The Stock Market Emotion Index

A New Sentiment Measure Using Enhanced OBV and Money Flow Indicators

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"The most important single factor in shaping security markets is public psychology."

- Gerald M. Loeb (1935) [1]

Research Background:

Since 2001, I have developed and implemented a new family of technical indicators called Huemo Index for equity and hedge fund asset managers. The indicator described in this paper is a special case of the Huemo Index. A portion of the research charts presented here were previously included in the paper entitled "Human Emotion Statistics and Index" submitted for the 2007 Charles H. Dow Award consideration. This paper extends the earlier manuscript by explaining the computational differences and rationale beyond the well known OBV and CMF indicators.

Introduction

The Stock Market Emotion Index (SMEI) is designed to be a new technical indicator for measuring the investor sentiment of any security actively traded on the stock market. It can be calculated easily with end-of-day data. The index calculation is solely based on observed short term market volatility as reflected by each day's trading volume, open, high, low, and close prices. In contrast to most known technical indicators which are

mainly applied for short term technical analysis, the new indicator is intended for identifying primary trend cycles that typically last one year or longer.

The basic premise of Dow theory is that the market discounts everything, including the emotions of all traders. The fundamentals of a company do not change suddenly when its daily stock price is fluctuating as driven by human emotions that are often irrational. However, over a longer time period, a company's fundamentals do change. Again, different types of human emotions, triggered by the flow of material events, are moving the stock price trend up or down. This paper summarizes the author's attempt in understanding primary trend extent and duration by proposing a new sentiment measure using statistical analysis of stock market human emotion.

What causes primary trend cycles? Investor psychology. The problem with fundamental analysis is that it assumes that investors are rational. The reality is that there are various types of investors with different types of emotional behavior. Rational or irrational behavior drives its unique thinking process that leads to the optimal time to trade and thus moves the market. In order to understand primary trend extent and duration, and to establish a conceptual basis for the statistical analysis of stock market emotion, a primary trend cycle model is composed as shown in Figure 1.

In my opinion, a primary trend cycle is driven by an orderly sequence of buying or selling actions from five types of investors. They are named as smart investors, rational investors, momentum investors, emotional investors, and contrarian investors. Here smart investors are informed investors, e.g., insiders, investors close to insiders, or those investors who have in-depth knowledge related to the security being traded. Rational investors are experienced, referring to mainly institutional investors who rely on financial statements and research reports to take trade actions. Momentum investors are traders. When traders get pessimistic, their grim outlook can become a self-fulfilling prophecy. The more desperate traders become to abandon a stock, the lower the price they will accept to get rid of it. Bottoms are seen when they have extreme level of pessimism. Reverse is also true. Tops are seen when momentum traders have extreme levels of

confidence. Emotional investors represent most general public who don't trade with logic; they trade by reacting on crowd emotions. Finally, contrarian investors try to take the opposite direction of crowd emotion. But Contrarians could make moves too early, long before the actual trend reversals.

The stock market has a history of alternating between bull markets and bear markets. The problem of successful investing is to identify a bull or bear trend in its early stage. In terms of technical analysis, an "ideal trend indicator" should be concurrent with the primary trend reversals, also illustrated in Figure 1.
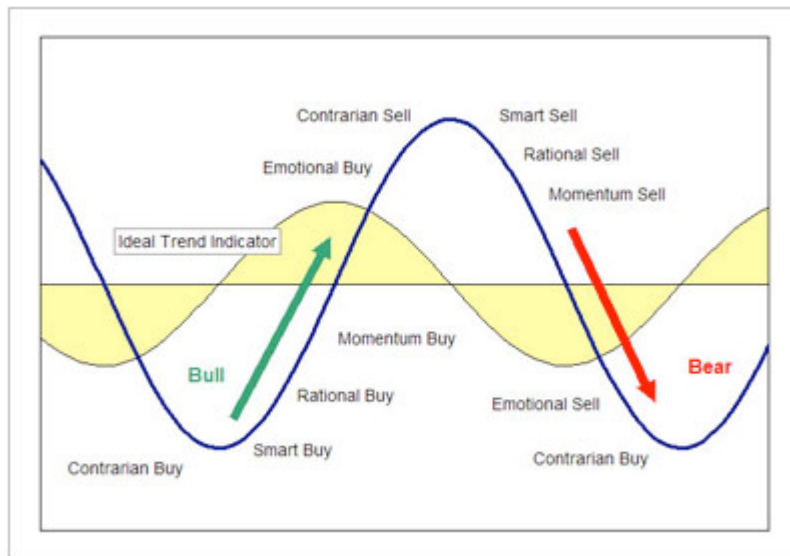

Figure 1: Primary Trend Drivers and Ideal Trend Indicator

The biggest challenge facing asset managers today is that in a bull market, it is difficult to distinguish a short-term correction from the beginning of a new bear market. On the other side, in a bear market, it is also difficult to distinguish a short-term rebound from the beginning of a new bull market. In 1932, Robert Rhea [2] stated that correct determination of the primary trend is the most important factor in successful investing and trading. However, there was no known method of forecasting the extent or duration of a primary trend. There are few studies in the technical analysis field that address primary trend analysis. Based on earning reports and historical data, it is not surprising

that most fundamental ratings and technical indicators are lagging behind the primary market trend.

The philosophy behind my human emotion analysis is that behavioral changes are leading the primary market trend. This is because contrarian and smart investors' actions are ahead of the other market participants' behavior as shown in Figure 1. These early actions could serve as evidences to develop a leading indicator. The problem of designing a primary trend indicator is how to detect the early actions by contrarian and smart investors, and then obtain trend confirmation from the actions by rational investors.

Technicians believe that volume precedes price, meaning that the loss of upside pressure in a bull trend or downside pressure in a bear trend actually shows up in the volume figures before it is manifested in a reversal of the price trend [3]. Some of earlier research attempts are contained in the important indicators developed by Joseph Granville and Marc Chaikin, among many others ([4] and [5]). These volume-based indicators are designed to uncover any volume divergences versus price movement. I will show in this paper a new statistical framework to reformulate, extend, and improve the existing volume-based indicators. I will describe how human emotion of market participants can be quantified and then statistically processed to derive a set of new technical indicators. The results provide a new angle to understand the extent and duration of a primary trend.

I. OBV and Money Flow Indicators Revisited

Even though many technicians see little advantage in coupling volume with price, some successful attempts have been made in the past to add volume into consideration to give a more complete representation of stock market behavior.

Volume can be viewed as a measure of supply and demand for the given security. When market emotion level is high on a security, its traded volume will increase, and vice versa. Volume grows when new buyers and new sellers enter the market in anticipation of more significant price movement. Such a volume driven price movement could

indicate the formation of a new trend, either up or down, depending on the prevailing fundamental changes of the underlying security.

Among those technicians who attempted to take consideration of volume, Joseph Granville introduced the On Balance Volume (OBV) indicator in his 1963 book [6]. This is the simplest and best-known indicator for measuring positive and negative volume flows. OBV is based on a cumulative total volume. The volume on an up day is added and the volume on a down day is subtracted [7], i.e.,

If today's close is greater than yesterday's close, then:

$$Today's\ OBV = Yesterday's\ OBV + Today's\ volume \qquad \textbf{(1)}$$

If today's close is less than yesterday's close, then:

$$Today's\ OBV = Yesterday's\ OBV - Today's\ volume \qquad \textbf{(2)}$$

The OBV line can be compared with the price chart of the underlying security to look for divergence or confirmation. Figure 2 is the OBV chart (shown in red) for S&P 500 (using SPY data and shown in blue) from 1999 to 2003.
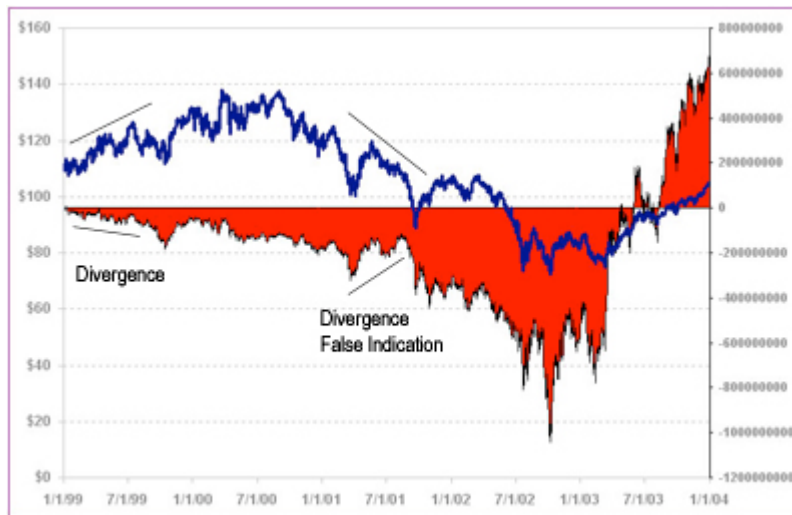

Figure 2: On Balance Volume Chart for SPY (1999 – 2003)

OBV is a simple indicator that can provide important trend confirmation, convergence and divergence signals over longer term time periods. However, OBV has a few limitations as seen in this example.

