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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. In this paper we develop an *Equity Market Sentiment Index* from publicly available data, and we then demonstrate 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.

JEL Classification: G11, G12.

Key Words: Market Sentiment, Investor Sentiment and Risk Appetite.

1. 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 behavior. 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, on the other hand, 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 [e.g., 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 (i.e., because there is a change in investor sentiment). Such shifts in risk attitudes may explain short-term movements in asset prices better than any other set of fundamental factors [see, e.g., Baek, Bandopadhyaya and Du (2005)]. Other studies have also recognized that investor sentiment may be an important component of the market pricing process [see Fisher and Statman (2000) and 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 P*ut-Call Ratio*, Randall, Suk and Tully (2003) utilize *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 utilize these and other investor sentiment measures appears in Table 1.

In this paper we show 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 we develop and quantify 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* have been used as measures of investor sentiment in equity markets. However, as argued in Kumar and Persaud (2002), 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 measure 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 tradeoff embedded in prices and therefore focuses solely on the market's willingness to accept whatever risks are inherent in the market at a given time.

We construct the *EMSI* using stock market price data for firms listed in the Massachusetts Bloomberg Index (MBI) [1]. We find that changes in our *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. We also find that changes in the MBI are related to the *EMSI*. In fact, our results indicate that lagged values of the *EMSI* better explain changes in the MBI than do past changes in the MBI itself (i.e. MBI's own price momentum).

[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.

The rest of the paper is organized as follows. Section 2 outlines the construction of the *EMSI*. Empirical results and discussion appear in Section 3. Section 4 concludes.

2. 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 risk appetite index could be constructed based upon the strength of the correlation between the *order* of currency performance and the *order* of currency risk.

In this paper we demonstrate 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

[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 organized by the Federal Reserve Bank of Boston. Other studies [e.g., Baek, Bandopadhyaya and Du (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.

million to $42 billion in market capitalization. Using data over the period from July 2, 2003 to July 1, 2004, we compute daily returns for each of the securities in the MBI. For each of the securities, we also compute the average standard deviation of the daily returns over the previous five days (the "historic volatility") for each day of the sample period.[5] We then rank the daily rate of return and rank the historic volatility and compute the Spearman rank correlation coefficient between the *rank* of the daily returns for each firm and the *rank* of the historic volatility of the returns for each firm, and multiply the result by 100. The *EMSI* is therefore computed as follows:

$$EMSI = \frac{\sum (R_{ir} - \bar{R}_r)(R_{iv} - \bar{R}_v)}{\left[\sum \left(R_{ir} - \bar{R}_r\right)^2 \sum \left(R_{iv} - \bar{R}_v\right)^2\right]^{\frac{1}{2}}} * 100 \; ; \quad -100 \le EMSI \le +100 \qquad (1)$$

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

3. 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. We place these *EMSI* values into five categories. For values between -10 to +10 we classify the market as risk-neutral, for values between -10 and -30 the market is labeled moderately risk-averse, and for values less than -30 the market is considered highly risk-averse. Similarly, if *EMSI* falls between +10 and +30, the market is labeled moderately risk-seeking, and if the index

[5] Results do not change if standard deviations of returns over a different number of days are used.

exceeds +30, the market is considered highly risk-seeking. During the sample period there were seventeen days on which the market was highly risk-seeking and seventy-eight days on which the market was moderately risk-seeking. The market was risk-neutral for one hundred and nine days, and exhibited moderately and highly risk-averse behavior for forty-two and six 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 August 8, 2003 when the *Globe* reported that the local economy was building steam, the *EMSI* increased by 31 points in a four-day period. On September 11 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 an April 6, 2004 *Globe* story which indicated that Bank of America planned to cut 12,500 jobs, the *EMSI* plummeted 42 points, and later in May 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 with 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%. To investigate the explanatory power of the *EMSI* in greater detail, we first posit the following equation:

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

MBI_t = The return on the Massachusetts Bloomberg Index from day t-1 to day t
$EMSI_t$ = The Equity Market Sentiment Index (see Equation 1) on day t

While we were unable 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 behavior of market participants for that particular day.

