Measures of Investor Sentiment: Who Wins the Horse Race?

Arindam Bandopadhyaya

University of Massachusetts Boston, arindam.bandopadhyaya@umb.edu

Follow this and additional works at: http://scholarworks.umb.edu/financialforum_pubs

Part of the Finance and Financial Management Commons

Recommended Citation

http://scholarworks.umb.edu/financialforum_pubs/22

This Occasional Paper is brought to you for free and open access by the Financial Services Forum at ScholarWorks at UMass Boston. It has been accepted for inclusion in Financial Services Forum Publications by an authorized administrator of ScholarWorks at UMass Boston. For more information, please contact library.uasc@umb.edu.
Measures of Investor Sentiment: Who Wins the Horse Race?

Arindam Bandopadhyaya
Financial Services Forum
College of Management
University of Massachusetts Boston

November 2006

Working Paper 1012
Measures of Investor Sentiment: Who Wins the Horse Race?

Arindam Bandopadhyaya
Department of Accounting and Finance
University of Massachusetts-Boston
100 Morrissey Boulevard
Boston, MA 02125
Tel. (617) 287-7854
E-mail: arindam.bandopadhyaya@umb.edu
1. Introduction

Traditional research on asset pricing has focused on firm-specific and economy-wide factors that affect asset prices. Recently, the finance literature has turned to non-economic factors such as investor sentiment as possible determinants of asset prices. Some researchers (e.g., Eichengreen and Mody, 1998) suggest that a change in one set of asset prices may change investor sentiment, thus triggering changes in a seemingly unrelated set of asset prices, especially in the short run, giving rise to pure contagion. Fisher and Statman (2000) and Baker and Wurgler (2006) have also recognized that investor sentiment may be an important component of the market pricing process. In fact, some studies (see, e.g., Baek, Bandopadhyaya and Du 2005) suggest that shifts in investor sentiment may explain short-term movements in asset prices better than any other set of fundamental factors.


The wide array of investor sentiment measures now available leads quite naturally to the question of which measures best mirror actual market movement. In this paper, I begin to address this question by picking two measures of investor sentiment, namely, the
Put-Call Ratio (PCR) and the VIX-Investor Fear Gauge (VIX). These measures are
computed daily by the Chicago Board Options Exchange (CBOE) and are widely used by
academicians and practitioners as measures of investor sentiment to gauge the prevailing
level of bullishness or bearishness in the market. In most cases these indicators are used
as contrarian tools: when market participants are most bullish, the likelihood of a
downside reversal is greatest; when investors become overly bearish, a market rally may
be on the horizon.

To investigate which of these measures “outperforms” the other, I first use a
random-walk model to see what portion of the variability in the daily movement of the
S&P 500 index is explained by past values of the index itself. Arguably, past values of
the index itself capture all relevant economic information that affects the index,
especially if the data are high frequency. Any unexplained portion of the daily
movement in the index must then be due to changes in other non-economic factors, such
as changes in market sentiment. Using daily data from 2004 until the middle of 2006, I
find that the PCR is a better explanatory variable than is the VIX for variations in the
S&P 500 index that are not explained by economic factors. This supports the argument
that, if one were to choose between the two measures as a measure of market sentiment,
then the PCR is a better choice than the VIX.

The rest of the paper is organized as follows. Section 2 describes the construction
of the PCR and the VIX in some detail. Statistical properties of the two sentiment
measures during the sample period are also discussed in this section. Section 3 outlines
the methodology used and discusses the results obtained. Section 4 concludes.
2. The Put Call Ratio and the VIX Investor Fear Gauge Index

Several PCRs are used in the literature, but the most-utilized one is based on data collected by the CBOE. Each day, the CBOE adds together all of the call and put options that are traded on all individual equities, as well as on various indices, including the S&P 100, and computes: \( \text{PCR} = \frac{\text{Volume of put option contracts}}{\text{Volume of call option contracts}} \).

On days when the major averages perform strongly, the number of calls bought typically far outweighs the number of puts, resulting in a relatively low put/call ratio. On days when the market is weak, the number of puts bought generally outnumbers the purchase of calls. Although a value of 1.0 might seem to be a “neutral” reading, empirically it has been observed that there are more calls than puts bought on what would be considered an “average” day. As a result, a PCR of approximately 0.80 is considered “normal”. Markets are considered “strong” when the ratio falls below 0.7 and “weak” when the ratio rises above 1.1.