- o It is difficult to identify a divergence in its early stage on a long-term OBV chart. In Figure 2, the early 1999 and mid 2001 OBV chart showed divergences but the primary trend was not yet reversed. According to Granville, investors must act quickly and decisively if they wish to profit from OBV analysis. Thus OBV may be only best suitable to signal a possible short-term trend reversal.
- o OBV does not provide clear bull versus bear trend indication since it does not have a centerline. For a centered indicator (e.g., MACD), the trend is bullish when the value of indicator is above its centerline and bearish when the value is below its centerline.
- o The value of OBV does not indicate any overbought or oversold conditions. The starting point for an OBV chart is arbitrary. Only the shape of the resulting indicator is used, not the actual level of the OBV. In Figure 2, I set the initial OBV value to zero on 1/1/1999. Different initial date assumptions will result in very different subsequent OBV values.

Many researchers have tried to overcome the limitations of OBV by using different volume and price formulation. Perhaps the most popular attempt was made by Marc Chaikin in developing his Chaikin Money Flow (CMF) indicator ([5] and [7]). Instead of using the close price, he used the mean price. Based on whether a stock closed in its upper or lower half of the day's action, Chaikin would either add or subtract volume. The basic premise behind the CMF is that the degree of buying or selling pressure can be determined by the location of the close relative to the high and low for the corresponding period. There is buying pressure when a stock closes in the upper half of a period's range and there is selling pressure when a stock closes in the lower half of the period's trading range. Chaikin has suggested using last 21 days as the typical period for calculating CMF [5]. For any 21-day period, each day's trading volume, high, low, and close prices are

used for CMF calculation. For a given time period, Accumulation / Distribution Line (ADL) is defined first. The cumulative total volume further divides ADL over the same period to obtain CMF. The exact definitions are as follows [7].

$$ADL = \sum_{1}^{21}[\frac{(close - low) - (high - close)}{high - low} * volume]$$

(3)

$$CMF = \frac{ADL}{\sum_{1}^{21} volume}$$

(4)

As with OBV, Chaikin suggested looking for a divergence between the price action and the indicator. If a stock trends up while the CMF rolls over and heads down, the stock will likely top out soon after. On the other hand, if a stock moves down while the CMF bottoms out and begins to move up, the stock will likely follow the reversal too.

As an important improvement over OBV, the values of the CMF can also be used to indicate the magnitude of buying and selling pressure. Values that bounce near and around the zero line are not strong enough to offer a bullish or bearish signal. Larger values above and below zero line are indicative of stronger buying and selling pressure respectively.

However, further examination unveils that CMF is not a clear indicator for identifying long-term trend reversals. For example, S&P 500 experienced a bear market that started in middle of 2000 and lasted about three years. S&P 500 then reversed to a bull market in late 2003. If I apply the standard 21-day CMF to the S&P 500 price chart (using SPY data), the resulting chart is shown in Figure 3. As a longer-term application of CMF, I also obtained a 200-day CMF chart for SPY shown in Figure 4.
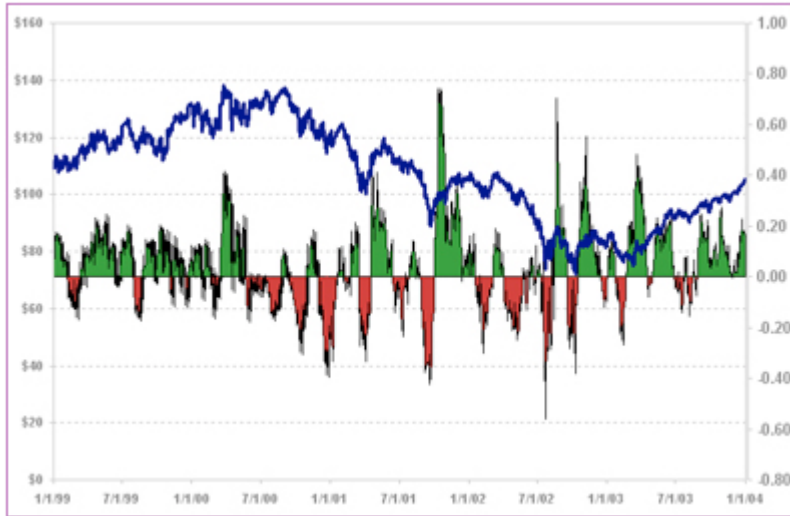
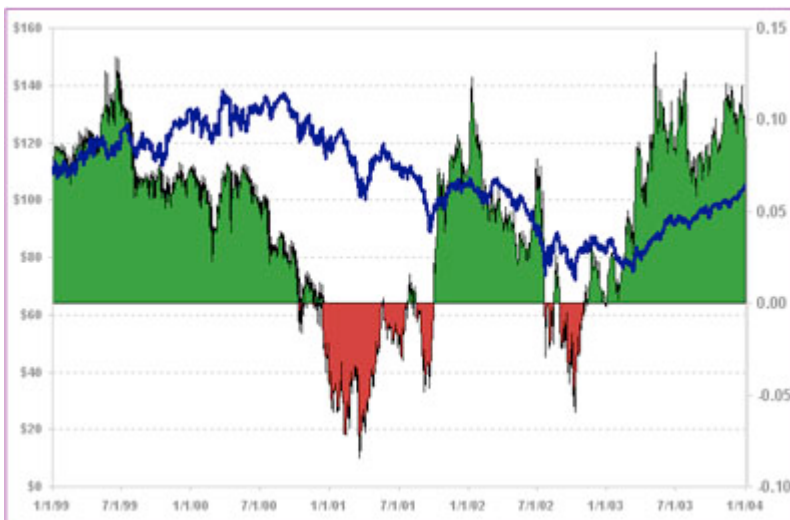Figure 3: 21-Day Chaikin Money Flow Chart for SPY (1999 – 2003)

Figure 4: 200-Day Chaikin Money Flow Chart for SPY (1999 – 2003)

As shown in Figure 3 and 4, obviously CMF is not a clear primary trend indicator due to the following limitations (Note: The similar weakness can also be seen for other known money flow indicators when they are applied to long-term trend analysis).

- o Marc Chaikin suggested using 21-day data for the summation in CMF calculation. When this form of CMF applies to longer-term trend analysis,

21-day is too short. It fails to provide any meaningful indication (Figure 3).

- o The straightforward application of CMF for primary trend analysis may be obtained by using 200-day as the summation or averaging period. However, as shown in Figure 4, CMF showed strong positive (bull) money flow in 2002 while SPY suffered the biggest loss in recent years.
- o CMF is a centered oscillator with simple interpretation of money flow concept. Unlike the other popular indicators such as MACD, a positive or a negative CMF value does not directly indicate a bull or a bear market status of a primary trend.

