Reported share volume/Avg # of shares	Baker and Stein (2002 WP)
NYSE seat prices	Trading volume or quoted bid–ask spread	Keim and Madhavan (2000)
4. Riskiness of an individual stock		
Beta	CAPM	Various
5. Risk aversion		
Risk Appetite Index	Spearman Rank correlation volatility vs excess returns	Kumar and Persaud (2002)
VIX — Investor Fear Gauge	Implied option volatility	Whaley (2000)

Such shifts in risk attitudes may explain short-term movements in asset prices better than any other set of fundamental factors (eg see Baek *et al*. (2005). Other studies have also recognised that investor sentiment may be an important component of the market pricing process (see Fisher and Statman, 2000; Baker and Wurgler, 2006).

Many investor sentiment measures have been identified in the academic literature and in the popular press. Dennis and Mayhew (2002) have used the Put–Call Ratio, Randall *et al*. (2003) use Net Cash Flow into Mutual Funds, Lashgari (2000) uses the Barron's Confidence Index, Baker and Wurgler (2006) use the Issuance Percentage, Whaley (2000) uses the VIX-Investor Fear Gauge, and Kumar and Persaud (2002) employ the Risk Appetite Index (RAI). A more detailed list of studies that use these and other investor sentiment measures appears in Table 1.

This paper shows that the risk appetite measure developed by Persaud (1996) for currency markets can be successfully adapted to measure investor sentiment in an equity market using publicly available data. Using Persaud's 1996 methodology, this study develops and quantifies an Equity Market Sentiment Index (EMSI) for a group of firms in an equity market index. In prior studies, the Put–Call

Ratio and the VIX-Investor Fear Gauge were used as measures of investor sentiment in equity markets. As argued in Kumar and Persaud (2002), however, these measures could be measuring changes in the underlying risk of the market itself just as easily as they could be measuring changes in investor attitude towards that risk; it is not possible to isolate the two phenomena. The advantage of the RAI developed in Persaud (1996) and the EMSI constructed in this paper is that changes to the underlying riskiness of the market do not directly affect the proposed measures, and thus these measures more accurately reflect the changes in the market's attitude towards risk. The RAI and the EMSI speak specifically to the risk/return trade-off embedded in prices and therefore focus solely on the market's willingness to accept whatever risks are inherent in the market at a given time.

The EMSI is constructed using stock market price data for firms listed in the Massachusetts Bloomberg Index (MBI).[1] It is found that changes in the EMSI are closely related to news items regarding key firms in Massachusetts as well as to news reports on the condition of the Massachusetts economy as a whole. It is also found that changes in the MBI are related to the EMSI. In fact, the results indicate that lagged values of the EMSI better explain changes in the MBI than do past changes in the MBI itself (ie MBI's own price momentum).

The rest of the paper is organised as follows. The second section outlines the construction of the EMSI. Empirical results and discussion appear in the third section. The fourth section concludes.

The construction of the equity market sentiment index

Persaud (1996) developed a measure of the market's attitude towards risk — a measure that he describes as the market's *appetite* for risk — in the context of currency markets.[2] He argues that, over the short run in the foreign exchange market, the market's changing appetite for risk is a dominant force and at times is the most influential factor affecting currency returns. He goes on to suggest that, if the market's appetite for risk were fixed, exchange rate changes would be driven only by unanticipated shifts in economic risk. If the appetite for risk grows and economic risks are unchanged, investors will feel overcompensated for these risk levels and the sense of overcompensation will grow as the level of risk grows.[3] As investors take advantage of what they see as an improving risk-return trade-off, currency values will change in line with their risk. High-risk currencies should appreciate more than low-risk ones, and the riskiest currency should rally the most.[4] Thus, a RAI could be constructed based upon the strength of the correlation between the *order* of currency performance and the *order* of currency risk.

