Do Investor Emotions Create Inefficient Markets?

Eric L. Prentis

Abstract

The credit crisis prompts a test of two fundamental economic theories that may have contributed to the financial panic, that is, the Rational Expectations Theory (RET) and the Efficient Market Theory (EMT). This empirical research uses a three-step process to remove random unsystemic risk from the stock price data and smooth volatility, over 81 years, and shows that technical analysis mechanical trading rules for an S&P 500 Index portfolio *substantially* beat a naïve buy-and-hold policy—by two-and-a-half times—at just two-thirds the risk, which is *significantly* less risky. The EMT says this should be *impossible* to achieve—consequently, the data do not support major tenets of the RET nor EMT. The explanation offered as to why the mechanical trading rules presented succeed is due to market participants' emotions, that is, investor fear and panic selling plunges stock prices downward below equity intrinsic values at market bottoms—and investor greed brings stock prices above equity intrinsic values at booming market tops—where speculators act with a herd mentality and trade based on the madness of crowd behavior rather than on market fundamentals, resulting in market bubbles—often spurred on by the sensationalism reported on in the financial media at these times.

(Key Words: Rational Expectations Theory; Efficient Market Theory; systemic market risk; technical analysis; mechanical trading rules)

1. Introduction

The credit crisis is a result of massive overleveraging of debt, United States (US) debt to GDP is 375%—at an all-time high—growing more than 100% since 2000. As a result, Moody's warns of a potential US debt rating downgrade, from AAA to AA, which could be devastating for the US economy—now awash in a tsunami of debt—over 50% of all residential and commercial real estate mortgages are expected to be in negative equity, or underwater, by 2012. The Gramm-Leach-Bliley Financial Services Modernization Act (1999) and the Commodity Futures Modernization Act of 2000 deregulate the US financial system, thereby increasing systemic counterparty credit risk through the use of naked credit default swap (CDS) derivatives which exacerbates the problem.

Due to financial deregulation in 2004, the securitization of structured asset-backed security debt amplifies leverage in the US financial markets—with bank debt-to-net-capital ratios reaching 40-to-1—and off-balance sheet structured investment vehicle (SIV) ratios as high as 100-to-1. Americans are experiencing high unemployment and can no longer afford to service this ocean of debt, consequently, debt needs to be reduced either through paying it down or by forgiveness, that is, by swapping debt for equity or by liquidation through default, foreclosure or bankruptcy. This ongoing de-leveraging process is deflationary, resulting in extensive economic hardship for Americans over an extended period of time. The question is, "Why is the credit crisis permitted to occur?"

Alan Greenspan, the former Federal Reserve chairman, testifies on the credit crisis during an October, 2008 Congressional hearing, "to making an error in assuming that markets would properly regulate themselves, had no idea a financial disaster was in the making, and acknowledged that the Federal Reserve's own economic computer models and experts simply did not forecast the current financial crisis." This prompts a test of two fundamental economic theories used to build these deficient computer models, that is, the Rational Expectations Theory (RET) (Muth 1961, and Lucas 1972) and the Efficient Market Theory (EMT) (Samuelson 1965, and Fama 1965, 1970).

A major tenet of the RET—which supports the EMT—is that all decisions by organizations or individuals who participate in an institutional marketplace, regardless whether their decisions are rational or irrational, results in a market that is systemically correct, that is, the marketplace produces rational results. Not all researchers agree however; a critique of this RET assumption points out that it does not maximize utility for rational investors who understand market fundamentals, and—based on correct timing—want to make more money over the long-term during a market run-up, and get out at the correct time, before the market plummets downward (e.g., Kumar and Lim 2008, and Graham, Harvey, and Huang 2009)).

The EMT defines markets as: 1) being in equilibrium and if unexpected events cause disequilibrium, it is only temporary, that is, markets are self-equilibrating; 2) asset prices "fully reflect" all available information, properly represent each asset's intrinsic value, and as a result, prices are always accurate signals for capital allocation; and 3) stock prices move randomly or are uncorrelated with, if not entirely independent of, the prior period's price change, consequently, beating the stock market on a risk-adjusted basis should be *impossible* to achieve when solely using technical analysis mathematical models or stock charts to make trading decisions. Therefore, says the EMT, if investors want to earn more money than the overall market, they have to take on additional risk.

The EMT concludes that even uninformed investors are treated fairly in an institutional marketplace because the price of each asset reflects its true value, so a naïve purchase may be made with confidence. This EMT conclusion does not seem convincing and does not match the evidence on investor hearding and market bubbles, discused later.

In the active versus passive stock portfolio management debate, the EMT emphasizes that since stock prices cannot be predicted, higher returns at less risk and expense may be achieved by simply investing in a diversified market portfolio, such as the Standard & Poor's (S&P) 500 Index, and holding it over the long term. The EMT's recommendation of passive portfolio management is investigated and found not to be supported by this empirical research.