The primary trend concept, first introduced by Charles Dow over a century ago, is crucial to today's institutional money managers to whom frequent trading is neither desirable nor effective. This situation has motivated my many years of continued effort in seeking better primary trend indicators. The resulting new Stock Market Emotion Index has generated the technical chart for SPY over the same period (1999 – 2003) shown in Figure 5. In the following sections, I will start to introduce and define this new indicator and then offer my interpretation of Figure 5.
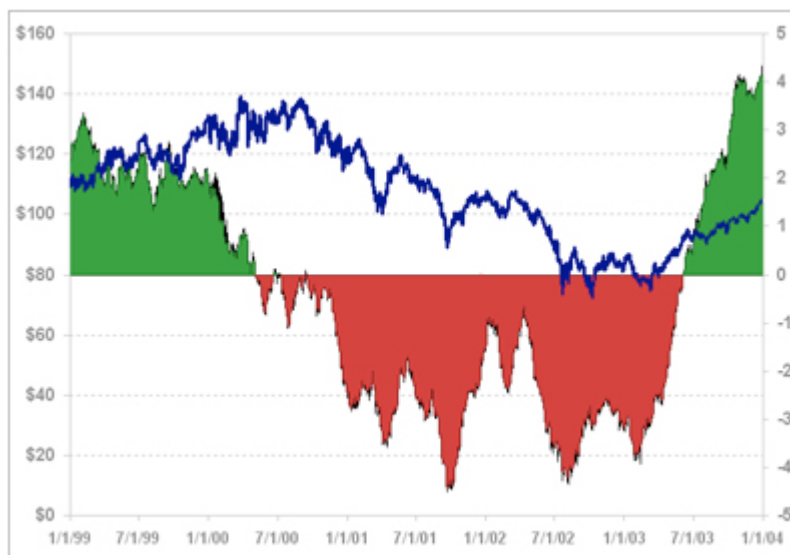

Figure 5: The New Stock Market Emotion Index Chart for SPY (1999 – 2003)

II. Stock Market Emotion Statistics

The word "statistics" for the following discussion is explicitly the plural of "statistic". It refers to the result of applying a statistical algorithm to a set of daily market data. To quantify or measure the human emotion level of a stock's price movement, I take samples at predefined times (open, close), events (high, low), and size (daily volume).

The OBV indicator only calculates inter-day price or volume relationship (see equations (1) and (2)). Instead of using the close price, the CMF indicator uses daily high, low, and close prices (see equations (3) and (4)). To derive the stock market emotion statistic, I measure the market strength based on volume weighted price changes that also take into consideration the market open price as well as daily high, low, and close.
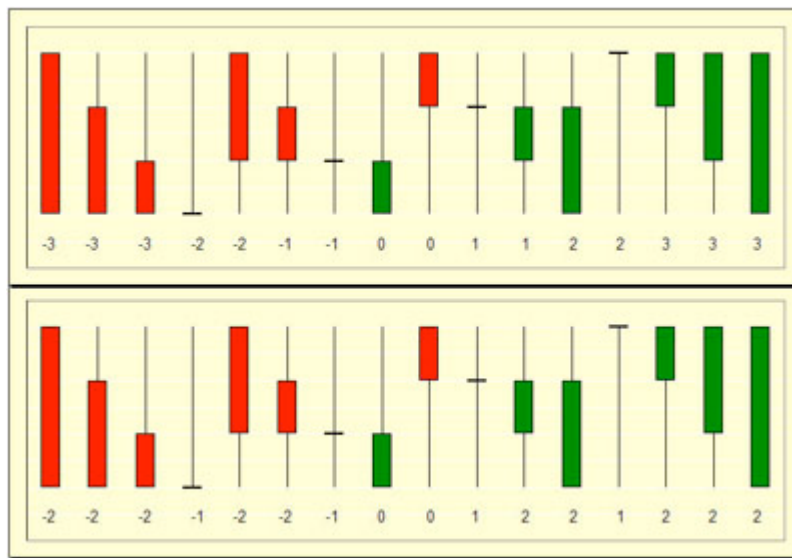

Figure 6: Quantization of Intra-Day Emotion Based on Candle Patterns

CMF directly uses daily high and low prices to calculate the mean price (see equation (3)). I find this is the vital cause why CMF fails to be a consistent indicator, especially for longer-term trend analysis. Any abnormal (noisy) intra-day prices (high or low) will result the mean price heavily distorted. When I perform averaging process over a longer time period, the distorted values make the resulting CMF chart unreliable. To eliminate the limitations of CMF, I find it is necessary to adopt a quantization process. Without

loss of essential information to form technical indicators, Quantization will limit the distortion caused by extreme intra-day prices (open, high, or low).

Through "quantization", I quantify continuous intra-day price movement into a few discrete levels to measure the magnitude of emotion and filter out any abnormal open, high, or low prices. As a special case, OBV indicator can be viewed as based on a simple two-level (-1 and 1) quantization process. A close up day is assigned a value of 1 and a close down day is assigned a value of -1. In general, I may classify all single day candle patterns into 16 typical candle patterns. These 16 candle patterns can then be ranked and assigned a value according to its selling or buying pressure as shown in Figure 6. For example, the candle pattern with a value of 2 shows more buying pressure than the candle pattern with a value of 0. The candle pattern with the most selling pressure (as a measure of negative emotion) is placed on the far left. And the candle pattern with the most buying pressure (as a measure of positive emotion) is placed on the far right. Two examples are shown in Figure 6 as possible ways to assign suitable values and rank the emotion levels based on candle patterns.

In my experiments of developing new technical indicators, the above quantization process proves very effective in removing the distortion impact of the extreme values. Through the quantization process described above, I can obtain a series of data samples measuring the daily human emotion levels for any stock over a given time period. For example, if today's close is higher than open, I assign a positive number to quantify the day's emotion. If today's close is lower than open, I assign a negative number to quantify the day's emotion. I name this statistic as Supply Demand Statistic (SDS) and will be discussed with more details in the next section. With SDS, each day is a new start. Yesterday's market data is assumed to have no impact on today's market emotion measurement. In particular, if a stock price has a gap down today but the close is higher then the open price, the SDS measure is positive. This is different from the closing price based analysis where a gap down will inevitably produce a negative effect on trend indication.

Since volume accurately signifies the degree of crowd emotion, my next step is to apply volume data to weight each daily statistic. The given statistic (such as SDS) is weighted by average volume over a given period (e.g., 21 days) to obtain the *stock market emotion statistic*. An example of the stock market emotion statistics derived from 6-month data of S&P 500 index share (SPY) is shown in Figure 7.

At first glance, the derived stock market emotion statistics appear random, denoting that roughly 50% of trading days display positive human emotion and the other 50% display negative emotion. Please notice that having a 50/50 ratio in this case does not indicate that it is completely random. As we will discover in the next, the statistical characteristic of stock market emotion has its unique dual-mode and non-symmetric probability distribution.

Through a quantization process, there are always trading days with zero emotion statistic values. They represent those days when the buying and the selling forces are about equal. Recall that Figure 6 shows two zero emotion candle patterns. Another special case with zero emotion is a doji candle pattern with open and close prices exactly in the middle of high and low. Depending on the market volatility, neutral emotion days can occur quite often. In a less volatile market condition, the majority of the trading days could be neutral emotion days. For example, this could happen for individual stocks during a sideway time period without any material events.

The stock market emotion statistics shown in Figure 7 can be plotted into a frequency distribution chart as shown in Figure 8. To focus on the actual forces affecting the trend, the frequency of zero values (i.e., neutral emotion days) is not displayed on Figure 8 (Note: if it is displayed, there will be a long bar in the middle). A surprising frequency distribution is now discovered for emotion statistics. Instead of the widely known single-mode normal distribution, the stock market emotion statistics follow a dual-mode and non-normal distribution. I call the right mode "bull emotion" and the left mode "bear emotion".
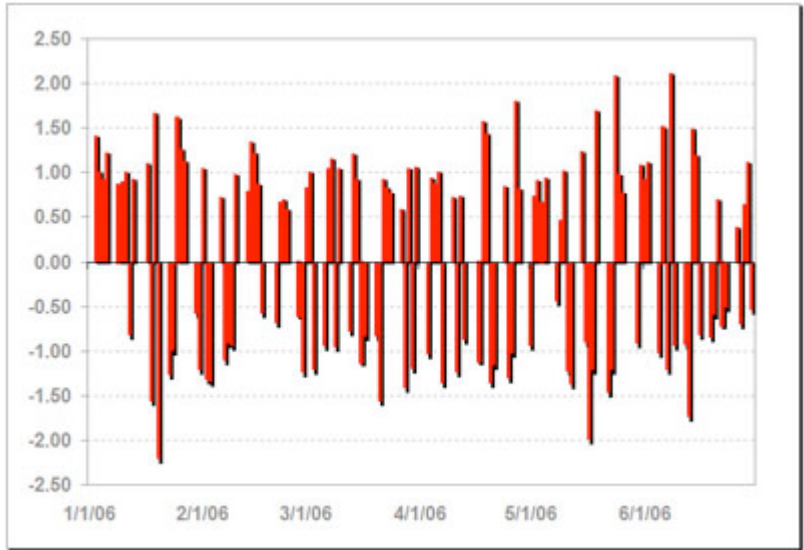
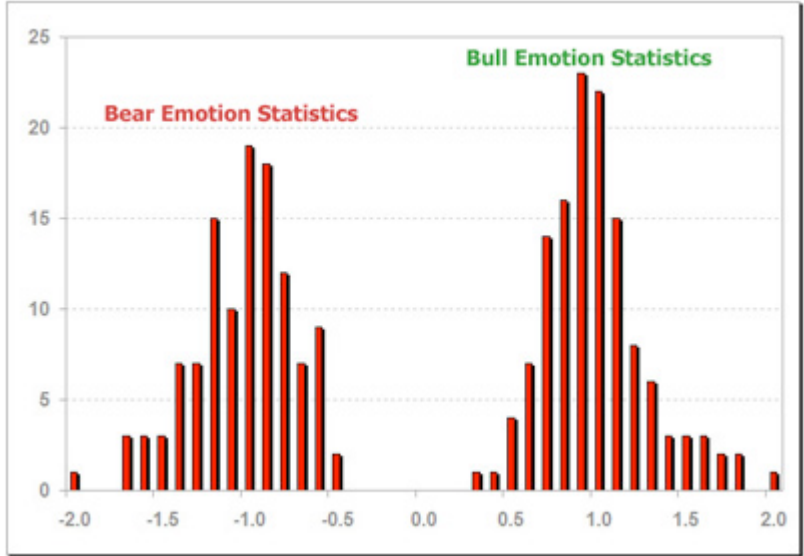Figure 7: Stock Market Emotion Statistics for SPY (6 Months)

