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The Boundaries of Technical Analysis

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Market Prognostication

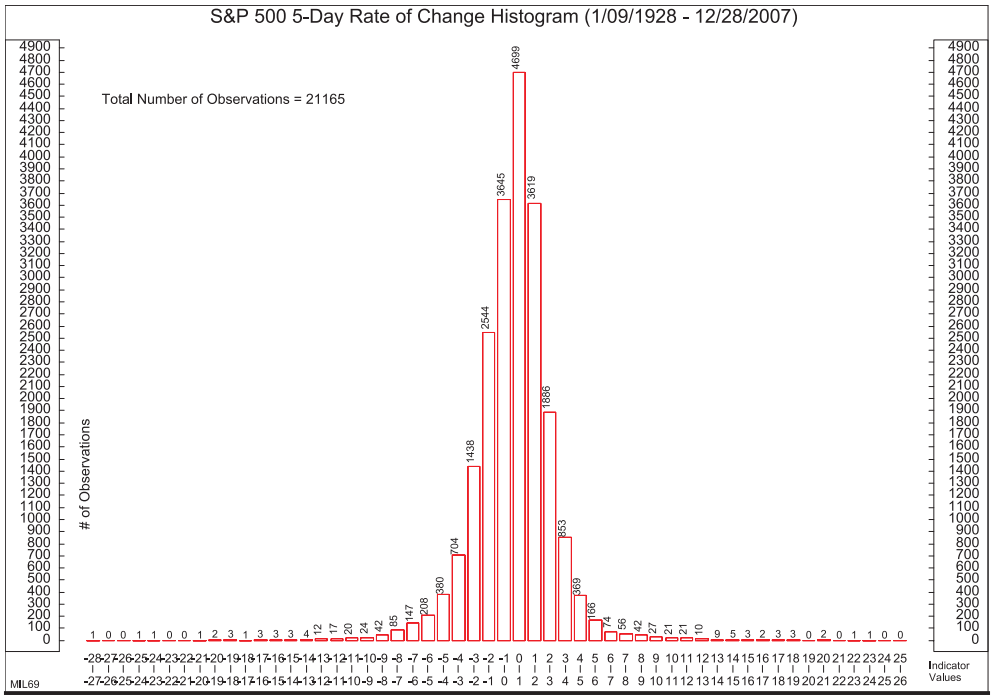
In his treatise on stock market patterns, the late Professor Harry V. Roberts[1] observed that "of all economic time series, the history of stock prices, both individual and aggregate, has probably been most widely and intensively studied," and "patterns of technical analysis may be little if nothing more than a statistical artifact."[2] Ibbotson and Sinquefield maintain that historical stock price data cannot be used to predict daily, weekly or monthly percent changes in the market averages. However, they do claim the ability to predict in advance the *probability* that the market will move between +X% and -Y% over a specific period.[3] Only to this very limited extent – forecasting the probabilities of return – can historical stock price movements be considered indicative of future price movements.

In Chart 1, we present a histogram of the five-day rate of change (ROC) in the S&P 500 since 1928. The five-day ROC of stock prices has ranged from -27% to + 24%. This normal distribution[4] is strong evidence that five-day changes in stock prices are effectively random. Out of 21,165 observations of five-day ROCs, there have been 138 declines exceeding -8%, (0.65% of total) and 150 gains greater than +8% (0.71% of total). Accordingly, Ibbotson and Sinquefield would maintain that over any given 5-day period, the probability of the S&P 500 gaining or losing 8% or more is 1.36%. Stated differently, the probabilities of the S&P 500 returning between -7.99% and +7.99% are 98.64%.

Professor Jeremy Siegel adopts this idea. Siegel states, "The total return on equities dominates all other assets."[5] Based on probabilities, we can be nearly certain that over the long-term, stocks will outperform bonds, gold, commodities, inflation, real estate, and other tradable investments.

Are these ideas true? Are stock price movements effectively random? Do historical stock market returns indicate probabilities of future returns? Can statistical analysis tell us that the equities market will continue to outperform all other assets? Can stock market data never indicate that over a given period of time the market will increase at a rate greater than its historical gain? Can stock market data never point toward the probability of a decline overwhelming the probability of a rally?

Chart 1



[1]Graduate School of Business, University of Chicago 1949-1992

[2]*The Journal of Finance*, Vol. 14, No. 1 (Mar., 1959), Roberts does admit that "phenomena that can be only described as *chance* today," such as the behavior of stock prices and the emission of alpha particles in radioactive decay, "may ultimately be understood in a deeper sense."

[3]*Stocks, Bonds, etc*: 1989 edition. Ibbotson & Sinquefield Ch. 10

[4]The true normal distribution is a mathematical abstraction, never perfectly observed in nature

[5]*Stocks for the Long Run*, J. Siegel

Roll of the Dice

Let us compare the capital markets to a pair of dice, and the shooting of the double sixes to an investment in the equity market. Let us assume that beginning in the year 1900 only one pair of dice existed and all gamblers played with that dice. Let us assume that the dice were weighted and biased towards the shooting of the double six. Rather than the honest odds of 2.78% for the throwing of the double six, let us assume the odds were 5.00%. It is logical to assume that all those who bet on or against the double six would seek compensation commensurate with the perceived (but inaccurately considered) risk. After a few years however, some gamblers may begin to notice a statistical anomaly. It would seem as if the double six were favored. Those gamblers would seek to adjust to the perceived new reality. As more and more gamblers took notice, and accepted the fact that the dice are inherently biased, they will adjust their betting odds accordingly.

Academics are, in fact, comparing the capital markets to those loaded dice. By studying historical market data, they have discovered the true nature of those dice. Ibbotson, Sinquefield, and Siegel can now state with certainty that stocks will outperform bonds and probabilistically return between +X% and -Y% over the next day, week, month or decade.

It is not just members of academia who have discovered the positive bias of the stock market. Investors in general seem to compare the market to those inadvertently loaded dice as well. Historically, investors wrongly assumed that buying stocks was a risky endeavor. As compensation for taking that risk, investors in equities

- Required a cash yield higher than that of long-term corporate bonds[6]
- Sought high absolute dividend yields[7]
- Invested only a small portion of their assets in stock[8]
- Limited their margin exposure[9]

Not yet realizing that the capital markets (dice) were positively biased towards the equity market (double sixes), investors liquidated en masse when dividend yields declined or economic slowdowns materialized. Experiencing decade after decade of stocks outperforming bonds, investors have come to realize that the market compensates for the risks assumed. They no longer require stock yields to be greater than the bond yield.[10] They no longer require a high absolute dividend yield.[11] High long-term exposure to the equity market is common.[12] Investing on margin is an accepted norm.[13] Further confirming the market's positive bias, the 1987 crash passed with nary an effect, and the 2000-2003 Internet-stock implosion did not destroy well-diversified portfolios. The Dow, small-cap, mid-cap, and emerging markets worldwide continue making new, all-time highs. The wealth-creating machine continues running as expected. Investors know that over the long-term (measured in decades), stocks create wealth. Over the short-term (measured in days, months, and years), stock market direction is unpredictable!

Statistics vs. Markets

We disagree with the view of the academics, and deem the application of conventional statistical analysis to stock market prices as misguided. Stock market returns and risks cannot be compared to the probable outcomes of the throw of a pair of dice.[14] Nor can a bell-shaped curve generated by historical stock price movements be compared to the bell-shaped curve generated by a Quincunx board.[15] This is because an economic system is not the same as a physical system. In a physical system, predicted outcomes of dice rolls and Quincunx ball drops are true by definition. Trials or historic tests are not required to determine future outcomes. The probabilities of the outcomes are inherent within the nature of the object or system.