The way the EMT defines markets—in point number one above—is challenged in the literature by Grossman and Stiglitz (1980), that is, a stock market always in equilibrium and therefore efficient is impossible because traders have different endowments, beliefs and preferences. Arbitrage costs throw markets out of equilibrium, thereby making markets necessary, accordingly, this calls the EMT into question. The current credit crisis and the US government's use of anywhere from $3-to-$24 trillion taxpayer dollars and Federal debt guarantees to stabilize the financial markets is a valid example that markets are not self-equilibrating.

Point number two above of the EMT's definition of markets—that stock prices "fully reflect" all information—has long been challenged in the literature by Ball and Brown (1968). The post-earnings-announcement drift survives robustness checks, including extensions to more recent data. De Bondt and Thaler (1985) show that the stock market overacts to recent unexpected and dramatic information. Bernard and Thomas (1990) study earnings announcements and find evidence of three-day abnormal return predictability based on one-to-four prior quarterly earnings announcements—and that post-earnings announcement drift seems to predict stock prices, consequently, excess returns may be earned.

The speed with which publicly announced information reported on by the media affects market prices is extensively examined (e.g., Grover, Lim, and Ayyagari (2006), Eraker (2008), and Dellavigna and Pollet (2009)). Chan, Jegadeesh, and Lakonishok (1996) test a "trend chaser" and earnings momentum strategy and conclude that the market seems to only respond gradually to new information.

The critique in the literature, pertaining to asset prices always being at their intrinsic values and therefore accurate signals for correct capital allocation—emphasizes that this EMT assumption does not take into account human nature and inherent herding behavioral instincts—where speculating occurs in response to the madness of crowd behavior rather than on market fundamentals, resulting in market bubbles (e.g., Shiller (2000), Prechter (2001), Miller (2002), Bitmead, Durand, and Ng (2004), Caparrelli, D'Arcangelis, and Cassuto (2004), Blasco and Ferreruela (2008), and Hanker and Owen (2008)). The Technology Bubble in 2000, the Oil Bubble in July, 2008, as well as many bubbles throughout history (i.e., John Law's Mississippi Scheme, the South Sea Bubble and Holland's Tulip Mania), and now the Real Estate Bubble—where US home prices nationally have declined approximately 30% since June, 2006, with at least another 15% drop in home prices expected—are compelling examples that market bubbles do occur and that market prices cannot always be trusted for correct capital allocation.

Point number three above of the EMT's definition of markets—that stock prices follow a random walk—is investigated and challenged by Lo and MacKinlay (1988), while the serial independence of stock prices is tested and critically questioned by Rosenberg and Rudd (1982), Ashley (1986), and Summers (1986). The risk and return of individual common stock or specialized portfolios are compared to a buy-and-hold benchmark S&P 500 Index portfolio and extensively reported on in the literature (e.g., Briec, Kerstens, and Jokung (2007), Siegel and Woodgate (2007), Kan and Smith (2008), and Basak, Jagannathan, and Ma (2009)).

In the final analysis, however, not being able to beat the stock market, with less risk, when using technical analysis mathematical models or stock charts to make trading decisions, remains the principal reason why the RET and EMT are considered fundamental theories in economics and finance (Fama 1965, 1970, 1991, and 1998). This crucial RET/EMT assumption is rigorously tested here—that is, by using only technical analysis mechanical trading rules to make buy and sell decisions, consistently applied over a long time period—this research scientifically shows how the stock market (i.e., a naïve buy-and-hold policy) is *substantially* beaten, at *significantly* lower risk, which the EMT says, "should be *impossible* to achieve," bringing the RET and EMT into doubt.

2. Why Statistical Tests Are Not Used, And Mechanical Trading Rules Are

When using statistical tests to determine whether stock price data are independent, it is very difficult to distinguish between an indisputable rootless series and one where the steady systemic element is faint—Summers (1986) estimates that it would require 5,000 years of data to make this determination using statistics. 5,000 years of market data are unavailable for this study, precluding using statistical inference tests for analysis purposes. Instead, this paper's empirical research methodology directly tests stock market price independence by employing a deterministic, technical analysis mathematical model—consisting of mechanical trading rules—to evaluate whether profits are greater than a benchmark naïve buy and hold policy, which Fama (1965, 1995) calls, "an equally valid scientific methodology vs. statistical inference."

The technical analysis mechanical trading rules decide when portfolio B should be either in a S&P 500 Index no-load mutual fund or out and invested in interest bearing, risk-free 3-month T-bills. The presented mechanical trading rules are the most significant difference between this paper and the statistical tests found in the referenced RET and EMT research. Perhaps, this is the first stock market technical analysis mechanical trading rules empirical research paper published in the literature since Alexander's unsuccessful simple filter rule tests, in the early 1960s (Fama, 1965, 1995)—and the primary reason why these results are so significant.