This paper demonstrates that the technique developed in Persaud (1996) can be applied to an equity market setting by constructing the EMSI for a group of firms in the MBI. The MBI follows 242 firms which span more than 50 industries and range in size from $2 million to $42 billion in market capitalisation. From data over the period from 2nd July, 2003, to 1st July, 2004, daily returns are computed for each of the securities in the MBI. For each of the securities, the average standard deviation of the daily returns over the previous five days (the 'historic volatility') is also computed for each day of the sample period.[5] Then the daily rate of return and the historic volatility are ranked, and the Spearman rank correlation coefficient between the *rank* of the daily returns for each firm and the

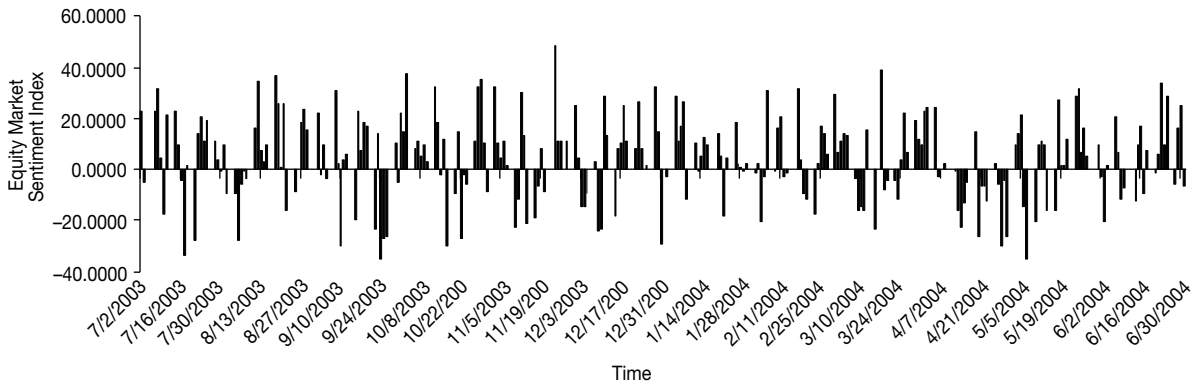

Figure 1 Equity Market Sentiment Index: 2nd July, 2003–1st July, 2004

rank of the historic volatility of the returns for each firm is computed, and the result is multipled by 100. The EMSI is therefore computed as follows

$$\text{EMSI} = \frac{\Sigma(R_{ir} - \overline{R}_r)(R_{iv} - \overline{R}_v)}{[\Sigma(R_{ir} - \overline{R}_r)^2 \Sigma(R_{iv} - \overline{R}_v)^2]^{1/2}} \star 100; -100 \leq \text{EMSI} \leq +100$$

where R_{ir} and R_{iv} are the rank of the daily return and the historical volatility for security i, respectively, and $\overline{R}_r$ and $\overline{R}_v$ are the population mean return and historical volatility rankings, respectively.

Empirical results and discussion

Figure 1 presents the EMSI for the one-year sample time period. EMSI ranges from a high of 48.09 to a low of −35.44. It averages 4.20 for the year with a standard deviation of 16.62. These EMSI values are placed into five categories. For values between −10 and +10, the market is classified as risk-neutral; for values between −10 and −30, the market is labelled moderately risk-averse and, for values <−30, the market is considered highly risk-averse. Similarly, if EMSI falls between +10 and +30, the market is labelled moderately risk-seeking and, if the index exceeds +30, the market is considered highly risk-seeking. During the sample period, there were 17 days on which the market was highly risk-seeking and 78 days on which the market was moderately risk-seeking. The market was risk-neutral for 109 days, and exhibited moderately and highly risk- averse behaviour for 42 and 6 days, respectively. For a summary of these categories, refer to Table 2.

Movements in the EMSI capture both positive and negative news as reported in the *Boston Globe*, New England's leading newspaper, concerning Massachusetts firms and the region's economy. A sample of news events and their impact on the EMSI appear in Table 3. For example, on 8th August, 2003 when the *Globe* reported that the local economy was building steam, the EMSI increased by 31 points in a four-day period. On 11th September of that year, when the *Globe* reported that the high-tech sector may be poised for new hiring, the EMSI gained 36 points in one day. When news hit that Putnam Investment's asset values fell by $14 billion, the EMSI dropped by 51 points in two days and, when the Commonwealth later charged Prudential with illegal trading, the EMSI again declined 38 points in three days. In reaction to a 6th April, 2004, *Globe* story which indicated that Bank of America planned to cut 12,500 jobs, the EMSI plummeted 42 points and, later in May,