A plot of the put/call ratio during the chosen sample period (January 2004 through April 2006) appears in Exhibit 2, and the frequency distribution of put/call values is in Exhibit 3. The put/call ratio had a minimum and maximum value of 0.32 and 1.42, respectively, with a mean of 0.86097 and a standard deviation of 0.15147. The modal class in the frequency distribution is the 0.80-0.89 range. Out of the 574 days in the sample period, on 463 days the put/call reading was between 0.70 and 1.1, days when the market was “normal”; in 73 days the value fell below 0.7 (“strong” market), and in 100 days the put/call ratio was above 1.1 (“weak” market).
The VIX is constructed on any trading day using the implied volatilities of options on equities in the S&P 100 index. The implied volatilities of eighth-day near-the-money, nearby and second nearby options from the S&P 100 index are first computed using the Black-Scholes option pricing model. These volatilities are then appropriately weighted to characterize the implied volatility of a 22-trading-day at-the-money option contract on the S&P 100 index. A plot of the VIX in the sample period is in Exhibit 4. The VIX attained a minimum and maximum value of 10.23 and 21.58, respectively, with a mean of 13.8879 and a standard deviation of 2.1690. The frequency distribution of the computed VIX values (Exhibit 5) indicates that the modal range is 12%-13%.

3. Methodology and Results

In this section, I investigate the following question: between the PCR and the VIX, which is a “better” measure of investor sentiment? To begin, I first use a random-walk model to determine what portion of the variability in the daily movements of the S&P 500 index is explained by its own past values. Specifically, I estimate:

\[
(S&P)_t = \beta_0 + \beta_1(S&P)_{t-1} + \varepsilon_t
\]  

(1)

Results from the estimation of equation (1) appear in Exhibit 6. Most notably, and perhaps not surprisingly, a vast majority of the variation in the S&P 500 index current-day value is explained by the value of the index the previous day, as evidenced by the

---

1 Nearby contracts are defined as ones with the shortest time. But with at least eight calendar days to expiration and the second nearby contracts that expire in the adjacent month. For a more detailed exposition of the construction of the VIX see Whaley (2000).

2 Results in this estimation, as well as in later estimations in this paper, are not qualitatively different if \(\ln(S&P)\) is used. Also, results do not change significantly if the S&P 100 index is used in place of the S&P 500 index.
extremely significant coefficient of (S&P)_{t-1} (t-statistic=182.4607) and a high value for the adjusted R-squared (0.9831). This is consistent with efficient markets where past values of the index itself capture all relevant economic information that affects the contemporaneous index values. However, any unexplained portion of the daily movement in the index must then result from changes in other non-economic factors. Thus, the residuals from the estimation of equation (1), RES, could represent variations in the market due to non-economic factors; one such factor is investor sentiment, which indices such as the PCR and the VIX attempt to approximate.

To investigate whether the PCR or the VIX better explains the residuals from the estimation of equation (1), I estimate the following equations:

\[(\text{Res})_t = \beta_0 + \beta_1(\text{PCR})_t + \varepsilon_t \quad (2)\]

\[(\text{Res})_t = \beta_0 + \beta_1(\text{VIX})_t + \varepsilon_t \quad (3)\]

Results from the estimation of equations (2) and (3) appear in Exhibits 7 and 8, respectively. Results indicate that both the PCR and the VIX are significantly related to the residuals. Their coefficients also have the correct anticipated negative signs, implying that the higher these indices are, the lower the market sentiment is. However, a comparison of the results from the two equations shows that the PCR has a greater explanatory power than does the VIX. The co-efficient of the PCR is greater in magnitude than that of the VIX (-16.94 versus -0.82), and while both the PCR and the VIX have a p-value of zero, the co-efficient of the PCR has a larger t-statistic than that of
the VIX (-8.37 versus -5.61). Moreover, equation (2) is a better fit than is equation (3) because:

1. the adjusted R-squared is greater (0.1079 versus 0.0508)
2. the maximized likelihood is larger (-1949.824 versus -1967.602)
3. the F-statistic of joint significance of variables is greater (70.1153 versus 31.53594).

4. Conclusion

Non-economic factors such as investor sentiment are increasingly becoming important explanatory variables in analyzing asset prices. As the literature on market sentiment grows, so too does the array of competing measures. Since wide varieties of market sentiment measures are available, a deeper understanding of the relative merits of these indices offers insight in. In this paper, I select two popularly utilized investor sentiment measures, the PCR and the VIX, to investigate which one of these outperforms the other in approximating non-economic factors that may be driving changes in asset prices. Using residuals from a random-walk equation of the S&P 500 index to represent variations in assets prices not explained by economic factors, I find that the PCR is a better measure of such factors than is the VIX and thus that the PCR is a better choice as a measure of market sentiment.
**References**