3. EMT Theorists' Concerns Addressed

Anomalies and direct challenges to the EMT in the literature, presented in sections 1 and 2, seem extensive and persuasive, but have failed to convince EMT theorists (Fama, 1998; Malkiel, 2003), due to their following concerns:

1) Stock selection bias.

2) Not adjusting returns based on greater security risk.

3) Not calculating economic gains once transaction costs are taken into account.

4) Not properly accounting for bid-ask spreads, and a bias in recording prices.

5) Not using a naïve buy-and-hold control portfolio for comparison purposes.

6) Survivorship bias.

7) Not testing for consistency over a sufficiently long time period.

8) Data-snooping biases.

Accordingly, EMT theorists' concerns are specifically taken into account in the design of the technical analysis mathematical model mechanical trading rules and empirical test used in this research, in order to rigorously evaluate the EMT, as follows:

1) Random unsystemic risk, associated with individual company common stock, is taken out of the data and only steady, systemic market risk, as a result of US political-economic conditions, remains when comparing two S&P 500 Index portfolios in this empirical study. Consequently, active portfolio management selection bias of individual common stock is not, and cannot be an issue in this study.

2) The S&P 500 Index buy-and-hold portfolio is designated portfolio A, while the technical analysis mechanical trading rules S&P 500 Index portfolio is designated portfolio B. The beta value of the trading S&P 500 Index portfolio B, providing excess returns, never exceeds the beta value for the S&P 500 Index buy-and-hold portfolio A, therefore, there is no need to adjust returns based on greater security risk.

3) Transaction costs are zero, for both S&P 500 Index no-load mutual funds.

4) The bid-ask spread and whether closing prices can actually be attained is not an issue in this research; because, no-load mutual fund companies calculate their net asset values as of the trading day's close which likewise is the trading point in this study. In

addition, the buy or sell trading signal is given one business day prior to the actual stock mutual fund trading day in this empirical research, allowing for ample time to make the required transaction; therefore, a bias in recording prices is impossible.

5) Identical investment portfolios are compared, consisting of two S&P 500 Index no-load mutual funds, differentiated solely by deterministic, technical analysis mechanical trading rules. The S&P 500 Index has long been employed as a control benchmark by researchers to evaluate unique portfolio selection methodologies. As an important variation, in this research, two S&P 500 Index portfolios are used for comparison purposes, one for trading and the other as the naïve buy-and-hold control portfolio.

6) Survivorship bias is not an issue in this study; because, the S&P 500 Index will not go bankrupt, as with the possibility for an individual company.

7) A long-duration empirical study of the data from 1928–2008, over 81 years, is used to demonstrate that long-term trends—as a result of political-economic conditions—are consistently reliable over an extensive time period, in both good times and bad.

8) Data snooping is "statistical testing bias" where a computer is used to check a vast number of different hypotheses against a single data set—fishing for statistically significant correlations between various combinations of variables, hoping that one will eventually become evident—even though there are no "real correlations." This research does NOT use statistical testing—due to the reasons mentioned in the previous section—but rather, deterministic, technical analysis mechanical trading rules, consistently applied over a long time period—consequently, data snooping *cannot* and *does not* occur in this research. In addition, the data in this study are split in two, beginning with a random start

date for results comparison, and each segment is reported on separately which replicates an out-of-sample study, confirming this research's reported results.

Fama (1965, 1995) explains that the testing of technical analysis mechanical trading rules, when compared to a benchmark naïve buy-and-hold policy, is empirical, not theoretical; consequently, no new financial theories are required in this study.

Fama's (1965, 1995) 45 year old challenge for technical analysis is to "rigorously test mechanical trading rules to *show* they can *consistently* make better than chance predictions of stock prices." And since it is not possible to be just a little bit pregnant—all that is required is to show just one instance where deterministic, technical analysis mechanical trading rules *substantially* beat a benchmark naïve buy and hold policy, at *significantly* less risk, to call into question a major tenet of the EMT—because, says the EMT, "this should be *impossible* to achieve." Fama (1965, 1995) references, as an example of an acceptable technical analysis mechanical trading rule test, Alexander's unsuccessful filter rule trials, performed over 63 years, for individual common stock versus market indices.

4. Three-step Process Removes Random Unsystemic Risk From The Data And Smoothes Price Volatility

There is theoretical support and empirical evidence that aggregate price indexes perform more systemically than their individual company components. This is the result of a diminution of random or chance elements due to averaging, leading to the subsequent appearance of only steady systemic elements (Kendall 1953).