Table 2 Risk categorisation of daily EMSI figures

Range of EMSI	Category	Number of days
–30 and below	Highly risk averse	6
–10 to –30	Moderately risk averse	42
10 to+10	Risk neutral	109
+10 to +30	Moderately risk seeking	78
+30 and above	Highly risk seeking	17

Table 3 News and EMSI

News	Fact date	Index change (up/down)	From (date)	To (date)
Confidence among mass. Firms leaps	2-Jul-03	▲ 36 (–5 to 31)	3-Jul-03	8-Jul-03
An ailing image: drug industry's tenacious price protection stirs anger	11-Jul-03	▼ 56 (23 to –33)	14-Jul-03	17-Jul-03
Data suggest economy building steam	8-Aug-03	▲ 31 (–3 to 34)	8-Aug-03	12-Aug-03
Bay state jobless rate declines	16-Aug-03	▼ 52 (36 to –16)	18-Aug-03	22-Aug-03
Investors' loyalty facing test	10-Sep-03	▲ 60 (30 to –30)	10-Sep-03	11-Sep-03
'Now hiring' returning to high tech's vocabulary	11-Sep-03	▼ 36 (–30 to 6)	11-Sep-03	12-Sep-03
A wary eye on the bulls: the dollar could lose value	23-Sep-03	▲ 49 (14 to –35)	23-Sep-03	24-Sep-03
State revenue up, but disappointing	2-Oct-03	▼ 34 (37 to 3)	3-Oct-03	10-Oct-03
Investor habits likely to change: top executive at putnam investments resigned	4-Nov-03	▲ 47 (25 to –23)	4-Nov-03	10-Nov-03
Putnam assets fall by $14b	11-Nov-03	▼ 51 (30 to –21)	12-Nov-03	14-Nov-03
In dividends we trust: biggest increase in payouts	20-Nov-03	▲ 57 (–9 to 48)	20-Nov-03	25-Nov-03
Fund investors rethinking their strategy	28-Nov-03	▼ 50 (25 to –25)	1-Dec-03	9-Dec-03
Survey: mass. Losing anchor companies	9-Dec-03	▲ 25 (0 to –25)	9-Dec-03	10-Dec-03
State charges prudential allowed illegal trading	12-Dec-03	▼ 38 (20 to –18)	12-Dec-03	15-Dec-03
$750b vow for lending draws fire	8-Jan-04	▲ 37 (25 to –12)	8-Jan-04	9-Jan-04
Mfs appeared aware of market timing	16-Jan-04	▼ 29 (10 to –19)	16-Jan-04	22-Jan-04
Rebuilding a high-tech giant	22-Jan-04	▲ 37 (–19 to 18)	22-Jan-04	26-Jan-04
No bubble billionaires: boston scientific shares to an all-time high	5-Feb-04	▼ 46 (–15 to 31)	5-Feb-04	6-Feb-04
Great numbers, but show us your worst: the mutual fund industry has declared open season	22-Feb-04	▲ 34 (–17 to 17)	23-Feb-04	25-Feb-04
The good and the bad of a fund closing	7-Mar-04	▼ 29 (10 to –19)	7-Mar-04	9-Mar-04
Trustees on the hot seat	16-Mar-04	▲ 51 (39 to –12)	17-Mar-04	23-Mar-04
Mutual fund firms adding disclaimers	22-Mar-04	▼ 34 (–12 to 22)	23-Mar-04	25-Mar-04
Bank of america to cut 12,500 jobs	6-Apr-04	▲ 42 (20 to –22)	6-Apr-04	14-Apr-04
Emc quarterly earnings and revenues post gains	16-Apr-04	▼ 24 (–10 to 14)	16-Apr-04	19-Apr-04
Growth solid in quarter: 4.2% rise in gdp	30-Apr-04	▲ 47 (–26 to 21)	30-Apr-04	5-May-04
Sign of rebound: small firms thinking bigger	9-May-04	▼ 46 (–35 to 11)	9-May-04	12-May-04
Merger to claim 500 jobs: BOA says losses will hit mass. over 2 years	14-May-04	▲ 26 (10 to –16)	14-May-04	18-May-04
Numbers down, chins up at merged biotechs	18-May-04	▼ 48 (–16 to 32)	18-May-04	25-May-04
Strategic fit: boston scientific pays $740m for microelectronic	2-Jun-04	▲ 35 (–15 to 20)	2-Jun-04	7-Feb-04
Boston employers are planning to boost hiring	15-Jun-04	▼ 25 (9 to 34)	15-Jun-04	23-Jun-04

when it appeared that the Bank of America/Fleet Bank merger might cost Massachusetts 500 jobs, the EMSI declined another 26 points. Lastly, the EMSI rose 25 points after a June 2004 story regarding a boost in hiring by Boston employers.