In economic systems such as the Capital Asset Price Structure of the United States markets, there are no physical objects or material systems to analyze. Historical returns and risks may never be replicable. The structure is in a constant state of unrest. Economies based on capitalism can turn to socialism. Heavily regulated or protected industries can be liberalized. Thriving industries can virtually vanish due to foreign competition. Industries prosperous in a free environment may encounter excessive regulation or nationalization by a socialistically inclined Congress. Tax rates may be raised or lowered. The unit of account itself (the currency) may be recalibrated. The Federal Reserve may mismanage the supply of money and credit, transform mild recessions into deep depressions, or turn normal cyclical recoveries into credit based booms. In short, when measuring the capital markets, particularly the stock market, one is measuring the results of a myriad of factors that may or may not repeat. Unique factors that may affect the markets in the future are not necessarily part of the historic system being measured.

Most importantly, statistical analysis of stock *prices* does not measure any of the various financial statistics of the companies that make up the market. Nor does statistical analysis measure any of the economic and political factors that contribute to the wealth of the nation. *All that is actually being measured are the prices that investors are paying* for those economic entities. Prices paid for marketable securities are far removed from a physical or natural system suitable to the rigors of statistical dissection.

We therefore believe that based on statistical analysis one can only affirm that the stock market may or may not outperform bonds in the future or that stocks may or may not exhibit a long-term rising price trend in the future. We can only know with a certainty that stocks may or may not compensate investors for risk assumed, and we can have no idea where the market will trade one day, one week, one month, one year, or one decade from the present.

We plainly disagree with Ibbotson, Sinquefield and Siegel, and do not recognize the ability to predict probabilities of stock market fluctuations. We take note that Nobel Prize winning economists portray the movement of stock prices as a random or drunkard's walk.[16] Does this understanding of stock price movements mark the futility of technical market analysis?

[6]From 1871-1938 dividend yields averaged 1.1/4 times bond yields. From 1938-1955 they averaged 2 times the bond yield. *Security Analysis*, Graham and Dodd 1962 edition page 420

[7]At the eight market peaks from 1901 to 1929 yields averaged 3.55%. At the 10 market peaks from 1930 to 1956 yields averaged 4.74%. At the 10 market peaks from 1960 to 1984 yields averaged 3.11% At the five market peaks since 1987 yields averaged 1.97% (*Ned Davis Research* reports 405 and 400)

[8]NDR charts # S485 and S486.

[9]Investors have increased margined investments as % of GDP from .43% in 1950 to 2.00% currently. NDR charts 20420

[10]Bond yields are currently 2.4 times stock yields

[11]At the five market peaks since 1987, yields averaged 1.97% (Ned Davis Research reports 405 and 400)

[12]NDR charts # S485 and S486

[13]Investors have increased margined investments as % of GDP from .43% in 1950 to 2.00% currently. NDR charts 20420

[14]Paul M. Montgomery *Universal Economics* Jan 2, 2007 (757-597-9528)

[15]See http://www.jcu.edu/math/isep/Quincunx/Quincunx.html

[16]William Sharpe, *et al. Investments*, (6th Ed.)

Paradox of Prediction

In fact, were the movements of stock market prices to be of a random nature, the ultimate price trend may still be known and predictable in advance. This apparent paradox – that directionality can be predicted even if price movements were random – is based on a unique exception to the drunkard's walk rule.

The famed zoologist and writer Stephen Jay Gould gives the following example. "A man staggers out of a bar dead drunk. He stands on the sidewalk in front of the bar, with the wall of the bar on one side and the gutter on the other. If he reaches the gutter he falls down into a stupor and the sequence ends. For simplicity's sake, [and this example fits with the linear direction of stock price movement, either up or down] we will say that the drunk staggers in a single line only, either toward the wall or toward the gutter. He does not move at right angles along the sidewalk parallel to the wall and gutter.

"Where will the drunkard end up if we let him stagger long enough and entirely at random? He will finish in the gutter absolutely every time and for the following reason: Each stagger goes in either direction with 50% probability. The bar wall at one side is a 'reflecting boundary.' If the drunkard hits the wall, he just stays there until a subsequent random stagger propels him in the other direction. In other words, only one direction of movement remains open for continuous advance – toward the gutter.

"In a system of linear motion structurally constrained by a wall at one end, random movement, with no preferred directionality whatsoever, will inevitably propel the average position away from a starting point at the wall. The drunkard falls into the gutter every time, but his motion includes no trend whatever toward this form of perdition."[17]

We posit that rigorous technical analysis can identify areas of "reflecting boundaries" in the capital markets. The direction of stock price movements can therefore be predicted in advance despite the perceived random nature of their daily and weekly moves.

Graham & Dodd Meet Technical Analysis

Value investors admit that stock prices do not always reflect the many financial statistics of the companies they value. The only certainties that stock prices do reveal are the levels at which buyers and sellers have agreed to transact.[18] The discipline of value investing depends on this fact, that stock price fluctuations are not always value driven. Stock price movements must be radically independent of fluctuations in the value of the underlying entity in order for value investing to be effective. If stock prices always reflect the underlying value of a company, how could a company whose intrinsic value was $50 ever trade at $20? How could a company worth $50 ever trade at $100? How could a stock, or for that matter the market, ever be overpriced or undervalued?

A more philosophical complexity is the following: If a stock appraised at $50 can be found to trade at $20, why can it not forever remain at $20? How can we be confident that this stock will return to intrinsic value? Why should a market that evaluates securities incorrectly be assumed to correctly price those very same securities in the future?

Benjamin Graham was asked this very question. In testifying before Congress, Graham stated, "That is one of the mysteries of our business, and it is a mystery to me as well as to everybody else. We know from experience that eventually the market catches up with value."[19]

Graham, the father of fundamental security analysis considered the philosophy behind his discipline to be a "mystery."[20] By our understanding, value investing works because excessively low or high stock prices relative to intrinsic valuation serve as a *technical indicator* of the proximity of a reflecting boundary. That reflecting boundary exists at a price level and during a time period when many diverse fundamental and technical factors converge. Low valuation is one of the factors that can contribute to that reflecting boundary. Low valuation itself is not that boundary, for if it were, then levels of undervaluation that determine a bottom would remain consistent over time. However a stock or market may bottom at 40% of intrinsic value, at other times it may do so at 50% or 30% of intrinsic value. There must be other factors that combine to contribute to that reflecting boundary. We do not attempt to discover those factors. We use technical data to discover when and at what level these reflecting boundaries exist. In our view, the primary *causes* of stock price movements are too diverse, complex, and hidden to be analyzable. What we as technicians attempt to do is recognize the *symptoms* that lead and accompany directional movement of stock market prices.

We posit that "reflecting boundaries" exist in the stock market. We do not know the nature of these reflecting boundaries. They are clearly not a predetermined boundary that can be measured and calculated. Nor are they fixed at a specific price level or calendar date. Their existence can at times be temporary, or very long lasting. There can be a single boundary or a series of boundaries at successively higher or lower prices. For reasons not knowable through direct analysis, these boundaries can cause stock prices to find support against further decline, or conversely they can cause stock prices to find resistance against further rally.

Discovering the Boundaries

Having theorized that stock price movements are generally random but are affected by boundaries of support and resistance, let us now reveal methods of discovering those boundaries. Let us return to Chart 1, the five-day rate of change.