Individual company stock price movements are composed of steady, systemic market risk and random unsystemic risk. As much as 50% of a company's stock price movements are random unsystemic risk fluctuations associated with the internal circumstances within that particular company. The remaining 50% of a company's stock price movements represent only steady, systemic market risk. The random unsystemic risk component is the chaotic portion of the stock price data that if filtered out leaves only the steady, systemic market risk of the overall market which may then be analyzed to determine market efficiency.

Rather than studying individual company stock price movements that include the randomness of unsystemic risk—as evaluated in the many referenced research publications, including Alexander's filter rule tests—instead, only steady, systemic market risk is analyzed in this study by using well diversified stock index portfolios as proxies for the overall market. Two S&P 500 Index portfolios are employed, one for active trading and the other held as a control or benchmark portfolio; thereby focusing only on steady, systemic market risk which removes much of the random or chance stock market price behavior from the research data.

When investing over 1, 2, 3, 4, 5 years or more, day-to-day stock price movements are immaterial to trading success and may be thought of as just daily market chatter. Concentrating on whether a stock price or the stock market will be either up or down tomorrow is not the correct question. Day-to-day stock price action is very volatile, so to dampen out this daily chatter and give perspective to what is actually occurring over the long term in the stock market—S&P 500 Index "monthly price data" are used to smooth out stock price volatility.

Monthly price data are important in dampening out day-to-day price movements. However, using last month's price to predict next month's price is also not conducive to long-term trend development. To further smooth out price fluctuations and focus on steady, systemic market risk in the stock market, nine and two month simple moving average (SMA) trend lines are fit to the S&P 500 Index monthly price data for actively managed portfolio B. Accordingly, S&P 500 Index nine and two month SMA trend lines smooth out data volatility and give an overall view of the long-term stock market trend which is the third step in removing much of the random stock market price behavior from the research data. Focusing only on steady, systemic market risk in the data and smoothing stock price volatility, to reduce random fluctuations, are major differences between this paper and the referenced RET and EMT research—and an important reason why these results are so significant.

5. S&P Index Services Supplies Data From 1928 to 2008

S&P Index Services supply the S&P 500 Index open, high, low and closing price data. The price data set—as received—begins in 1928 and goes through 2008; and the entire data set from S&P Index Services is used in this research. Nine and two month simple moving average (SMA) trend lines are fit to these supplied research data.

Using a very long duration study of 81 years assures that stock market data are collected during normal times as well as when the stock market is either panicking, and plunging lower under duress or booming, and spurting higher with confidence, as a result of either fear or greed dominating investors' emotions (e.g., Camerer (2002), Fisher and Statman (2002), and Lo (2002)).

Two identical S&P 500 Index mutual funds are used, both with beta values equal to one (*B* = 1) which represent only steady, systemic market risk. S&P 500 Index portfolio A is the buy-and-hold benchmark while actively managed S&P 500 Index portfolio B uses only the S&P 500 Index nine and two month SMA trend lines and a deterministic, technical analysis mathematical model—consisting of mechanical trading rule heuristics, which are presented in section 6—to determine when to be either invested in the stock market or out and invested in risk-free 3-month Treasury bills (T-bills).

6. Mechanical Trading Rule Heuristics

The underlying motivation, for the presented technical analysis mechanical trading rules, comes from Edwards, Magee, and Bassetti (2001). The 200 day simple moving average (SMA) trend line is routinely mentioned by practitioners when discussing the stock market—that is, if up-trending: a bull market—if down-trending: a bear market. Since monthly data are used in this study, the nine month SMA trend line is very close to the 200 day duration time period. The 50 day SMA trend line is used by practitioners for crossovers and penetrations, to determine turning points in the long-term direction of the stock market. Using monthly data, the two month SMA trend line is very close to the 50 day duration time period. Utilizing calculus, the nine and two month SMA trend lines are translated into mathematics, for ease of testing. Please note: nine and two month SMA trend lines are not used with individual common stock, because of individual stock's random unsystemic risk behavior—but rather, only with the steady, systemic market risk of a large company, capitalization-weighted, well diversified S&P 500 Index portfolio.

Relative Maxima: Sell Stock

To identify a change in the long-term uptrend in the stock market, the first derivative (f') of the S&P 500 Index portfolio B nine-month SMA trend line function $f\,(L_9)$ is calculated immediately after the close of trading on the last trading day of each month—at time t. The S&P 500 Index nine-month SMA trend line function $f\,(L_9)$ is increasing and positive when its first derivative is greater than zero:

$$f'\,(L_9) > 0 \tag{1}$$

The transition from topping or rounding over to a long-term downtrend is identified by finding the relative maxima for the S&P 500 Index nine-month SMA trend line function f (L_9), where its first derivative $f'\,(L_9) > 0$ changes to a negative slope:

$$f'\,(L_9) < 0 \tag{2}$$

Find:

$$m_9 \leq \tan(355°),\ \text{at time t} \tag{3}$$

Equation (3) is valid when the S&P 500 Index nine-month SMA trend line function f (L_9) slope (m_9), at time t, is less than or equal to the slope of a 355 degree tangent line. A transition from topping or rounding over to long-term downtrend is partially confirmed and subject to the following two conditions—both of which are required for the "relative maxima: sell stock" decision to be declared.