Figure 8: Dual-Mode Frequency Distribution of Stock Market Emotion Statistics

III. The Stock Market Emotion Index (SMEI) Defined

As a long-term investor sentiment index, *Stock Market Emotion Index* (SMEI) is intended to provide a consistent indicator for estimating the extent and duration of a primary trend. In order to better understand my logic of deriving the new indicator, without loss of generality and for easier illustration purpose, let me start with one standard bell curve distribution (to be extended later to dual-mode) to define what is in statistical terms a "bull" or "bear" trend. I will use "bell curve" instead of "normal" to emphasize that the actual distribution is not assumed to be a normal distribution.
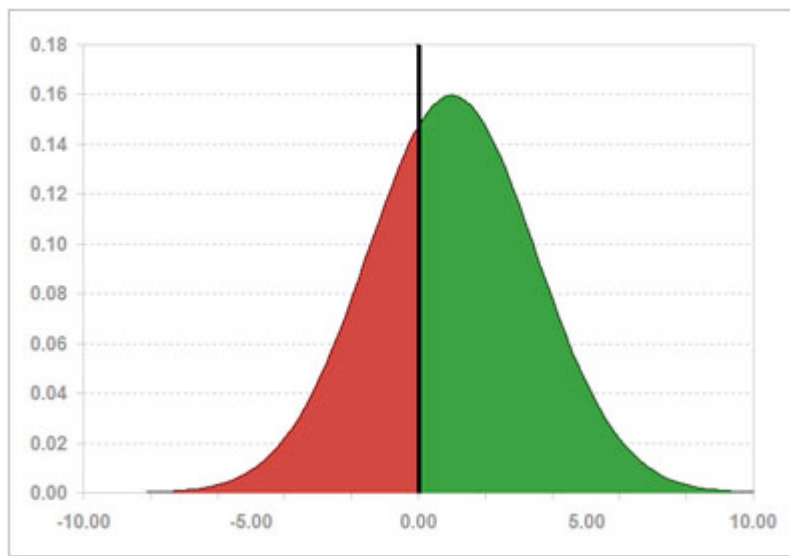

Figure 9: A Statistically Defined "Bull" Trend (Single Mode Bell Curve)

Positive crowd emotion (bulls) drives price upwards and negative emotion (bears) drives price down. The bell curve in Figure 9 shows that the probability of positive crowd emotion (shown in green) is larger than the probability of negative crowd emotion (shown in red), thus it can be statistically defined as a "bull" trend in force.

Let us now revisit the dual-mode frequency distribution of stock market emotion statistics (Figure 8). When a primary trend reversal occurs during a time window (say, one year), if I measure the stock market emotion statistics and continuously monitor the underlying statistical distributions, it can be observed that the dual-mode distribution curves are

shifting as shown in Figure 10. Of cause, the two bell curves may not be shifting together. The cumulative areas under the bell curves, no matter how the bell curves shift, represent the ultimate effect of the fight between bulls and bears.
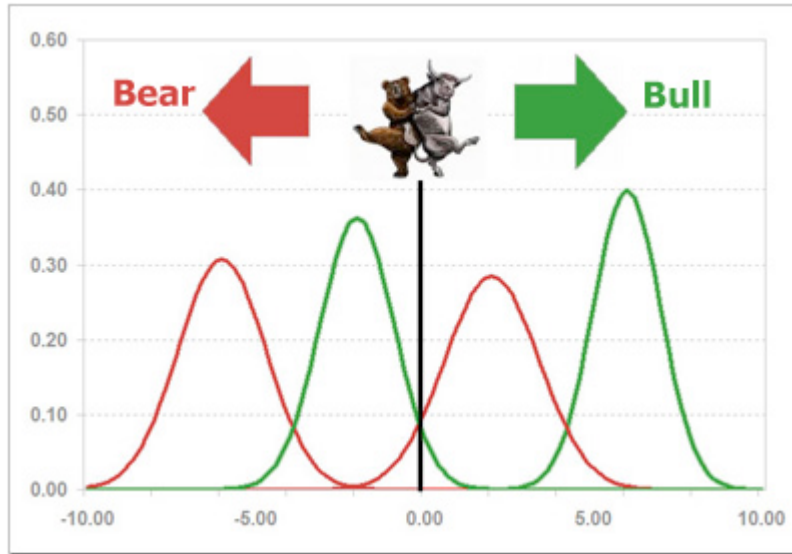

Figure 10: Trend Reversal Indicated By Shifting of Dual-Mode Bell Curves

At certain point, a "bull" trend is triggered when the dual-mode bell curves are shifting far enough to the right and a "bear" trend is the reverse, shifting to the left. To derive the SMEI, I calculate the sum of the "bull" emotions (where the bell curves for stock market emotion statistics are greater than zero) and the "bear" emotions (where the bell curves for stock market emotion statistics are less than zero). If the "bull" is greater than "bear", the primary trend is "bull", and vice versa.

Based on the calculation of the areas under the above dual-mode bell curves, a new technical indicator is ready to be defined. For the results published in this paper, I assumed the simplest form of quantization, i.e., a bear emotion sample is assigned "−1", a bull emotion sample is assigned "+1", and a neutral emotion day is assigned "0". To explore a comprehensive statistical sampling process, I have further adopted a multiple indicator approach and defined the following five stock market emotion statistics, including one based on Relative Strength Index (RSI, see [8]). In my multiple indicator

approach, each indicator utilizes a similar process as illustrated earlier, i.e., performing the quantization process first and then computing the total areas under the dual-mode bell curves. The mathematical formulation of the whole process is summarized as follows. For easier presentation, the sign function is used as defined by:

$$\text{sgn } x = \begin{cases} -1 & : & x < 0 \\ 0 & : & x = 0 \\ 1 & : & x > 0. \end{cases}$$

(5)

For the results published in this paper, I have selected five simple emotion statistics: Close Emotion Statistic (CES), Money Flow Statistic (MFS), Supply Demand Statistic (SDS), Relative Strength Statistic (RSS), and Psychological Level Statistic (PLS). They are defined as follows:

$$CES = sgn(close_{today} - close_{yesterday}) * volume_{today}$$

(6)

$$MFS = sgn(close_{today} - \frac{high_{today} + low_{today}}{2}) * volume_{today}$$

(7)

$$SDS = sgn(close_{today} - open_{today}) * volume_{today}$$

(8)

$$RSS = sgn(RSI_{today} - 0.5) * volume_{today}$$

(9)

$$PLS = \begin{cases} volume_{today}, & if \quad close_{today} > high_{21days} \\ -volume_{today}, & if \quad close_{today} < low_{21days} \\ 0, & otherwise \end{cases}$$

(10)

In equation (10), $high_{21days}$ is the highest intra-day price over last 21 trading days and low_{21days} is the lowest intra-day price over last trading 21 days. The consolidated *Stock Market Emotion Statistic* (SMES) is defined as:

$$SMES = \frac{CES + MFS + SDS + RSS + PLS}{5 * volume_{average}} \tag{11}$$

Here $volume_{average}$ is the average daily volume over last 21 trading days. The final formula for calculating *Stock Market Emotion Index* (SMEI) is defined as:

$$SMEI = \sum_{1}^{260} \frac{CES + MFS + SDS + RSS + PLS}{10 * 5 * volume_{average}} \tag{12}$$

In equation (12), I selected 21-day for volume averaging, 260-day for summation of total emotion statistics (over one year). The dividing factors of 5 and 10 are used to obtain an indicator with its values largely contained within a band between –10 and +10. As I pointed out earlier, the general stock market characteristics follow a dual-mode and non-symmetric distribution. The above computational process does not assume a normal distribution or any single-mode distribution.