This is a simple indicator, one that is based solely on price and time. Note that the curve generated by five-day rates of change is a standard curve. This five-day data should proffer no predictive edge, and a statistician would conclude that these five-day rates of change are random. They are random in the sense that they cannot be predicted in advance. But where others perceive randomness, we take notice. Why would buyers be willing to pay 8-24% more for a diversified portfolio of stocks than they were willing to pay five days prior? Why would sellers be willing to accept 8-24% less than they were willing to receive five days prior? We do not care to know the answer. We care that it is a good question. We care that the action of those buyers and sellers are effectively aberrant.

Our notion is that the only information that can be gleaned from stock prices is *the willingness of investors to pay those prices.* We therefore study the tails of standard statistical curves and take note when they reflect anomalous behavior on the part of those who determine market prices. The specific *times* at which this action takes place cannot be predicted in advance, and their occurrence is effectively random. But those uncommon actions, when they do take place, signal the proximity of that "reflecting boundary." When an apparent reflecting boundary has been hit by a myriad of buyers and sellers, the market inevitably propels away from that boundary.

[17] *Full House* by Stephen Jay Gould, pages 149-151
[18] See *The Essays of Warren Buffet.* Cunningham, Pg. 65
[19] 84th Congress, 1st session, "*Factors Affecting the Buying and Selling of Securities*," March 11, 1955
[20] Technical disciplines are indeed a mystery. We do know from experience though, that these disciplines work

Chart 1

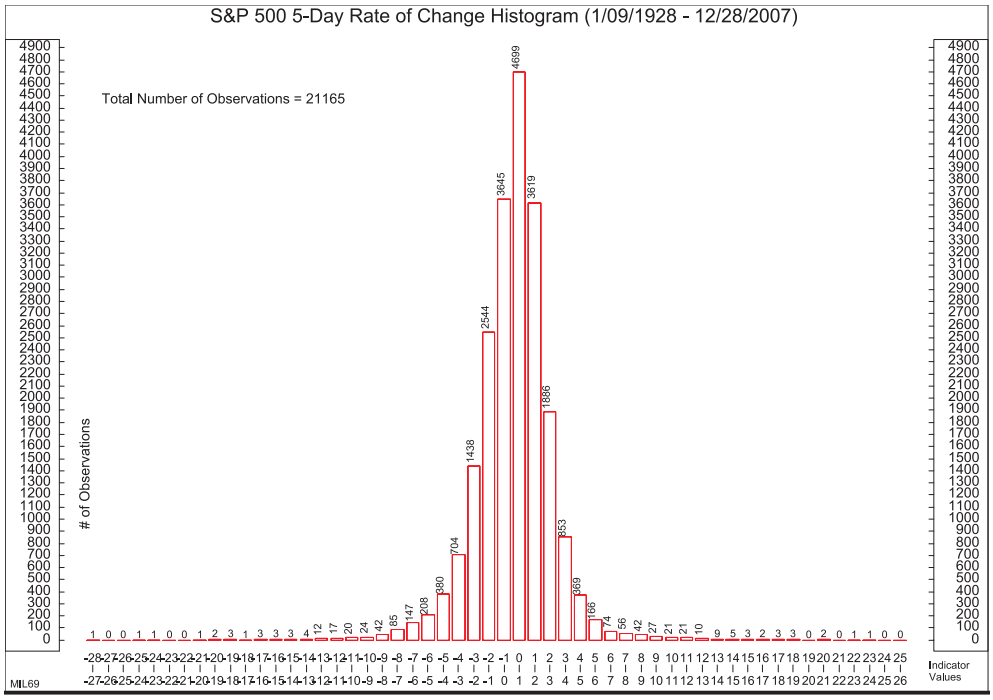
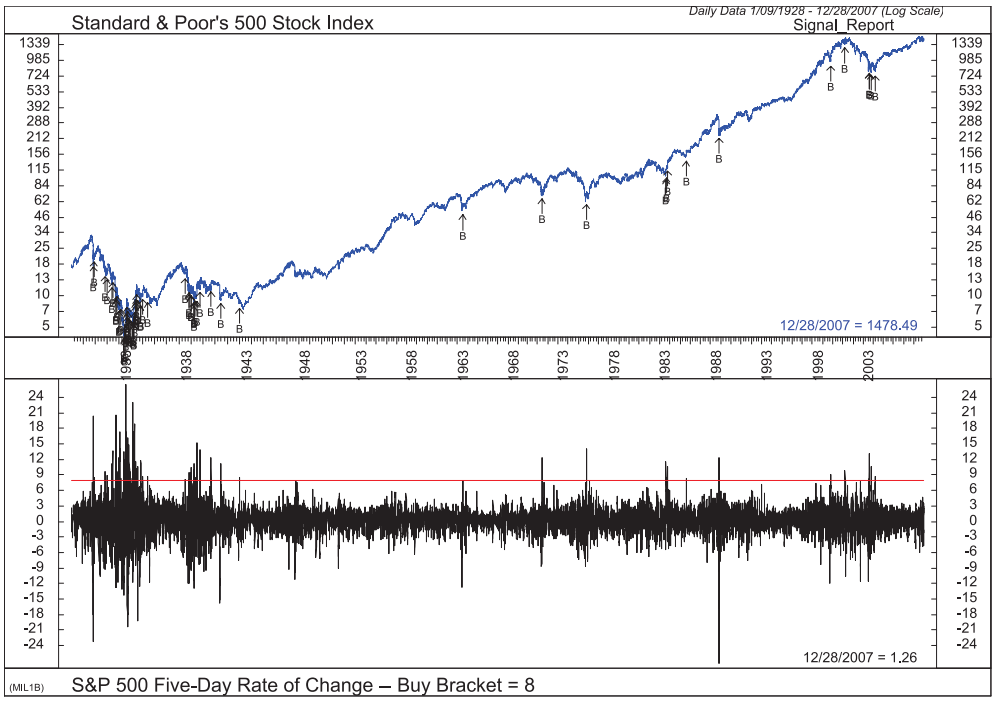


Chart 2 displays an arrow *each time* the S&P 500 has rallied 8%[21] or more over a five- day period. See Appendix 1 for all signal dates.

Chart 2
Five-Day ROC +8%



Note that the periods during which those extraordinary events occur are often proximate significant turning points.[22]

[21]We are not the first to notice the predictive ability of this raw Five-day ROC data

[22]Readers should note that prior to March, 1957, the S&P 500 consisted of only 90 stocks and was therefore less suitable to general market analysis

Technical indicators do not reveal causes of market movement. They simply indicate the proximity of a reflecting boundary. We therefore use technical indicators only in context of a potential reflective boundary. When creating models we utilize data only when they are proximate to a measured high or low, a potentially precise turning point.

Using the five-day Rate of Change we eliminate all signals that are not proximate to potential and significant short term lows. Each signal date that is more than six days after the markets lowest low over the previous 90 days is therefore ignored. Additionally, we void of any thrust type indicator that signals just one to three days after a market low. We therefore eliminate any signal that flashes only one to three days after a 90 day low. This five-day ROC indicator then signals whenever the market has gained 8% or more over five days, as well as having made a new 90 day low within the previous four, five, or six days. See Appendix 2.[23]

Table 1 presents all of the final five-day +8% ROC signals.