Exhibit 1: Measures of Market Sentiment Used in Prior Research

<table>
<thead>
<tr>
<th>Name</th>
<th>How Measured</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Optimism/Pessimism about the Economy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fisher and Statman (2003)</td>
</tr>
<tr>
<td>2. Optimism/Pessimism about the Stock Market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Put/Call Ratio</td>
<td>Puts outstanding Calls outstanding</td>
<td>Dennis and Mayhew (2002)</td>
</tr>
<tr>
<td>Trin. Statistic</td>
<td>Vol Decl issues/# Decl Vol Adv issues/# Adv</td>
<td>NO ACADEMIC REF</td>
</tr>
<tr>
<td>Mutual Fund Cash Positions</td>
<td>% cash held in MFs</td>
<td>Gup (1973)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Branch (1976)</td>
</tr>
<tr>
<td>Mutual Fund Redemptions</td>
<td>Net redemptions/total assets</td>
<td>Neal and Wheatley (1998)</td>
</tr>
<tr>
<td>AAII Survey</td>
<td>Survey of individual investors</td>
<td>Fisher &amp; Statman (2000)</td>
</tr>
<tr>
<td>Investors Intelligence Survey</td>
<td>Survey of newsletter writers</td>
<td>Fisher &amp; Statman (2000)</td>
</tr>
<tr>
<td>Barron's Confidence Index</td>
<td>Aaa yield – Bbb yield</td>
<td>Lashgari (2000)</td>
</tr>
</tbody>
</table>
### Exhibit 1 (Continued): Measures of Market Sentiment Used in Prior Research

<table>
<thead>
<tr>
<th>Name</th>
<th>How Measured</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Riskiness of the Stock Market</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gross ann. debt &amp; equ. issued</td>
<td></td>
</tr>
<tr>
<td>RIPO</td>
<td>Avg. ann. first-day returns on IPO's</td>
<td>Baker &amp; Wurgler (2006)</td>
</tr>
<tr>
<td>Turnover</td>
<td>Reported sh.vol./avg shs listed NYSE (logged &amp; detrended)</td>
<td>Baker &amp; Wurgler (2006)</td>
</tr>
<tr>
<td>Market Liquidity</td>
<td>Reported share volume Avg # of shares</td>
<td>Baker &amp; Stein (2002 WP)</td>
</tr>
<tr>
<td>NYSE Seat Prices</td>
<td>Trading volume or quoted bid-ask spread</td>
<td>Keim and Madhavan (2000)</td>
</tr>
<tr>
<td><strong>4. Riskiness of an individual stock</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>CAPM</td>
<td>Various</td>
</tr>
<tr>
<td><strong>5. Risk Aversion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Appetite Index</td>
<td>Spearman Rank correlation volatility vs. excess returns</td>
<td>Kumar and Persaud (2002)</td>
</tr>
</tbody>
</table>
Exhibit 3: Put/Call Ratio Frequency Distribution
Exhibit 5: VIX Frequency Distribution
Exhibit 6: Results from the Estimation of Equation (1)

\[(S&P)_t = \beta_0 + \beta_1(S&P)_{t-1} + \varepsilon_t\]

S&P = S&P 500 Index

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>8.8128</td>
<td>1.3676</td>
<td>0.1720</td>
</tr>
<tr>
<td>S&amp;P_{t-1}</td>
<td>0.9928</td>
<td>182.4609</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Adjusted R-Squared = 0.9832  
Log-likelihood Ratio = -1983.004  
F-Statistic = 33292.00

Exhibit 7: Results from the Estimation of Equation (2)

\[(Res)_t = \beta_0 + \beta_1(PCR)_t + \varepsilon_t\]

RES = Residuals from Equation (1)  
PCR = Put/Call Ratio

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>14.5922</td>
<td>8.2470</td>
<td>0.0000</td>
</tr>
<tr>
<td>PCR</td>
<td>-16.9447</td>
<td>-8.3735</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Adjusted R-Squared = 0.1080  
Log-likelihood Ratio = -1949.824  
F-Statistic = 70.1154

Exhibit 8: Results from the Estimation of Equation (3)

\[(Res)_t = \beta_0 + \beta_1(VIX)_t + \varepsilon_t\]

RES = Residuals from Equation (1)  
VIX = Investor Fear Gauge

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>11.39728</td>
<td>5.5488</td>
<td>0.0000</td>
</tr>
<tr>
<td>VIX</td>
<td>-0.821107</td>
<td>-5.6157</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Adjusted R-Squared = 0.0508  
Log-likelihood Ratio = -1967.602  
F-Statistic = 31.5359