In the next sections, I will present case studies to show the new SMEI charts can generate much clearer signals for indicating primary trend reversals. In comparison to the well-known OBV and CMF indicators, the improved robustness and clarity are obtained by the following computational differences.

1. As defined in equation (6), Close Emotion Statistic is a similar statistic used for calculating the OBV indicator. However, instead of only calculating the cumulative total volume, SMEI utilizes 21-day and 260-day windows to obtain a centered indicator. The process effectively removes the memory effect caused by the arbitrary initial OBV value. It also makes SMEI useful for indicating overbought or oversold conditions.

2. Another statistic, Money Flow Statistic (see equation (7)), is a similar statistic used for calculating the CMF indicator. However, the original calculation process

of deriving Chaikin Money Flow indicator has a major defect when it is applied for long-term trend analysis. It is widely accepted that CMF utilizes the same period (say, 21-days) for two summations (equations (3) and (4)). The rationale of each summation was poorly understood in the past. It is now made clear by my earlier description of the dual mode distributions (Section II). These two summations are independent and have complete different interpretations. In most cases, two summations should NOT be made over the same period. The first step of obtaining a good statistic (equations (3) and (11)) is to remove the memory effect of the statistical sample. And the second step of summation (equations (4) and (12)) over a time period (say, 260 days for long term trend analysis) is to calculate the total area (cumulative probability) under bell curves so that the bull and bear emotion forces can be quantified.

3. When defining the consolidated Stock Market Emotion Statistic (SMES), I have proposed Supply Demand Statistic (SDS) designed for capturing the intra-day market emotion, which is based on open and close prices only. In other words, for SDS, yesterday's market behavior has no effect on today's emotion statistic.

4. Furthermore, I have also added two other important statistics - Relative Strength Statistic (RSS) and Psychological Level Statistic (PLS). They are selected to capture the psychological effects quantified by RSI indicator and price breakouts. As I will show in the next sections, by introducing a multiple indicator approach, the SMEI is made more robust for real world applications.

IV. SMEI Index Applied to Market Indexes

As a long-term investor sentiment indicator, SMEI can be applied to stock market indexes as well as exchange-traded index funds. I have tested the SMEI using the S&P market index data from 1950 through 2006 and the charts are shown in Appendix (Figure 21 − 27). For actual trading securities, the examples of an index share (SPY) from 1994 through 2006 and a sector index share (XLE) from 2000 through 2006 are shown in Figure 11, 13, 15, along with the corresponding daily stock market emotion statistic charts (Figure 12, 14, 16).

The SMEI charts (Figure 11, 13, 15) are derived from the corresponding stock market emotion statistic charts (Figure 12, 14, 16) using the computational process defined in the previous section. Here are a few important observations:

- *The extent of the primary market trend*

    o The results help understand the extent of the bull or bear market as given by the magnitude of the SMEI. When SMEI is positive, the higher the value, the more strongly the bull trend is taking place. When SMEI is negative, the lower the value, the more powerful the bear is controlling the trend (Figure 11).

- *The duration of the primary market trend*

    o The SMEI generates very few zero-crossing trading signals (buy or sell) over a seven-year period. When the SMEI approaches zero, it leads to a potential primary trend reversal. Therefore, SMEI can help determine the duration of a bull or bear trend (Figure 11).

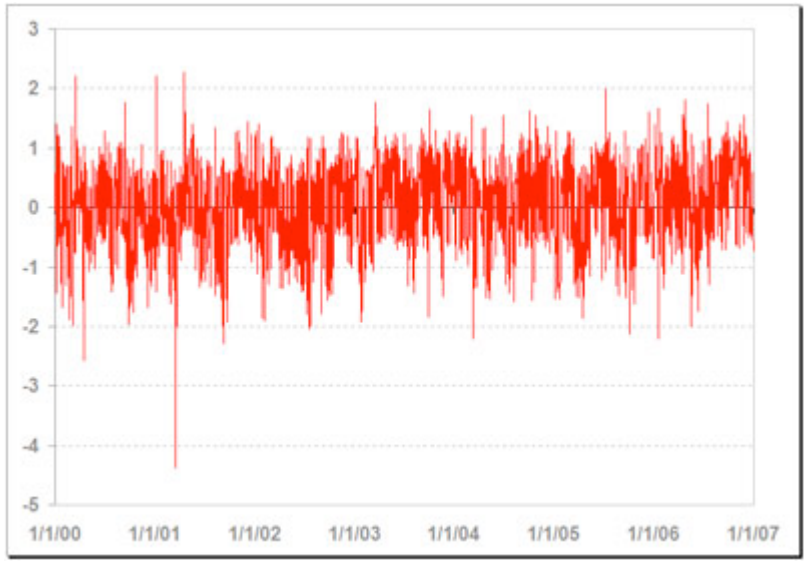Figure 11: SPY Stock Market Emotion Index (2000 - 2006)

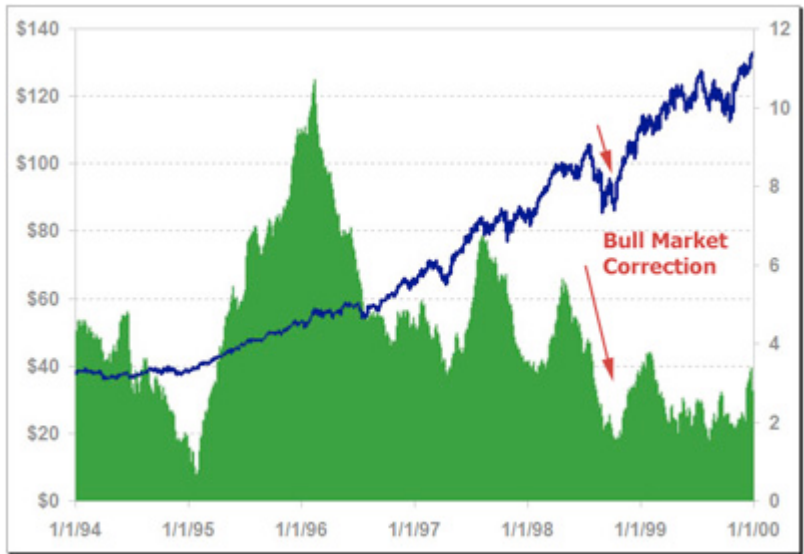Figure 12: SPY Stock Market Emotion Statistics (2000 – 2006)

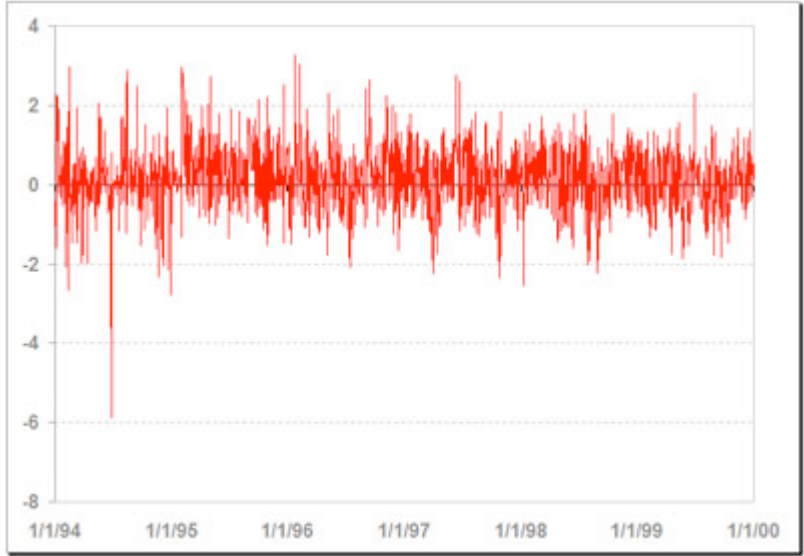Figure 13: SPY Stock Market Emotion Index (1994 - 1999)