Table 1
Five-Day ROC 8% or greater 4-6 days after 90-day low

Signal Date	# of Days Post 90-day Low	Signal Results
3/18/2003	5	**80% 4 Years 7 Months**
10/15/2002	4	**65% 4 Years 4 Months**
7/29/2002	4	**61% 4 Years 6 Months**
8/20/1982	6	**53% 1 Year 2 Months**
10/10/1974	6	**55% 2 Years**
6/1/1970	4	**34% 11 Months**
7/5/1962	6	**65% 3 Years 7 Months**
1/5/1942	5	TOP DAY
6/15/1940	5	**14% 4 Months**
4/5/1938	4	**31% 7 Months**
10/25/1937	6	5 Days to TOP
7/7/1937	6	**5.8% 1 Months**
6/8/1934	5	7 Days to TOP
10/27/1933	5	**24% 3 Months**
3/15/1933	5	**74% 11 Months**
6/6/1932	4	**112% 3 Months**
10/9/1931	4	**9% 1 Month**
6/8/1931	5	**11% 17 Days**
11/15/1930	5	5 Days to TOP
11/19/1929	4	**25% 5 Months**

Recognizing the existence of reflecting boundaries and using *price and time data alone,* we have created an indicator in the S&P 500 Index that signaled within four to six days of the historic lows of:

- ✓ November 13, 1929
- ✓ June 1, 1932
- ✓ February 27, 1933
- ✓ June 26, 1962
- ✓ May 26, 1970
- ✓ October 3, 1974
- ✓ August 12, 1982

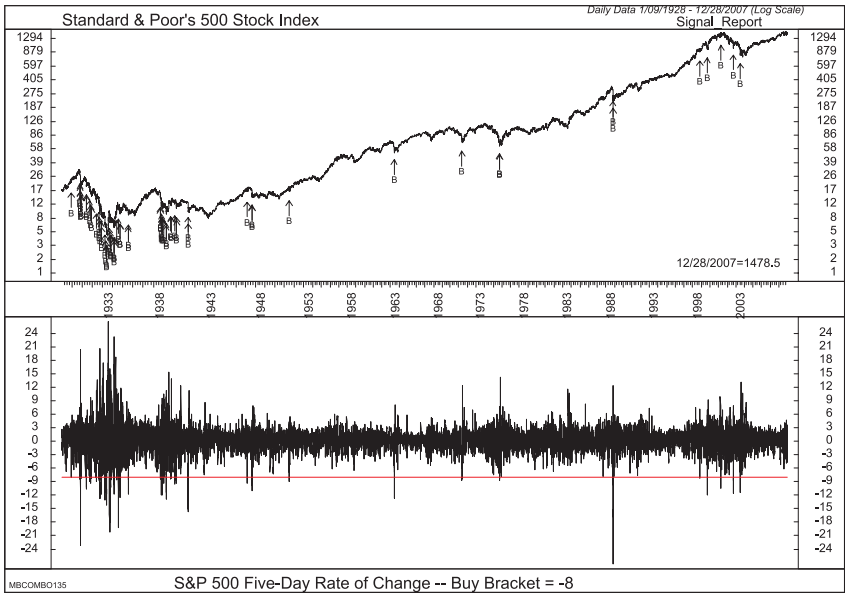
And that signaled within four days of the triple bottom that began the latest bull market:

- ✓ July 23, 2002
- ✓ October 9, 2002
- ✓ March 11, 2003

[23]William J. O'Neill has elaborated on this concept in his market studies.

We have displayed the right tails of the five-day ROC curve. We have established that random movements of stock prices in conjunction with boundary analysis can be used to pinpoint proximate turning points. We now turn to the left tails of the same standard curve. Chart 3 displays an arrow *each time* the S&P 500 has *declined* 8% or more over a five-day period. See Appendix 3 for all signal dates.

Chart 3
Five-Day ROC -8%

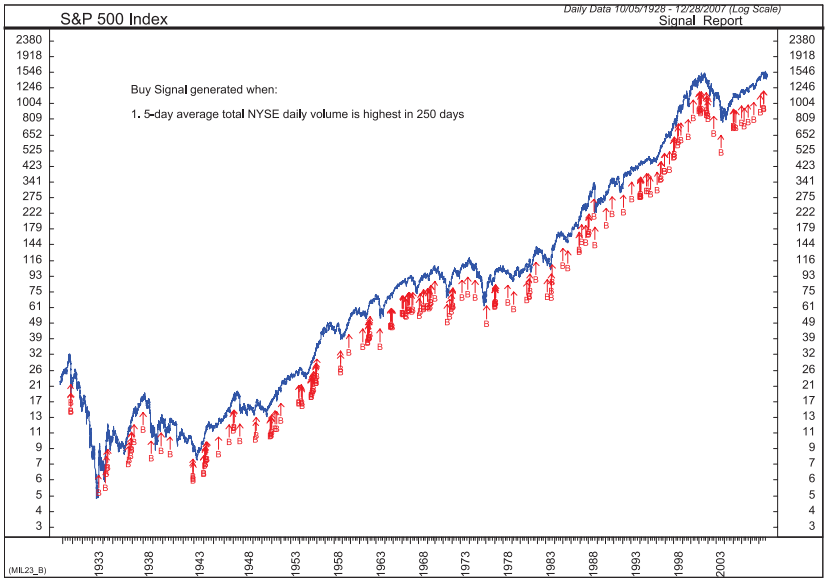


Note that these signals, which use a negative 8% parameter, often occur directly proximate a significant turning point.

Using these -8% five-day ROC signal dates, we eliminate all signals that are not proximate to potential lows. We therefore include only those signals that take place as the market is trading at a maximum of one day[24] after a six month low. All signal dates that are two days or more after a six-month low are eliminated.

Having utilized the two main legs of technical analysis, price and time, we will now introduce the third leg of technical analysis, volume. Five-day market volume can be represented by a standard curve, yet significant increases in market volume are not randomly distributed. The following (Chart 4) indicates each time the five-day average of daily volume was highest in 250 days. Out of 20,876 observations since 1929, there have been 425 instances (2.04% of total) of five-day average daily volume at a 250 day high. See Appendix 4 for all dates on which this occurred.

Chart 4
Five-Day Volume Highers in 250 Days



[24]Oversold action may signal within one day of a low. Only thrust action within three days of a low is suspect

We wonder why sellers would accept 8-24% less than they were willing to obtain five days prior. More importantly, we note that their urgency to sell (as reflected in the 250-day volume figures) increases dramatically as prices decline. In Table 2 we combine price, time and volume. Table 2 lists all periods during which both the five-day rate of decline was -8% or greater (price and time) *and* the five-day average of volume was highest within 250 days (time and volume). Additionally, in seeking indications of a technical reflecting boundary, we consider only those dates on which the price the sellers receive for their index of stocks was within one day of the lowest price they could have received during the previous six months (price and time). Results in Table 2 are compelling. By observing aberrations in price, time, and volume, we have created a viable capitulation-defining indicator.