To further investigate the impact of the *EMSI* on the MBI, we estimate the following equation, which includes additional lagged values of the *EMSI* and the MBI:[6]

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

[6] Standard specification tests were utilized to determine the appropriate number of lags included for both variables.

(MBI_t and $EMSI_t$ are defined earlier). To avoid autocorrelation problems associated with estimating Equation (3) using ordinary least squares, we used the polynomial distributed lagged model (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 do not significantly impact MBI_t, the lagged 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.

4. Conclusion

There has been growing interest in investor psychology as a potential explanation for stock price movements. In this study, using a technique developed in Persaud (1996), we construct a measure called the *Equity Market Sentiment Index* (*EMSI*) which utilizes publicly available data to measure the market's willingness to accept the risks inherent to 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 tradeoff.

Using data for the portfolio of firms included in the Massachusetts Bloomberg Index (MBI) we find that our *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, our results indicate that lagged values of the *EMSI* better explain changes in the market index value than lagged values of the market index itself. This has important implications since 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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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, Suk, and Tully (2003)
Mutual Fund redemptions	Net redemptions/total assets	Neal and Wheatley (1998)
AAII Survey	Survey of individual investors	Fisher & Statman (2000) Fisher & Statman (2003)
Investors Intelligence Survey	Survey of newsletter writers	Fisher & 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 & Statman (2000) Fisher & Statman (2003)

Table 1 (Continued)

Measures of Market Sentiment Used in Prior Research

Name	How Measured	Studies
3. Riskiness of the Stock Market		
Issuance %	Gross annual equities issued Gross ann. debt & equ. issued	Baker & Wurgler (2006)
RIPO	Avg. ann. first-day returns on IPO's	Baker & Wurgler (2006)
Turnover	Reported sh.vol./avg shs listed NYSE (logged & detrended)	Baker & Wurgler (2006)
Closed-end fund discount	Y/E, value wtd. avg. disc. on closed-end mutual funds	Baker & Wurgler (2006) Neal and Wheatley (1998) Lee, Schleifer, & Thaler (1991) Chopra, Lee, Schleifer, & Thaler (1993)
Market liquidity	Reported share volume Avg # of shares	Baker & 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)

Table 2

Risk Categorization 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

Table 4

Explanation of Massachusetts Bloomberg Index Returns
Using Ordinary Least Squares Estimates

$$\mathbf{MBI_t = \beta_0 + \beta_1\ MBI_{t-1} + \beta_2\ EMSI_t + \varepsilon_t}$$

MBI_t = Massachusetts Bloomberg Index return from day t-1 to t
MBI_{t-1} = One period lagged value of MBI_t
$EMSI_t$ = The Equity Market Sentiment Index on day t

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

Table 5

Explanation of Massachusetts Bloomberg Index Returns
Using Polynomial Distributed Lagged Model Estimates

$$MBI_t = \beta_0 + \beta_1 MBI_{t-1} + \beta_2 MBI_{t-2} + \beta_3 MBI_{t-3} + \beta_4 MBI_{t-4} + \beta_5 MBI_{t-5} + \beta_6 MBI_{t-6} + \delta_0 EMSI_t + \delta_1 EMSI_{t-1} + \delta_2 EMSI_{t-2} + \delta_3 EMSI_{t-3} + \delta_4 EMSI_{t-4} + \delta_5 EMSI_{t-5} + \varepsilon_t$$

MBI_t = Massachusetts Bloomberg Index return from day t-1 to t
MBI_{t-i} = i period lagged value of MBI_t
$EMSI_t$ = The Equity Market Sentiment Index for Massachusetts on day t
$EMSI_{t-i}$ = i period lagged value of $EMSI_t$

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

Variable	Coefficient	t-Statistic
$EMSI_t$	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**

** Denotes significance at 1% level
* Denotes significance at 5% level

R-Squared	0.570109
Adjusted R-Squared	0.559317
Durbin Watson Statistic	1.846193
F Statistic	52.82586
Value (F Statistic)	0.0000

Figure 1

The Equity Market Sentiment Index: July 2, 2003 – July 1, 2004