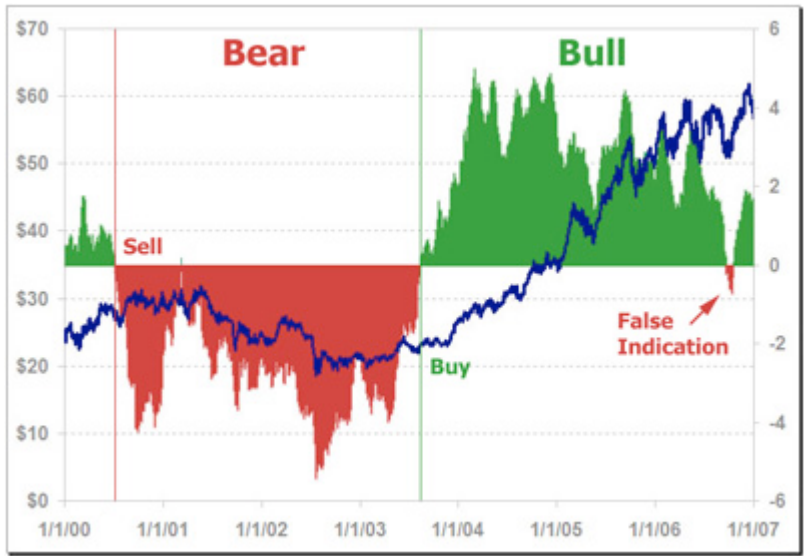Figure 14: SPY Stock Market Emotion Statistics (1994 – 1999)

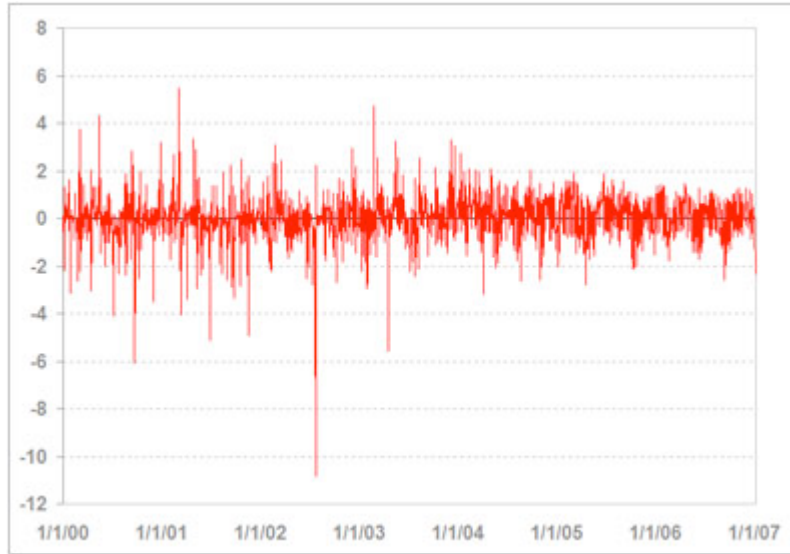Figure 15: XLE Stock Market Emotion Index (2000 - 2006)

Figure 16: XLE Stock Market Emotion Statistics (2000 – 2006)

- *Long term trading indicator*

    o For the entire period when SPY market data was available, the SMEI charts (Figure 11 and 13) for SPY only generated two significant trend reversal signals in thirteen years based on zero crossing with one week confirmation. SPY was sold on September 21, 2000 at $131.16. The SMEI remained negative until June 11, 2003. SPY was then bought at $95.16 when the SMEI became positive and held since then. As of last trading day of 2006 (December 29), SPY closed at $141.69.

- *Market correction versus primary trend reversal*

    o Further examination of the SMEI charts suggests that the sudden drop in the SMEI indicates a price correction. It often may not trigger a bull to bear trend reversal as long as the SMEI stays positive (Figure 13). This phenomenon explains why some research analysts and contrarians have made wrong bear calls due to the lack of knowledge of the primary trend extent and duration.

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- *Predictive power*

  o SMEI could be used as a leading trend indicator. For example, based on SPY
    market data from 1993 through 2006, the SMEI is calculated every year from
    1995 until 2006 for the first trading day of the year (see Table 1). A positive
    SMEI on the first day of the year predicts an up-trend and a negative SMEI
    indicates a downtrend. Actual returns are based on S&P 500 index share data
    (SPY).

Table 1

Year	Stock Market Emotion Index	Trend Indication	Actual Return
1995	1.39	UP	37.98%
1996	8.75	UP	21.84%
1997	4.03	UP	33.48%
1998	3.18	UP	28.66%
1999	2.84	UP	20.37%
2000	1.78	UP [Note 1]	-9.77%
2001	-2.15	Down	-12.06%
2002	-1.49	Down	-21.59%
2003	-3.21	Down [Note 2]	28.18%
2004	3.90	UP	10.70%
2005	3.05	UP	4.83%
2006	0.11	UP [Note 3]	14.32%
2007	5.42	UP	5.15%

[Note 1] The SMEI was positive in early 2000. On March 24, 2000, the market was up 5.85% from January 3, 2000. Afterwards, the SMEI went negative and the market ended lower than at the start of the year.

[Note 2] The SMEI was negative in early 2003. On March 11, 2003, the market was down 11.59% from January 2, 2003. The SMEI then went positive and the market ended higher than at the beginning of 2003.

[Note 3] The SMEI was positive but close to zero at the beginning of 2006. For the first six months of 2006, the market did not go anywhere. But the SMEI stayed positive throughout the year 2006 and rose exceptionally after May 2006, which indicated that a stronger bull market was imminent for the rest of 2006.

- *Overbought and oversold alert*

  o The situation when SMEI reaches a positive or negative extreme could serve
    as a overbought or oversold alert. In Figure 15, the SMEI chart for the energy
    sector index share (XLE) is largely contained between –6 to +6. When SMEI
    is greater than +4 (overbought) or SMEI is less than –4 (oversold), it alerts a
    short-term market extreme condition. Potential short-term bull market
    correction (when overbought) or bear market rebound (when oversold) may
    prevail.

- *Sector strength indicator*

  o It is also worth noting that SMEI can be effectively applied to evaluate a
    sector's trend strength (Figure 15) so that it can help provide tactical rotation
    guidance.

V. SMEI Index Applied to Individual Stocks

Applying SMEI as a primary trend indicator has been extensively tested for over 1,000
stocks, including the stocks with various sizes of market capitalization as well as
international stocks. A complete report with over 500 charts has been generated. It
includes all stocks in the S&P 500 index tested over the recent five-year market period
(2002-2006). A comprehensive charting tool is already developed to easily generate a
SMEI chart for any actively traded security. Like most of other well-known technical
indicators, there could be many different ways to interpret and apply the indicators to
actual trading actions. The system I developed also includes thirteen stock ratings
automatically generated based on the current status of the SMEI readings. The thirteen
stock ratings based on the SMEI are:

1. *SMEI is positive and up in an early bull market -* ***Strong Buy***
2. *SMEI is positive and down in an early bull market -* ***Hold***

3. *SMEI is positive and up in a middle bull market - **Buy***

4. *SMEI is positive and down in a middle bull market - **Hold***

5. *SMEI is positive and up in a late bull market - **Buy***

6. *SMEI is positive and down in a late bull market - **Weak Sell (reduce)***

7. *SMEI is negative and up in an early bear market - **Hold***

8. *SMEI is negative and down in an early bear market - **Strong Sell***

9. *SMEI is negative and up in a middle bear market - **Hold***

10. *SMEI is negative and down in a middle bear market - **Sell***

11. *SMEI is negative and up in a late bear market - **Weak Buy (accumulate)***

12. *SMEI is negative and down in a late bear market - **Sell***

13. *The absolute value of SMEI is less than 0.2 - **Wait (sideline)***

Similar to earlier examples, SMEI helps understand the primary trend's extent and duration. It can recognize market corrections from major trend reversals. When a bear trend starts, it is especially useful as a selling indicator to avoid downtrend losses.

In this section, I selected a few non-perfect cases from my complete report to illustrate how SMEI can be practically applied in assisting investment decisions.

Validation of investment decisions

SMEI can be effectively applied as a validation tool for money managers and research analysts.