Table 2
Five-Day ROC -8%
Six Month Low
250-Day Volume High

Signal Date	Signal Results
7/23/2002	83% IN 4 1/2 YEARS
9/21/2001	21% IN 3 1/4 MONTHS
9/20/2001	18% IN 3 1/4 MONTHS
9/19/2001	15% IN 3 1/2 MONTHS
9/18/2001	13% IN 3 1/2 MONTHS
9/17/2001	12% IN 3 1/2 MONTHS
9/01/1998	56% IN 1 1/2 YEARS
10/19/1987	63% IN 2 3/4 YEARS
5/28/1962	69% IN 3 2/3 YEARS
9/09/1946	14% IN 1 3/4 YEARS
10/29/1929	25% IN 6 MONTHS
10/28/1929	14% IN 6 MONTHS

Table 3
Five-Day ROC -8%
Six Month Low
250-Day Volume High
Last Signal in Series

Buy Signal Date	One Day Price Lag	Five-day Average of 250 DAY Volume Lag	Six-Month Low Lag	Signal Results
11/6/1929	+1	1	4	21% IN 5 MONTHS
11/14/1929	+1	7	1	28% IN 5 MONTHS
9/9/1946	+1	0	0	17% IN 1 3/4 YEARS
5/28/1962	+1	0	0	62% IN 3 2/3 YEARS
10/23/1987	+1	1	4	61% IN 2 3/4 YEARS
10/28/1987	+1	4	7	50% IN 2 3/4 YEARS
9/2/1998	+1	0	2	48% IN 1 1/3 YEARS
9/21/2001	+1	0	0	16% IN 2 1/2 MONTHS
7/23/2002	+1	0	0	73% IN 4 1/2 YEARS

This method can be refined further. We wait until a series of five-day 8% declines ends. Since we cannot know when that final day of a series occurs until a day after the series ends, we set our signal dates as one day after a -8% ROC extreme. To accommodate this adjustment we allow our buy signal to lag the 250-day volume boundary and the six-month low boundary by a maximum of seven days. (see table 3)

Recognizing the existence of reflecting boundaries, and using *price, volume and time* alone, we have created an indicator in the S&P 500 Index that signaled within four-days of the historic lows of: November 13, 1929; October 19, 1987; July 23, 2002; and near the final low of June 26,1962.

TRIN + Five-Day Volume

This concept that markets turn at reflecting boundaries permits the same indicators to call both tops and bottoms. It depends on whether those indicators are signaling at a potential top boundary or at a potential bottom boundary. An excellent example is the S&P 500 TRIN indicator.

We consider a reading on the S&P 500 TRIN at or below .50 as representing extreme urgency to buy. Since 1957 there have been 530 (4.13% of total) days in which TRIN was at .50 or below. Looking at the five-day volume figures, we find that since 1957 there have been 240 instances (1.87% of total) in which the five-day average volume was highest in 375 days. (see appendix 5) When TRIN trades at or below.50 on a given day or on the previous day, and the five-day average volume is highest in 375 days on that day or on the previous day, we have an indicator suggestive of a potential market turn.

If the market has traded at a new one-year low within the previous ten days (supportive boundary), we get a buy signal. See Table 4, and note that all seven signals resulted in long-term bull markets. (see chart appendix 6)

If however the market is trading at a new three year high (potential top boundary) and during the previous five days TRIN traded at or below .50, and the five-day average volume was highest in 375 days within one day of the TRIN extreme, we get a sell signal. (see table 4a) Note that all signals led to bear markets. (see chart appendix 7)

Table 4
TRIN + Volume + 1-Year Low
BUY SIGNAL

Signal Date	Signal Results	TRIN Date	5-Day Volume Date	1-Year Low Date
10/23/1957	49% Gain in 1.75 Years	10/23/1957	10/23/1957	10/23/1957
5/29/1962	Early Signal +61% in 3.5 Years	5/29/1962	5/29/1962	5/28/1962
3/9/1982	Early Signal +54% in 1.6 Years	3/9/1982	3/9/1982	3/8/1982
8/18/1982	54% Gain in 1.3 Years	8/17/1982	8/18/1982	8/12/1982
8/3/1984	106% Gain in 3 Years	8/3/1984	8/3/1984	7/24/1984
10/20/1987	56% Gain in 2.75 Years	10/20/1987	10/20/1987	10/19/1987
7/24/2002	85% Gain in 5 Years	7/24/2002	7/24/2002	7/23/2002

Table 4a
TRIN + Volume + 3-Year High
SELL SIGNAL

Signal Date	Signal Results	TRIN Date	5-Day Volume Date	3-Year High Date
9/27/1965	3.63% rally followed by 22% Bear Market	9/24/1965	9/24/1965	9/27/1965
11/28/1980	Top day to 27% Bear Market	11/20/1980	11/19/1980	11/28/1980
8/13/1987	8 days and .63% before 1987 crash -33.5%	8/11/1987	8/12/1987	8/13/1987
3/21/2000	3 days and 2.2% to 2000-2003 45% Decline	3/16/2000	3/17/2000	3/21/2000

Combining extremes in TRIN, volume, and proximity to potential reflective boundaries, creates an indicator that correctly identified seven major bull markets and four major bear markets. (see charts appendix 6 and 7)

We have demonstrated that at significant turning points, the ultimate trend of the market can be predicted. We have introduced a new idea in technical analysis, the idea of "reflecting boundaries." While in this paper we have demonstrated longer term boundaries, this idea can be used for the shorter term as well. This concept when used in conjunction with existing technical indicators can greatly assist the analyst in pinpointing market turning points. We hope this paper opens new possibilities for those who work at this mystifying discipline.

Appendices

Appendix 1

All signals listed

S&P 500 GAINS 8% over a 5-Day Period					
DATE	DATE	DATE	DATE	DATE	DATE
3/19/2003	9/9/1939	10/27/1933	12/9/1932	7/27/1932	1/5/1931
3/18/2003	9/8/1939	10/25/1933	11/12/1932	7/26/1932	1/3/1931
10/17/2002	9/7/1939	7/27/1933	11/11/1932	7/25/1932	11/15/1930
10/16/2002	9/6/1939	7/7/1933	11/10/1932	7/23/1932	12/7/1929
10/15/2002	9/5/1939	7/6/1933	10/19/1932	7/15/1932	11/21/1929
8/12/2002	10/5/1938	6/21/1933	10/17/1932	7/14/1932	11/20/1929
7/31/2002	10/4/1938	6/12/1933	9/24/1932	7/13/1932	11/19/1929
7/30/2002	10/3/1938	6/2/1933	9/23/1932	6/15/1932	
7/29/2002	10/1/1938	5/29/1933	9/22/1932	6/14/1932	
3/21/2000	6/25/1938	5/27/1933	9/21/1932	6/7/1932	
10/15/1998	6/24/1938	5/4/1933	9/7/1932	6/6/1932	
11/2/1987	6/23/1938	5/3/1933	8/26/1932	3/5/1932	
8/6/1984	6/22/1938	5/2/1933	8/25/1932	2/17/1932	
10/13/1982	6/21/1938	5/1/1933	8/24/1932	2/16/1932	
10/12/1982	5/7/1938	4/25/1933	8/23/1932	2/15/1932	
10/11/1982	4/13/1938	4/24/1933	8/19/1932	2/13/1932	
8/26/1982	4/12/1938	4/22/1933	8/18/1932	1/11/1932	
8/25/1982	4/9/1938	4/21/1933	8/11/1932	1/9/1932	
8/23/1982	4/6/1938	4/20/1933	8/10/1932	1/8/1932	
8/20/1982	4/5/1938	4/19/1933	8/9/1932	11/9/1931	
10/15/1974	1/11/1938	4/13/1933	8/8/1932	10/21/1931	
10/14/1974	1/10/1938	4/11/1933	8/6/1932	10/20/1931	
10/11/1974	1/8/1938	4/10/1933	8/5/1932	10/10/1931	
10/10/1974	1/6/1938	3/20/1933	8/4/1932	10/9/1931	
6/2/1970	10/29/1937	3/18/1933	8/3/1932	10/8/1931	
6/1/1970	10/25/1937	3/17/1933	8/1/1932	6/26/1931	
7/5/1962	7/7/1937	3/16/1933	7/30/1932	6/25/1931	
1/5/1942	6/8/1934	3/15/1933	7/29/1932	6/24/1931	
6/15/1940	1/19/1934	1/4/1933	7/28/1932	6/8/1931	