Subject to,

First:

$$m_2 \leq \tan(353°), \text{ at time t} \tag{4}$$

Equation (4) is valid when the S&P 500 Index two-month SMA trend line function f (L_2) slope (m_2), at time t, is less than or equal to the slope of a 353 degree tangent line. A "relative maxima: sell stock" transition from topping or rounding over to long-term downtrend is partially confirmed, and:

Second:

$$X_1 \text{ and/or } X_2 \leq f(L_9), \text{ for month t} \tag{5}$$

X_1 is the opening S&P 500 Index price for month t, while X_2 is the closing price for month t. When either the opening price for month t or the closing price for month t—or both the opening and closing prices for month t—are less than (below) or equal to the S&P 500 Index nine-month SMA trend line function $f(L_9)$, equation (5) is valid.

When a transition from topping or rounding over to a long-term downtrend is ultimately confirmed for the S&P 500 Index portfolio B nine and two month SMA trend lines (i.e., when equations (3), (4) and (5) at time t are all confirmed as valid); a "relative maxima: sell stock" is declared. All portfolio B shares are redeemed from the S&P 500 Index no-load mutual fund and invested in risk-free 3-month T-bills, at the close of trading on the first trading day of the following month (i.e., t + 1).

Relative Minima: Buy Stock

To identify a change in the long-term downtrend in the stock market, the first derivative (f') of the S&P 500 Index portfolio B nine-month SMA trend line function $f(L_9)$ is calculated immediately after the close of trading on the last trading day of each month—at time t. The S&P 500 Index nine-month SMA trend line function $f(L_9)$ is decreasing and negative when its first derivative is less than zero:

$$f'(L_9) < 0 \qquad (6)$$

The transition from accumulation or bottoming to a long-term uptrend is identified by finding the relative minima for the S&P 500 Index nine-month SMA trend line function $f(L_9)$, where its first derivative $f'(L_9) < 0$ changes to a positive slope:

$$f\,'(L_9) > 0 \tag{7}$$

Find:

$$m_9 \geq \tan(5°), \text{ at time t} \tag{8}$$

Equation (8) is valid when the S&P 500 Index nine-month SMA trend line function $f(L_9)$ slope (m_9), at time t, is greater than or equal to the slope of a five degree tangent line. A transition from accumulation or bottoming to long-term uptrend is partially confirmed and subject to the following condition which is required for the "relative minima: buy stock" decision to be declared.

Subject to,

$$\text{If (3), (4) and (5) at time t; then } f\,`(L_9) < 0, \text{ for months t + 1 and t + 2} \tag{9}$$

Once a transition from topping or rounding over to a long-term downtrend is confirmed as valid, for month t, that declaration shall remain in force for the next two months (i.e., t + 1 and t + 2), defining a negative slope for $f\,`(L_9)$. At stock market peaks $f\,`(L_9)$ can vacillate, consequently, a "relative minima: buy stock" should not be declared within two months of a "relative maxima: sell stock" declaration.

When a transition from accumulation or bottoming to a long-term uptrend is ultimately confirmed for the S&P 500 Index portfolio B nine and two month SMA trend lines (i.e., when equations (8) and (9) at time t are both confirmed as valid); a "relative minima: buy stock" is declared. All portfolio B funds are taken from the risk-free 3-month T-bill interest bearing account and invested in the S&P 500 Index no-load mutual fund, at the close of trading on the first trading day of the following month (i.e., t + 1).

Flow Chart: Mechanical Trading Rule Heuristics

A flow chart of the relative maxima and minima trading rule heuristics' methodology is shown in Figure 1: Portfolio B: Mechanical Trading Rule Heuristics Flow Chart.

Insert Figure 1 Here

The flow chart presents the step-by-step procedure of how the relative maxima and minima mechanical trading rule heuristic equations determine when to move actively managed portfolio B from the S&P 500 Index no-load mutual fund to the risk-free 3-month T-bill interest bearing account, and back again.

7. Trading Buy and Sell Signals

Valid trading buy or sell signals are declared immediately after the close of trading on the last trading day of month t—one business day prior to the actual S&P 500 Index no-load mutual fund trading day—that is, at the close of trading on the first trading day of the following month (i.e., t + 1), allowing ample time to make mutual fund transactions.