Not only do the movements in EMSI correspond to positive and negative news events affecting firms in Massachusetts and the economy of Massachusetts, but changes in the EMSI also closely replicate changes in the MBI. The EMSI and the MBI return for the same trading day have a significant correlation coefficient of 74.84 per cent. To

Table 4 Explanation of Massachusetts Bloomberg Index returns using ordinary least squares estimates[a]

Variable	Coefficient	*t*-statistic	*p*-value
Constant	–0.001321	–2.96277	0.0033
MBI_{t-1}	0.040734	0.977536	0.3342
$EMSI_t$	0.046143	17.78022	0.0000
R-squared	0.561510		
Adjusted *R*-squared		0.557973	
Durbin Watson statistic		2.231518	
F statistic		158.7884	
Value (*F* statistic)		0.0000	

[a]$MBI_t = \beta_0 + \beta_1\ MBI_{t-1} + \beta_2\ EMSI_t + \varepsilon_t$
MBI_t = Massachusetts Bloomberg Index return from day *t*–1 to *t*
MBI_{t-1} = one period lagged value of MBI_t
$EMSI_t$ = Equity Market Sentiment Index on day *t*

investigate the explanatory power of the EMSI in greater detail, the following equation is first posited

$$MBI_t = \beta_0 + \beta_1\ MBI_{t-1} + \beta_2\ EMSI_{t+\varepsilon t} \quad (2)$$

where MBI_t is the return on the Massachusetts Bloomberg Index from day $t-1$ to day t, and $EMSI_t$ is the Equity Market Sentiment Index (see Equation 1) on day t.

While it was not possible to confirm whether EMSI Granger causes MBI return or not, results indicate that the EMSI is able to explain changes in the MBI returns. The results from an estimation of Equation (1), which appear in Table 4, indicate that a majority of the variation in MBI_t is explained by the two independent variables MBI_{t-1} and $EMSI_t$ ($R^2 = 0.56$). Interestingly, while MBI_{t-1} (the lagged value of the return in MBI) has an insignificant impact on the dependent variable MBI_t, the coefficient on $EMSI_t$ is highly significant. This implies that returns in the MBI for any given day were primarily driven not by returns on the previous day, but by the risk-seeking behaviour of market participants for that particular day.

To investigate the impact of the EMSI on the MBI further, the following equation is estimated, which includes additional lagged values of the EMSI and the MBI[6]

$$\begin{aligned} MBI_t = {} & \beta_0 + \beta_1\ MBI_{t-1} + \beta_2\ MBI_{t-2} + \beta_3\ MBI_{t-3} + \beta_4\ MBI_{t-4} + \beta_5\ MBI_{t-5} + \beta_6\ MBI_{t-6} \\ & + \delta_0 EMSI_t + \delta_1 EMSI_{t-1} + \delta_2 EMSI_{t-2} + \delta_3 EMSI_{t-3} + \delta_4 EMSI_{t-4} + \delta_5 EMSI_{t-5} + \varepsilon t \end{aligned} \quad (3)$$

(MBI_t and $EMSI_t$ are defined earlier). To avoid autocorrelation problems associated with estimating Equation (3) using ordinary least squares, the polynomial distributed lagged model was used (see Harvey, 1990). The results from the estimation of Equation (3) appear in Table 5.