Appendix 2

4-6 Days after 90 Day Low		
Signal Date	Days post 90-day low	Signal
3/18/2003	5	BUY SIGNAL
10/15/2002	4	BUY SIGNAL
8/12/2002	14	Mid-Range
7/29/2002	4	BUY SIGNAL
3/21/2000	20	Mid-Range
10/15/1998	31	Mid-Range
11/2/1987	10	Mid-Range
8/6/1984	9	Mid-Range
10/11/1982	41	Mid-Range
8/20/1982	6	BUY SIGNAL
10/10/1974	6	BUY SIGNAL
6/1/1970	4	BUY SIGNAL
7/5/1962	6	BUY SIGNAL
1/5/1942	5	BUY SIGNAL
6/15/1940	5	BUY SIGNAL
9/5/1939	34	Mid-Range
10/1/1938	89	Mid-Range
6/21/1938	68	Mid-Range
5/7/1938	31	Mid-Range
4/12/1938	10	Mid-Range
4/9/1938	8	Mid-Range
4/5/1938	4	BUY SIGNAL
1/8/1938	38	Mid-Range
1/6/1938	36	Mid-Range
10/29/1937	10	Mid-Range
10/25/1937	6	BUY SIGNAL
7/7/1937	6	BUY SIGNAL
6/8/1934	5	BUY SIGNAL
1/19/1934	73	Mid-Range
10/27/1933	5	BUY SIGNAL
10/25/1933	3	3 Day Limit
7/27/1933	88	Mid-Range
7/6/1933	80	Mid-Range
6/21/1933	87	Mid-Range
6/12/1933	79	Mid-Range

4-6 Days after 90 Day Low		
Signal Date	Days post 90-day low	Signal
6/2/1933	71	Mid-Range
5/27/1933	67	Mid-Range
5/1/1933	44	Mid-Range
4/19/1933	34	Mid-Range
4/13/1933	26	Mid-Range
4/10/1933	23	Mid-Range
3/15/1933	5	BUY SIGNAL
1/4/1933	69	Mid-Range
12/9/1932	49	Mid-Range
11/10/1932	89	Mid-Range
10/19/1932	86	Mid-Range
10/17/1932	84	Mid-Range
9/21/1932	30	Mid-Range
9/7/1932	81	Mid-Range
8/23/1932	43	Mid-Range
8/18/1932	35	Mid-Range
8/3/1932	22	Mid-Range
7/23/1932	43	Mid-Range
7/13/1932	34	Mid-Range
6/14/1932	11	Mid-Range
6/6/1932	4	BUY SIGNAL
3/5/1932	27	Mid-Range
2/13/1932	2	3 Day Limit
1/8/1932	3	3 Day Limit
11/9/1931	28	Mid-Range
10/20/1931	12	Mid-Range
10/9/1931	4	BUY SIGNAL
10/8/1931	3	3 Day Limit
6/24/1931	19	Mid-Range
6/8/1931	5	BUY SIGNAL
1/3/1931	14	Mid-Range
11/15/1930	5	BUY SIGNAL
12/7/1929	16	Mid-Range
11/19/1929	4	BUY SIGNAL

Mid-Range: Signal more than six days after 90 day low
Three Day Limit: Signals one to three days after 90 day low
BUY SIGNAL: Signals within four, five or six days after a 90 day low

Appendix 3
All Signals Listed

S&P 500 DECLINES 8% over a 5-Day Period				
DATE	**DATE**	**DATE**	**DATE**	**DATE**
7/23/2002	2/25/1946	9/10/1937	9/14/1932	9/9/1931
7/22/2002	5/22/1940	9/7/1937	9/13/1932	6/2/1931
9/21/2001	5/21/1940	7/27/1934	9/12/1932	12/16/1930
9/20/2001	5/18/1940	7/26/1934	6/2/1932	11/10/1930
9/19/2001	5/17/1940	7/24/1934	6/1/1932	10/9/1930
9/18/2001	5/16/1940	10/20/1933	5/31/1932	6/18/1930
9/17/2001	5/15/1940	10/19/1933	5/28/1932	6/16/1930
4/14/2000	5/14/1940	10/18/1933	5/27/1932	12/20/1929
9/2/1998	5/13/1940	10/16/1933	5/25/1932	11/14/1929
9/1/1998	4/8/1939	7/25/1933	5/3/1932	11/13/1929
8/31/1998	3/31/1939	7/24/1933	4/11/1932	11/12/1929
10/27/1997	1/26/1939	7/22/1933	4/9/1932	11/11/1929
10/28/1987	9/27/1938	7/21/1933	4/8/1932	11/6/1929
10/23/1987	9/14/1938	7/20/1933	4/7/1932	11/4/1929
10/22/1987	9/13/1938	6/17/1933	4/6/1932	10/30/1929
10/21/1987	3/31/1938	3/22/1933	4/5/1932	10/29/1929
10/20/1987	3/30/1938	3/21/1933	12/14/1931	10/28/1929
10/19/1987	3/29/1938	2/25/1933	12/12/1931	10/24/1929
10/16/1987	3/26/1938	2/16/1933	12/11/1931	10/23/1929
9/30/1974	3/25/1938	11/3/1932	11/23/1931	10/21/1929
9/13/1974	12/28/1937	10/25/1932	10/5/1931	10/19/1929
5/26/1970	11/24/1937	10/13/1932	10/3/1931	12/8/1928
5/25/1970	11/23/1937	10/10/1932	10/2/1931	
5/28/1962	11/22/1937	10/8/1932	10/1/1931	
6/29/1950	11/19/1937	10/7/1932	9/30/1931	
9/9/1946	11/6/1937	10/6/1932	9/29/1931	
9/4/1946	10/19/1937	10/5/1932	9/22/1931	
9/3/1946	10/18/1937	9/16/1932	9/21/1931	
2/26/1946	10/14/1937	9/15/1932	9/19/1931	