Figure 17: Nucor (NUE) Stock Market Emotion Index (2000 - 2006)

Case Study:

On September 10, 2004, research analysts from three firms updated their ratings on Nucor, the biggest steel maker in the United States. Smith Barney Citigroup gave a "Sell"; Merrill Lynch gave a "Buy"; and JP Morgan gave a "Neutral". Three totally different ratings were announced for the same stock on the same day. Investors were confused.

Nucor had the SMEI value of 4.19 on September 10, 2004 (Figure 17), which indicated a strong bull trend was taking place. Since then, Nucor stock price soared during the subsequent two years. In fact, the SMEI first identified Nucor as a buy (the SMEI turned positive) on October 14, 2003 when Nucor was traded at $12.14 (split adjusted). As of December 29, 2006, Nucor closed at $54.66, and the stock was still trending up with the SMEI value of 3.86. Notice that the SMEI did give a false bear indication in the end of 2005. However, the damage was insignificant if I followed the SMEI and bought Nucor in late 2003.

Market correction versus trend reversal

Again, for individual stocks, the most difficult problem facing money managers is distinguishing a short-term bull market correction (or bear market rebound) from a long-term trend reversal. SMEI can be effectively applied as a reference of confirming long-term trend reversals.

Case Study:

The Boeing example shown in Figure 18 is an imperfect case of applying SMEI. The calculated SMEI showed the inception of a false bull trend in early 2002, but the bull trend was short-lived. The SMEI quickly fell to negative again. It was just a bear market rebound. The real bull trend started in late 2004 when the SMEI turned positive again and stayed up afterwards. In the middle of 2006, Boeing had a significant price correction that lasted about three months. The SMEI clearly demonstrated that it was a bull market correction. The subsequent price movements proved the SMEI right.
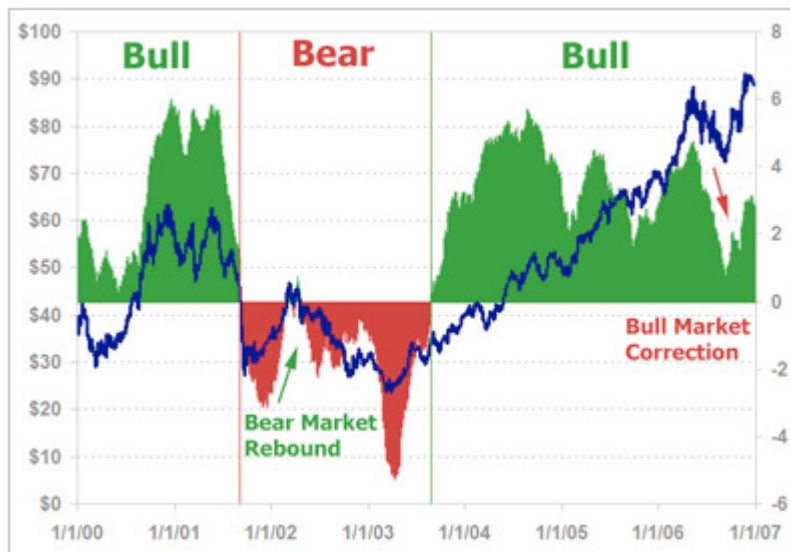
Figure 18: Boeing (BA) Stock Market Emotion Index (2000 - 2006)

Leading versus lagging technical indicators

No analysis can predict a catastrophic event. Since SMEI is capturing emotional changes of the market, early crowd emotion changes can compensate the lagging effect of historical data.

Case Study:

> A public company releases its earning reports quarterly. My back-tests found that unfavorable surprises could sometimes be detected in advance by subtle emotional changes in the market. One explanation for this phenomenon is that contrarians (concerned about over-optimistic expectation) and informed investors (e.g., supply chain partners) could exit before an adverse earning report is released.
>
> The example of General Electric (GE) is given in Figure 19. Several negative earning surprises reported by GE in 2001, 2002, and 2006 were preceded by the SMEI value depreciation. Although this is an imperfect case since the SMEI suggested wrongly a bear market start in 2004. The false alarm was trivial when compared to the accuracy of SMEI in the long run.
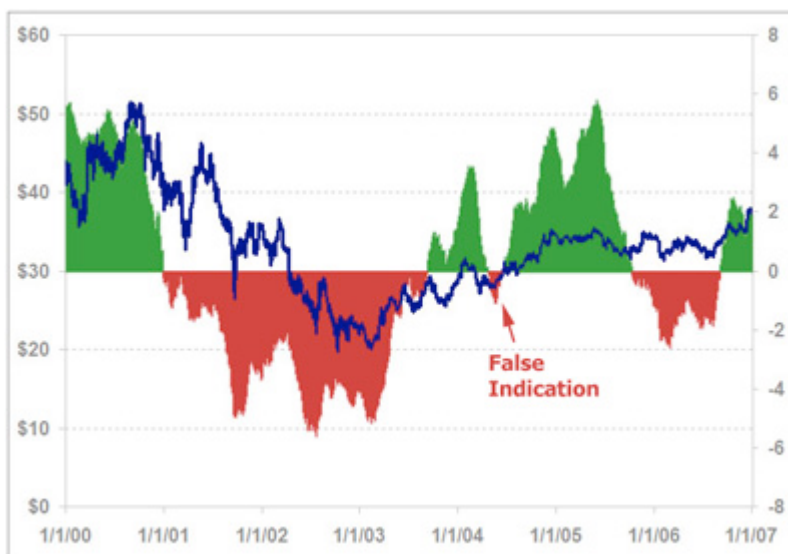
Figure 19: General Electric (GE) Stock Market Emotion Index (2000 - 2006)

Securities where the Stock Market Emotion Index does not apply

SMEI is based on each day's trading prices and volume. In order to calculate the distribution of the underlying human emotion changes, I must have sufficient and meaningful trading data as statistical samples.

Case Study:

SMEI requires securities to have at least twelve months of historical data (intra-day prices and volume). Hence it is difficult to calculate the SMEI for certain securities such as mutual funds and newly listed stocks.

Even though trading data is available for treasury bills and bonds, SMEI is found to have little value as a technical indicator for fixed income securities. The most likely reason for this is that bond trading involves less individual investor participation. Consequently, the trading data for fixed income securities may not be used as reliable statistical samples for capturing crowd emotions.

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Summary

This paper has provided an innovative approach to empowering investment decisions using the proposed Stock Market Emotion Index (SMEI). Specifically, SMEI has many potential applications, including but not limited to:

- Identification of bull market corrections (or bear market rebounds) versus major trend reversals
- Validation of potential buys or sells based on the SMEI value and trend confirmation
- Analysis of lagging positions
- Evaluation of stock selection alternatives
- Assessment of weighting and rebalancing strategies for asset classes, sector, and international investing

Like all other technical indicators, SMEI is not intended to replace human asset managers. The performance results can vary for asset managers using SMEI because there are situations where indications may be interpreted differently. Minor false indications could occur as shown in the case studies. Further research can also expand SMEI applications by looking into convergences and divergences between the pricing action and the indicator.

Following trend is the key to successful investing. For over a century, from Charles H. Dow to Ralph N. Elliott and many others, much research has been conducted to seek early signs when a primary trend changes. When investors buy or sell a stock, their emotions vote for or against the company. Stock market emotion analysis based on the proposed Stock Market Emotion Statistic and Stock Market Emotion Index complements the conventional methods of fundamental and technical analysis, allowing us to quantitatively explore a new dimension of stock market behaviors.