A number of important observations emerge from an examination of Table 5. A comparison of the *t*-ratios across the different lagged variables indicates that the most significant variables explaining MBI_t are the contemporaneous and one-day lagged values of the EMSI. The second lagged value of the EMSI is significant as well. Although they are relatively less significant, the lagged values of MBI_t do play a significant role in the equation; however, they lose their significance after two lags. Most importantly, while the sum of all the lagged values of MBI_t jointly does not significantly affect MBI_t, the lagged

Table 5 Explanation of Massachusetts Bloomberg Index returns using polynomial distributed lagged model estimates[a]

Variable	Coefficient	*t*-statistic
MBI_{t-1}	–0.24937	–4.63278**
MBI_{t-2}	–0.08360	–1.99927*
MBI_{t-3}	0.02330	0.51883
MBI_{t-4}	0.07134	1.68805
MBI_{t-5}	0.06051	1.88195
MBI_{t-6}	–0.00919	–0.22753
Sum of lags	–0.18702	–1.09072
$EMSI_t$	0.03873	16.3857**
$EMSI_{t-1}$	0.02262	13.0613**
$EMSI_{t-2}$	0.01043	4.48360**
$EMSI_{t-3}$	0.00215	0.86171
$EMSI_{t-4}$	–0.00221	–0.93336
$EMSI_{t-5}$	–0.00265	–0.82559
Sum of lags	0.06908	7.47905**
R-squared	0.570109	
Adjusted *R*-squared	0.559317	
Durbin Watson statistic	1.846193	
F statistic	52.82586	
Value (*F* statistic)	0.0000	

* Denotes significance at 5 per cent level.
** Denotes significance at 1 per cent level.
[a]$MBIt = \beta_0 + \beta_1 MBI_{t-1} + \beta_2 MBI_{t-2} + \beta_3 MBI_{t-3} + \beta_4 MBI_{t-4} + \beta_5 MBI_{t-5} + \beta_6 MBI_{t-6} + \delta_0 EMSI_t + \delta_1 EMSI_{t-1} + \delta_2 EMSI_{t-2} + \delta_3 EMSI_{t-3} + \delta_4 EMSI_{t-4} + \delta_5 EMSI_{t-5} + \varepsilon_t$
MBI*t* = Massachusetts Bloomberg Index return from day *t*–1 to *t*
MBI_{t-i} = *i* period lagged value of MBIt
$EMSI_t$ = Equity Market Sentiment Index for Massachusetts on day *t*
$EMSI_{t-i}$ = *i* period lagged value of EMSI *t*

values of $EMSI_t$ combined do play a significant role. These results suggest that the EMSI better explains MBI returns than do past returns of the MBI itself.

Conclusion

There has been growing interest in investor psychology as a potential explanation for stock price movements. This study, using a technique developed in Persaud (1996), constructs a measure called the Equity Market Sentiment Index (EMSI), which uses publicly available data to measure the market's willingness to accept the risks inherent in an equity market at a given point in time. This measure relates the rank of a stock's riskiness to the rank of its return and therefore directly measures the market's pricing of the risk-return trade-off.

From data for the portfolio of firms included in the MBI, it is found that the EMSI captures Massachusetts-related news events as reported in the *Boston Globe* and is highly correlated with the MBI. Moreover, daily price movements in the MBI are significantly related to investor sentiment. In fact, the results indicate that lagged values of the EMSI explain changes in the market index value better than lagged values of the market index itself. This has important implications, as it appears that short-run changes in the market index value are driven primarily by investor sentiment rather than by the index's own price momentum. Researchers and practitioners should pay close attention to investor sentiment as a determinant of changes in financial markets.

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Notes

1. The Massachusetts Bloomberg Index follows the performance of public companies which are either based in or do considerable business in Massachusetts. This Massachusetts Bloomberg Index closely approximates other indices that contain a larger collection of firms.
2. Persaud discusses the risk appetite in a research report published by JP Morgan Securities Ltd. This idea has received attention in the 'Economics Focus' series in the *Economist* (1996), and in a 1998 conference on business cycles organised by the Federal Reserve Bank of Boston. Other studies (eg Baek *et al*. (2005) have used Persaud's notion of risk appetite to construct risk appetite indices applicable to different contexts.
3. In Persaud, the risk of a currency is proxied by the yield on the bonds denominated in that currency.
4. The reverse argument applies when the risk appetite falls. High- risk (or high-yielding) currencies would be devalued more than those perceived to be safe.
5. Results do not change if standard deviations of returns over a different number of days are used.
6. Standard specification tests were used to determine the appropriate number of lags included for both variables.

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