Appendix 4

5-day average total NYSE volume is highest in 250 days								
DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE
8/10/2007	4/19/1999	10/17/1989	4/20/1978	1/9/1968	3/10/1961	7/19/1954	1/11/1946	11/18/1935
8/9/2007	9/2/1998	10/16/1989	4/19/1978	1/4/1968	3/9/1961	7/16/1954	12/7/1945	10/25/1935
8/1/2007	9/1/1998	2/1/1989	4/18/1978	1/3/1968	3/8/1961	7/15/1954	6/29/1945	10/24/1935
7/31/2007	10/30/1997	1/31/1989	4/17/1978	8/4/1967	2/28/1961	7/14/1954	6/16/1944	10/23/1935
7/30/2007	10/29/1997	1/30/1989	4/14/1978	8/3/1967	2/27/1961	7/12/1954	6/15/1944	8/14/1935
3/5/2007	10/28/1997	1/27/1989	7/21/1977	8/2/1967	2/24/1961	5/24/1954	6/14/1944	8/13/1935
3/2/2007	10/27/1997	10/22/1987	7/20/1977	7/21/1967	2/23/1961	4/30/1954	6/13/1944	8/2/1935
5/24/2006	10/24/1997	10/21/1987	2/25/1976	7/13/1967	2/21/1961	4/20/1954	5/7/1943	8/1/1935
5/23/2006	10/23/1997	10/20/1987	2/24/1976	3/16/1967	2/3/1961	4/14/1954	4/9/1943	7/21/1933
9/22/2005	7/18/1997	10/19/1987	2/23/1976	1/17/1967	2/2/1961	4/6/1953	4/8/1943	7/20/1933
9/21/2005	7/17/1997	8/13/1987	2/5/1976	1/16/1967	1/31/1961	3/31/1953	4/7/1943	6/9/1933
4/20/2005	6/25/1997	8/12/1987	2/4/1976	4/15/1966	1/30/1961	3/2/1953	4/6/1943	6/2/1933
4/19/2005	1/27/1997	1/20/1987	1/30/1976	4/14/1966	1/16/1961	2/27/1953	3/30/1943	6/1/1933
12/17/2004	1/24/1997	1/16/1987	1/29/1976	3/4/1966	1/13/1961	12/1/1952	3/5/1943	5/31/1933
5/4/2004	1/23/1997	1/15/1987	1/27/1976	3/3/1966	1/12/1961	11/24/1952	3/4/1943	4/24/1933
2/2/2004	1/10/1997	1/14/1987	1/26/1976	12/10/1965	1/11/1961	11/21/1952	3/1/1943	8/12/1932
1/22/2004	12/20/1996	1/12/1987	1/21/1976	12/9/1965	1/10/1961	11/20/1952	2/27/1943	8/11/1932
1/9/2004	7/17/1996	1/9/1987	1/20/1976	12/8/1965	1/5/1961	11/19/1952	2/26/1943	8/10/1932
7/25/2002	12/20/1995	9/15/1986	1/15/1976	12/7/1965	5/19/1960	12/22/1950	2/16/1943	8/9/1932
7/24/2002	12/19/1995	9/12/1986	1/13/1976	12/6/1965	5/18/1960	6/30/1950	2/15/1943	8/8/1932
7/23/2002	12/18/1995	3/17/1986	1/12/1976	12/3/1965	10/20/1958	6/29/1950	2/13/1943	11/4/1929
9/21/2001	12/15/1995	3/14/1986	1/31/1975	10/14/1965	10/17/1958	6/28/1950	12/31/1942	10/29/1929
9/20/2001	12/6/1995	3/13/1986	1/30/1975	9/29/1965	10/16/1958	6/27/1950	12/30/1942	10/28/1929
9/19/2001	7/12/1995	12/16/1985	1/29/1975	9/28/1965	10/15/1958	4/21/1950	12/29/1942	10/25/1929
9/18/2001	7/11/1995	12/13/1985	1/28/1975	9/24/1965	10/14/1958	1/13/1950	12/18/1942	10/24/1929
9/17/2001	6/22/1995	12/11/1985	9/25/1973	9/23/1965	10/24/1957	1/12/1950	12/31/1941	
1/9/2001	2/6/1995	12/10/1985	11/8/1972	9/22/1965	10/23/1957	1/11/1950	12/30/1941	
1/8/2001	2/3/1995	8/7/1984	3/7/1972	6/30/1965	10/22/1957	1/10/1950	12/12/1941	
1/5/2001	4/6/1994	8/6/1984	3/6/1972	6/15/1965	10/14/1957	1/9/1950	12/11/1941	
1/4/2001	4/5/1994	8/3/1984	2/9/1971	3/5/1965	10/11/1957	12/16/1949	12/10/1941	
12/21/2000	1/10/1994	1/10/1984	2/8/1971	3/4/1965	1/7/1955	12/15/1949	12/9/1941	
12/6/2000	1/7/1994	1/9/1984	2/4/1971	3/2/1965	1/6/1955	12/14/1949	12/8/1941	
12/5/2000	10/20/1993	10/13/1982	2/3/1971	3/1/1965	1/5/1955	12/9/1949	12/5/1941	
10/31/2000	10/19/1993	10/12/1982	2/2/1971	2/25/1965	1/4/1955	12/7/1949	9/8/1939	
10/18/2000	10/18/1993	8/26/1982	2/1/1971	2/1/1965	1/3/1955	12/6/1949	9/7/1939	
3/17/2000	2/24/1993	8/24/1982	1/27/1971	1/29/1965	12/9/1954	12/5/1949	9/6/1939	
3/16/2000	2/22/1993	8/23/1982	1/26/1971	11/27/1963	12/8/1954	10/28/1949	9/5/1939	
3/7/2000	2/8/1993	8/20/1982	1/25/1971	10/28/1963	12/7/1954	5/18/1948	10/19/1938	
3/6/2000	2/5/1993	8/19/1982	12/4/1970	10/25/1963	12/6/1954	5/17/1948	10/18/1938	
3/3/2000	2/4/1993	8/18/1982	9/29/1970	10/23/1963	11/30/1954	5/15/1948	10/22/1937	
3/1/2000	1/27/1993	3/9/1982	9/28/1970	10/22/1963	11/18/1954	5/14/1948	10/21/1937	
1/27/2000	1/26/1993	3/8/1982	9/25/1970	9/11/1963	11/17/1954	4/23/1948	10/20/1937	
1/26/2000	1/25/1993	3/5/1982	6/1/1970	9/9/1963	11/12/1954	4/22/1948	1/15/1937	
1/25/2000	1/20/1993	11/19/1980	12/19/1968	9/6/1963	8/6/1954	4/21/1948	1/14/1937	
1/24/2000	1/17/1992	2/13/1980	6/13/1968	6/1/1962	8/5/1954	4/20/1948	1/13/1937	
1/21/2000	2/7/1991	1/16/1980	6/7/1968	5/31/1962	8/4/1954	9/10/1946	2/21/1936	
1/11/2000	2/6/1991	1/14/1980	4/10/1968	5/29/1962	8/3/1954	9/9/1946	2/20/1936	
1/10/2000	2/5/1991	1/11/1980	4/5/1968	5/28/1962	8/2/1954	1/18/1946	11/22/1935	
12/17/1999	10/19/1989	10/11/1979	4/4/1968	4/5/1961	7/30/1954	1/14/1946	11/21/1935	
4/20/1999	10/18/1989	10/10/1979	4/3/1968	4/4/1961	7/20/1954	1/12/1946	11/19/1935	