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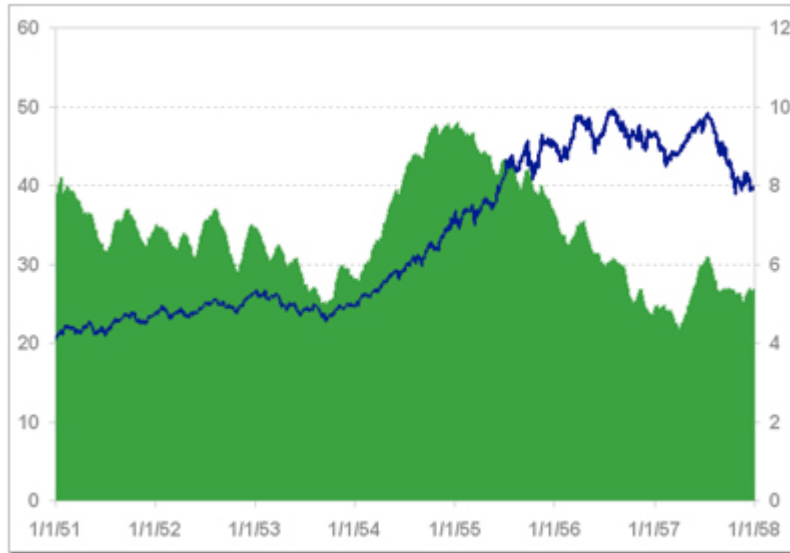
Acknowledgement

Appendix

Figure 20: S&P 90 and S&P 500 Stock Market Emotion Index Chart (1951 – 1957)
(* Prior to March 4, 1957, the primary S&P stock market index consisted of 90 companies, known as S&P 90.)
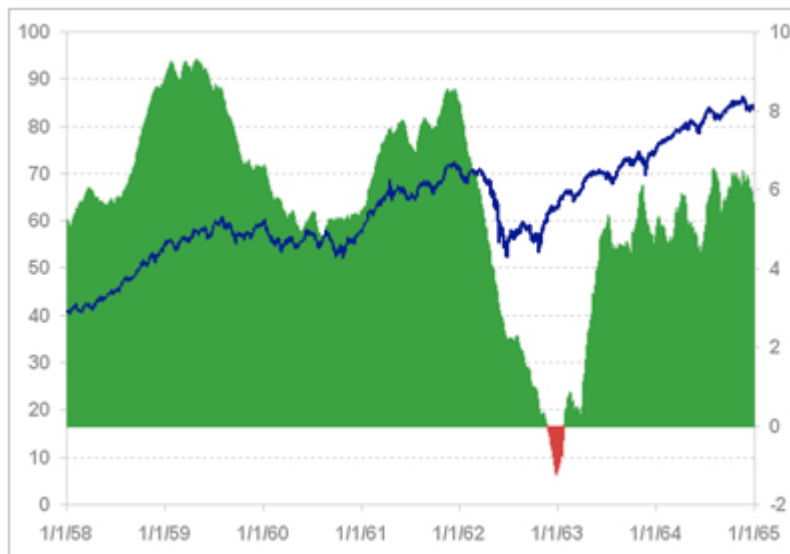

Figure 21: S&P 500 Stock Market Emotion Index Chart (1958 – 1964)

Figure 22: S&P 500 Stock Market Emotion Index Chart (1965 – 1971)

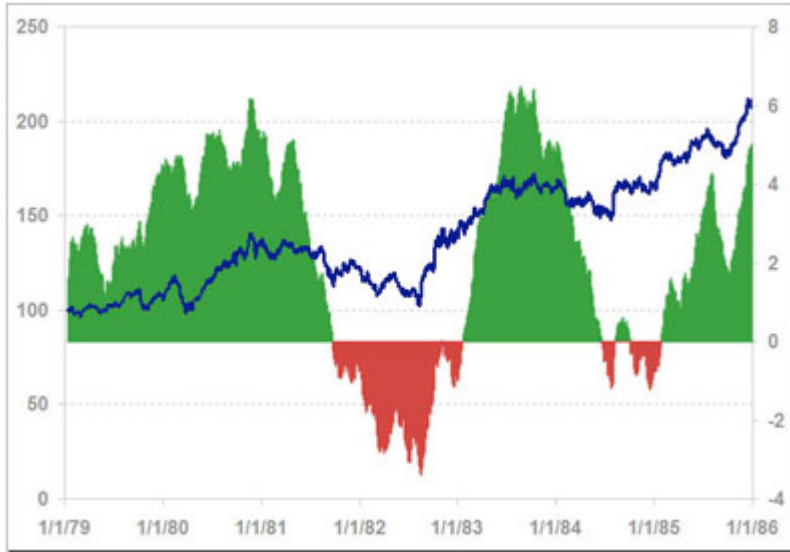Figure 23: S&P 500 Stock Market Emotion Index Chart (1972 – 1978)

Figure 24: S&P 500 Stock Market Emotion Index Chart (1979 – 1985)
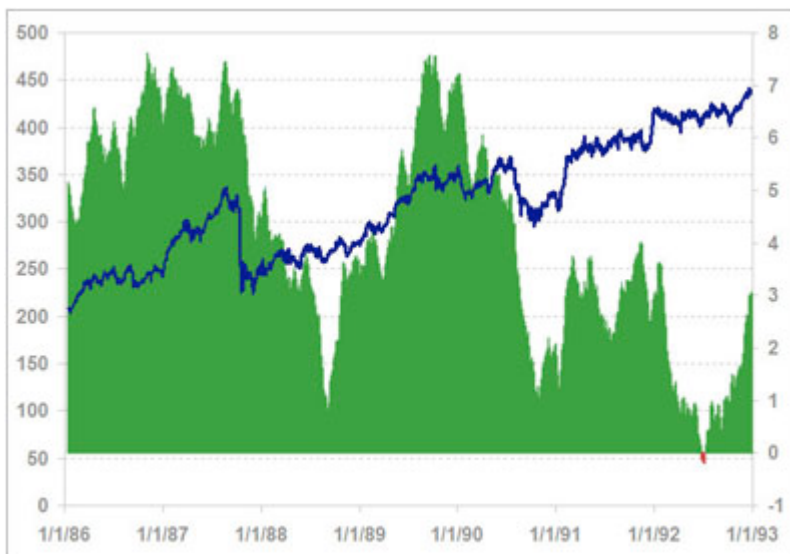

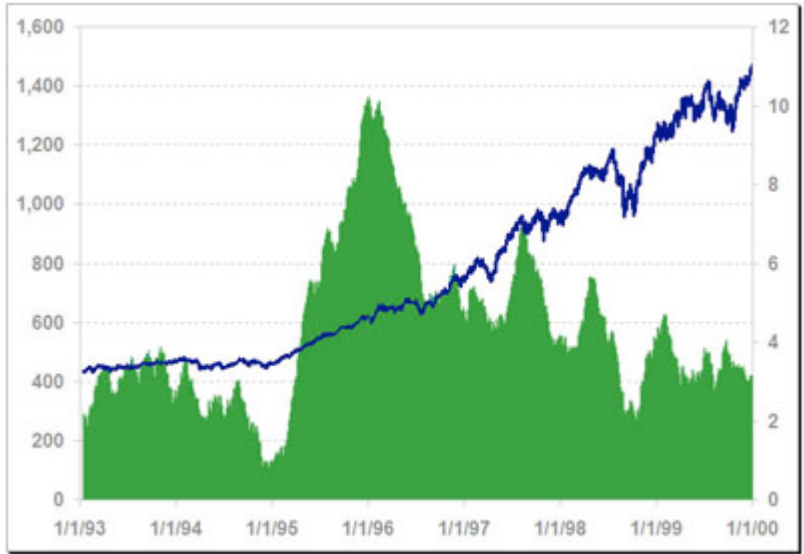Figure 25: S&P 500 Stock Market Emotion Index Chart (1986 – 1992)

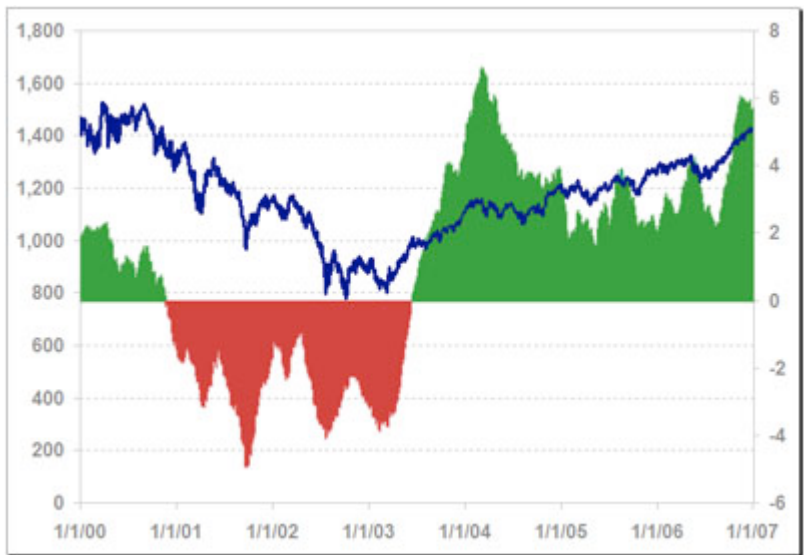Figure 26: S&P 500 Stock Market Emotion Index Chart (1993 – 1999)

Figure 27: S&P 500 Stock Market Emotion Index Chart (2000 – 2006)