Transaction costs for both no-load mutual funds are zero; and corporate survivorship bias does not come into play for either of the S&P 500 Index portfolios. The bid-ask spread and whether closing prices can actually be attained are not an issue in this study, because, no-load mutual fund companies calculate net asset values at the close of trading which is the trading point for the mechanical trading rule heuristics .

Once the long-term stock market trend line is identified—dependent upon the S&P 500 Index portfolio B "relative maxima: sell stock" or "relative minima: buy stock" trading rule heuristic declarations—there is a higher probability that the long-term stock market trend will continue, either upward or downward.

8. Dividend and Interest Payments

While A & B portfolios are invested in the S&P 500 Index they both receive identical dividend payments, consequently, for this study—no accounting for either portfolio's accrued dividends during these concurrent time periods in the stock market is undertaken. When portfolio B is transferred out of the stock market into an interest bearing account, the interest earned is at the risk-free 3-month T-bill rate, therefore, a determination of whether 3-month T-bill interest rates are either higher or lower than S&P 500 Index dividend yield payments is required.

Over this empirical study from Jan. 3, 1928 to Dec. 31, 2008 (i.e., a total of 972 months), S&P 500 Index dividend yields average 3.98%, based upon S&P 500 Index historical annual dividend data supplied by S&P Index Services. During the same time period, 3-month T-bill interest rates average 3.70%, based on data from the Federal

Reserve Statistical Release. Average 3-month T-bill interest rates less than S&P 500 Index dividend yields are expected over the entire 972 month planning horizon, given the risk-free nature of T-bills. However, the timing of dividend and interest payments concern speculators.

S&P 500 Index dividend yields and 3-month T-bill interest rates fall into two distinct main phases. The first phase is from 1928 through 1959, S&P 500 Index dividend yields average 5.28% and 3-month T-bills average 1.02%. Beginning in 1960, a marked shift in corporate dividend governance lowers dividend yields and at the same time events in the economy increase 3-month T-bill interest rates. During the second phase—from 1960 through Dec. 31, 2008—S&P 500 Index dividend yields average 3.12% and 3-month T-bill interest rates average 5.46%.

Consequently, from 1928 through 1959—when portfolio B is at times out of the S&P 500 Index no-load mutual fund and invested at the risk-free 3-month T-bill interest rate—dividends accrue to the buy-and-hold S&P 500 Index portfolio A at the dividend yield to interest rate differential of 4.26% (i.e., 5.28% - 1.02%) per year or 0.00355 per month. The number of S&P portfolio A shares are increased by dividing the dividend-interest differential earned by the S&P 500 Index share price, at the time when the S&P portfolio B portfolio is reinvested.

Similarly—from 1960 through 2008—when portfolio B is periodically out of the S&P 500 Index no-load mutual fund and invested at the risk-free 3-month T-bill interest rate, interest accrues to portfolio B at the interest rate to dividend yield differential of 2.34% (i.e., 5.46% - 3.12%) per year or 0.00195 per month. The number of portfolio B shares are increased by dividing the interest-dividend differential earned by the S&P 500 Index share price, at the time when portfolio B is reinvested in the S&P 500 Index no-load mutual fund. An analysis of the research data is presented next using S&P 500 Index nine and two month SMA trend lines and relative maxima and minima trading rule heuristics.

9. Results

Portfolios A and B—when invested in the stock market—are in identical S&P 500 Index no-load mutual funds. An equal amount of money is initially invested in each portfolio, that is, $1,000 dollars. Portfolio B may trade into the S&P 500 Index no-load mutual fund or out, earning interest on risk-free 3-month T-bills. All S&P 500 Index no-load mutual fund shares or 3-month T-bills are redeemed for cash at the conclusion of this study, on Dec. 31, 2008. All stock market trades are performed at the close of trading on the first trading day of month t + 1, as a result of the S&P 500 Index portfolio B relative maxima and minima trading rule heuristics.

Portfolio A is the buy and hold strategy and $1,000 dollars are invested—at the close of trading on the first trading day of 1928, on January 3rd—in a S&P 500 Index no-load mutual fund at the S&P 500 Index price of $17.76 dollars per share. The 56.306 shares purchased are held until redeemed on Dec. 31, 2008 for the S&P 500 Index price of $903.25 dollars per share, equaling a total of $50,858.39 dollars.

When portfolios A and B are invested concurrently in S&P 500 Index mutual funds, dividends are paid to both portfolios at the same rate, therefore, dividend payments are identical and are not included in these calculations. From 1928 through 1959, while portfolio B is periodically invested at the risk-free 3-month T-bill interest rate, shares are added to portfolio A because S&P 500 Index dividend yields are higher than 3-month T-bill interest rates. Portfolio A adds dividend-interest differential payments at the rate of 4.26% per year or 0.00355 per month. Table 1: S&P 500 Index Portfolio A: Additional Shares – 1928 through 1959, steps through the added share calculations for portfolio A.