Appendix 5

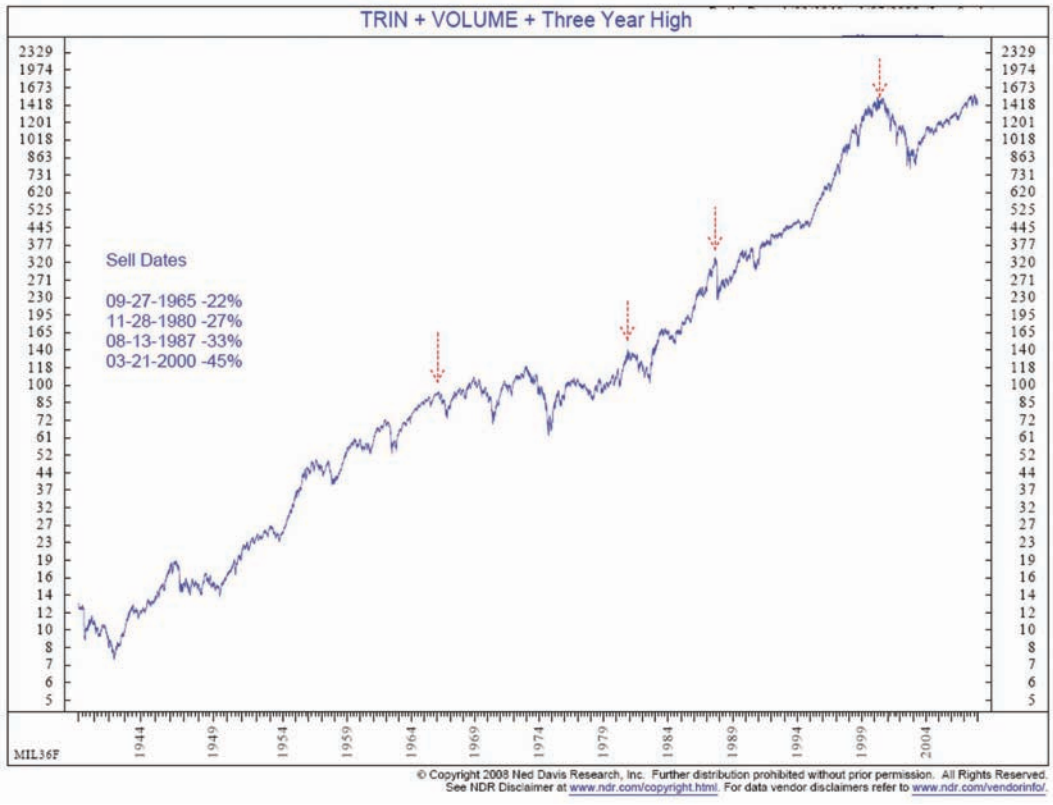
5-day average total NYSE volume is highest in 375 days						
DATE	DATE	DATE	DATE	DATE	DATE	DATE
8/10/2007	9/2/1998	10/16/1989	2/4/1976	4/15/1966	10/24/1957	4/21/1948
8/9/2007	9/1/1998	10/22/1987	1/30/1976	4/14/1966	10/23/1957	4/20/1948
8/1/2007	10/30/1997	10/21/1987	1/29/1976	3/4/1966	10/22/1957	9/10/1946
7/31/2007	10/29/1997	10/20/1987	1/27/1976	3/3/1966	10/14/1957	9/9/1946
7/30/2007	10/28/1997	10/19/1987	1/26/1976	12/10/1965	10/11/1957	1/18/1946
3/5/2007	10/27/1997	8/13/1987	1/21/1976	12/9/1965	1/7/1955	1/14/1946
3/2/2007	10/24/1997	8/12/1987	1/20/1976	12/8/1965	1/6/1955	1/12/1946
5/24/2006	10/23/1997	1/20/1987	1/15/1976	12/7/1965	1/5/1955	1/11/1946
5/23/2006	7/18/1997	1/16/1987	1/13/1976	12/6/1965	1/4/1955	12/7/1945
9/22/2005	7/17/1997	1/15/1987	1/12/1976	12/3/1965	1/3/1955	6/29/1945
9/21/2005	6/25/1997	1/14/1987	1/31/1975	10/14/1965	12/9/1954	5/7/1943
4/20/2005	1/27/1997	1/12/1987	1/30/1975	9/29/1965	12/8/1954	4/9/1943
4/19/2005	1/24/1997	1/9/1987	1/29/1975	9/28/1965	12/7/1954	4/8/1943
12/17/2004	1/23/1997	9/15/1986	1/28/1975	9/24/1965	12/6/1954	4/7/1943
7/25/2002	1/10/1997	9/12/1986	9/25/1973	9/23/1965	11/30/1954	4/6/1943
7/24/2002	12/20/1996	3/17/1986	11/8/1972	9/22/1965	11/18/1954	12/31/1941
7/23/2002	7/17/1996	3/14/1986	2/9/1971	6/30/1965	11/17/1954	12/30/1941
9/21/2001	12/20/1995	3/13/1986	2/8/1971	6/15/1965	11/12/1954	12/12/1941
9/20/2001	12/19/1995	8/7/1984	2/4/1971	6/1/1962	8/6/1954	12/11/1941
9/19/2001	12/18/1995	8/6/1984	2/3/1971	5/31/1962	8/5/1954	12/10/1941
9/18/2001	12/15/1995	8/3/1984	2/2/1971	5/29/1962	8/4/1954	9/8/1939
9/17/2001	12/6/1995	10/13/1982	2/1/1971	5/28/1962	8/3/1954	9/7/1939
1/9/2001	7/12/1995	10/12/1982	1/27/1971	4/5/1961	8/2/1954	9/6/1939
1/8/2001	7/11/1995	8/26/1982	1/26/1971	4/4/1961	7/30/1954	10/22/1937
1/5/2001	6/22/1995	8/24/1982	1/25/1971	3/10/1961	7/20/1954	10/21/1937
1/4/2001	2/6/1995	8/23/1982	12/4/1970	3/9/1961	4/6/1953	10/20/1937
12/21/2000	2/3/1995	8/20/1982	9/29/1970	3/8/1961	3/31/1953	2/21/1936
12/6/2000	4/6/1994	8/19/1982	9/28/1970	2/28/1961	3/2/1953	2/20/1936
12/5/2000	4/5/1994	8/18/1982	9/25/1970	2/27/1961	2/27/1953	11/22/1935
10/31/2000	1/10/1994	3/9/1982	12/19/1968	2/24/1961	12/22/1950	11/21/1935
10/18/2000	1/7/1994	3/8/1982	6/13/1968	2/23/1961	6/30/1950	11/19/1935
3/17/2000	10/20/1993	11/19/1980	6/7/1968	2/21/1961	6/29/1950	11/18/1935
3/16/2000	10/19/1993	2/13/1980	4/10/1968	2/3/1961	6/28/1950	10/25/1935
3/7/2000	10/18/1993	1/16/1980	4/5/1968	2/2/1961	6/27/1950	10/24/1935
3/6/2000	2/24/1993	1/14/1980	4/4/1968	1/31/1961	4/21/1950	10/23/1935
3/3/2000	2/22/1993	1/11/1980	4/3/1968	1/30/1961	1/13/1950	8/14/1935
3/1/2000	2/8/1993	10/11/1979	1/9/1968	1/16/1961	1/12/1950	7/21/1933
1/27/2000	2/5/1993	10/10/1979	1/4/1968	1/13/1961	1/11/1950	7/20/1933
1/26/2000	2/4/1993	4/20/1978	1/3/1968	1/12/1961	1/10/1950	6/9/1933
1/25/2000	1/27/1993	4/19/1978	8/4/1967	1/11/1961	1/9/1950	6/2/1933
1/24/2000	1/26/1993	4/18/1978	8/3/1967	1/10/1961	12/16/1949	6/1/1933
1/21/2000	1/17/1992	4/17/1978	8/2/1967	1/5/1961	5/18/1948	5/31/1933
1/11/2000	2/7/1991	4/14/1978	7/21/1967	10/20/1958	5/17/1948	4/24/1933
1/10/2000	2/6/1991	2/25/1976	7/13/1967	10/17/1958	5/15/1948	8/12/1932
12/17/1999	10/19/1989	2/24/1976	3/16/1967	10/16/1958	5/14/1948	8/11/1932
4/20/1999	10/18/1989	2/23/1976	1/17/1967	10/15/1958	4/23/1948	
4/19/1999	10/17/1989	2/5/1976	1/16/1967	10/14/1958	4/22/1948	

Appendix 6

Table 4 BUY SIGNAL

Appendix 7

Table 4a SELL SIGNAL



Acknowledgement

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About the Author

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