Insert Table 1 Here

The additional portfolio A shares, due to dividend-interest differential payments, increase from 56.306 to 91.817 shares, up through the end of 1959. Each time portfolio B is traded out of the S&P 500 Index no-load mutual fund into 3-month T-bills—portfolio A receives higher dividends than portfolio B receives in interest—so dividend-interest differential accrues on Mar. 1, 1933 by taking portfolio A's 56.306 shares, times S&P 500 Index share price of $5.77, equaling $324.89 dollars, times 27 months—which represents the accumulated duration before portfolio B is transferred back into the S&P 500 Index no-load mutual fund—times 0.00355, to equal $31.14 dollars; representing the dividend-interest differential earned and credited to portfolio A. The 5.397 shares added to portfolio A, shown in the last column of Table 1, is calculated by dividing the $31.14 dollars of dividend-interest differential earned by the S&P 500 Index share price of $5.77. In this way through 1959, each time portfolio B earns interest by trading out of the stock market, portfolio A is credited with the difference in higher dividends over interest payments.

Calculating the total value of portfolio A at the end of the study is as follows. The additional S&P 500 shares, due to dividend-interest differential payment calculations, are

35.511 shares (i.e., 91.817 ending shares, minus 56.306 initial shares), times the S&P 500 Index redemption price on Dec. 31, 2008 of $903.25—shown on Table 2—equaling $32,075.31 dollars. The total value of buy-and-hold S&P 500 Index portfolio A on Dec. 31, 2008 is $82,933.70 dollars (i.e., $50,858.39 + $32,075.31).

The results for portfolio B are determined by trading in and out of the S&P 500 Index no-load mutual fund based on S&P 500 Index nine and two month SMA trend lines and relative maxima and minima mechanical trading rule heuristics, as shown in Table 2: S&P 500 Index Portfolio B: Gain From Trading - 1928 through 2008.

Insert Table 2 Here

The initial $1,000 dollar investment in S&P 500 Index portfolio B on Jan. 3, 1928 of 56.306 shares, at $17.76 dollars per share, is redeemed on Dec. 2, 1929 at $20.95 per share for a total of $1,179.61 dollars. From Dec. 2, 1929 to Mar. 1, 1933, portfolio B is out of the stock market and invested in risk-free 3-month T-bills. Portfolio B is reinvested in the S&P 500 Index on Mar. 1, 1933, at $5.77 dollars per share—purchasing a total of 204.438 shares. Portfolio B is redeemed on May 1, 1934 for a total of $2,138.42 dollars (i.e., 204.438 shares, times $10.46 per share).

As a result of trading, the original $1,000 investment in the S&P 500 Index portfolio B grows to $151,484.00 dollars (i.e., 108.558 shares, times $1,395.42 per share), when redeemed on Feb. 1, 2008 for 3-month T-bills which earn interest until the close of this study, on Dec. 31, 2008. The interest-dividend differential payment calculations for portfolio B are included next in Table 3: S&P 500 Index Portfolio B: Additional Shares – 1960 through 2008.

Insert Table 3 Here

Beginning in 1960, 3-month T-bill interest rates on average are higher than S&P 500 Index dividend yields. Accordingly, the interest rate versus dividend yield differential advantage shifts to portfolio B which adds interest-dividend differential payments at the rate of 2.34% per year or 0.00195 per month—when S&P 500 Index portfolio B is invested in 3-month T-bills.

Portfolio B total shares from trading, shown in Table 2 (which are transferred and listed for the appropriate date in the second column on Table 3)—begin the additional shares earned from interest-dividend differential calculations. Portfolio B redeems all S&P 500 Index shares on Mar. 1, 1960 and purchases 3-month T-bills, holding them for 11 months, and then re-enters the stock market on Feb. 1, 1961. The additional share calculation for the interest-dividend differential payment on Feb. 1, 1961 is: 137.826 shares, times the per share S&P 500 Index price of $61.90, equaling $8,531.43 dollars—times 11 months invested in T-bills, times 0.00195 per month, to equal $183.00 dollars earned—which is listed in the second to last column on Table 3. The interest-dividend differential payment of $183.00 dollars is divided by the S&P 500 Index price of $61.90, resulting in 2.956 additional shares which is shown in the last column of Table 3. The additional portfolio B shares, due to interest-dividend differential payments from 1960 through 2008, totals 39.032 shares—shown in the lower right-hand corner of Table 3.

Portfolio B is traded out of the S&P 500 Index no-load mutual fund into 3-month T-bills on Feb. 1, 2008, with additional shares earned due to the interest-dividend differential, equaling 35.435 shares (i.e., 39.032 shares, minus 3.597 shares earned after Feb. 1, 2008), times $1,395.42 (i.e., the S&P 500 Index share price on Feb. 1, 2008, shown on Table 2)—equaling $49,446.71 dollars. Adding in portfolio B's interest-dividend differential earned over 11 months, from Feb. 1, 2008 to Dec. 31, 2008, totals $3,249.33 dollars, as shown in row C-12/31/08 on Table 3. The total value of interest-dividend differential payments for portfolio B is $52,696.04 dollars (i.e.,$49,446.71 + $3,249.33).

Total funds in the mechanical trading rule heuristic S&P 500 Index portfolio B account, on Dec. 31, 2008, equals $204,180.04 dollars (i.e., $151,484.00 + $52,696.04). Trading rule heuristic S&P 500 Index portfolio B—by a total of $121,246.34 dollars (i.e., $204,180.04 - $82,933.70)—is +146% superior to buy-and-hold S&P 500 Index portfolio A, from Jan. 3, 1928 to Dec. 31, 2008.

10. Risk-Adjusted Returns

Portfolio B is superior to portfolio A by +146%, furthermore, each portfolio has a different risk profile. When either portfolio A or B is invested in a S&P 500 Index no-load mutual fund—a proxy for the overall stock market—each has a beta value equal to one (B_A=1) (B_B=1). When portfolio B is invested in risk-free 3-month T-bills, its beta value is equal to zero (B_B=0). Portfolio B is in 3-month T-bills for 327 months out of a total planning horizon of 972 months, a total of 34% of the time, and is invested in a S&P 500 Index no-load mutual fund the remaining 66% of the time.

Using a proportional portfolio risk weighting measure for 3-month T-bills and the S&P 500 Index no-load mutual fund, results in a beta value for portfolio B (B_B) that is linearly additive over the entire 972 months, equaling: $B_B = 0.34\ (0) + 0.66\ (1) = 0.66$. The buy-and-hold S&P 500 Index portfolio A has a beta value equal to one (B_A=1), throughout the entire planning horizon in this study.

Mechanical trading rule heuristic S&P 500 Index portfolio B—makes +146% more money than buy-and-hold S&P 500 Index portfolio A—and is -34% less risky—from Jan. 3, 1928 to Dec. 31, 2008.

11. Out-of-Sample Study Confirms Results

S&P Index Services and Federal Reserve Statistical Release 1928–2008 data sets are evenly split in two, and each segment is reported on separately which replicates an out-of-sample study. The planning horizon for this research is 972 months, from Jan. 3, 1928 to Dec. 31, 2008. The midpoint occurs after 486 months, on May 1, 1967, which is an existing reinvestment date, shown on Table 2. Accordingly, for portfolios A & B, on May 1, 1967, the data are divided in half: Segment 1: (Jan. 3, 1928 to May 1, 1967) and Segment 2: (May 1, 1967 to Dec. 31, 2008).

Segment 1: Portfolio A: (Jan. 3, 1928 to May 1, 1967). The value of buy-and-hold S&P 500 Index portfolio A at the close of trading on May 1, 1967 is 91.817 shares, from

Table 1, times the S&P 500 Index share price of $93.87 on May 1, 1967, from Table 2, equaling $8,618.86 dollars.

Segment 1: Portfolio B: (Jan. 3, 1928 to May 1, 1967). The value of trading rule heuristic S&P 500 Index portfolio B at the close of trading on May 1, 1967 is 111.652 shares, from Table 2, times the S&P 500 Index share price of $93.87, on May 1, 1967, equaling $10,480.77 dollars. Additional shares purchased with interest-dividend differentials earned, from Table 3, amounts to 7.520 shares, times the S&P 500 Index share price of $93.87, equaling $705.90 dollars; summing to a grand total of $11,186.67 dollars (i.e., $10,480.77 + $705.90).

Conclusion for Segment 1: (Jan. 3, 1928 to May 1, 1967). The economic improvement in trading rule heuristic S&P 500 Index portfolio B, over buy-and-hold S&P 500 Index portfolio A, is $2,567.81 dollars (i.e., $11,186.67 - $8,618.86) or +30%, at only 64% of the risk (B_B = 0.64), as a result of portfolio B being in risk-free 3-month T-bills for 173 months out of a total of 486 months.

Segment 2: Portfolio A: (May 1, 1967 to Dec. 31, 2008). As of May 1, 1967, buy-and-hold S&P 500 Index portfolio A's value is $8,618.86 dollars, while trading rule heuristic S&P 500 Index portfolio B's value is $11,186.67 dollars. Portfolio A's value on Dec. 31, 2008 is $82,933.70, less portfolio A's value on May 1, 1967 of $8,618.86, equaling $74,314.84 dollars of profit earned, from May 1, 1967 to Dec. 31, 2008.

Segment 2: Portfolio B: (May 1, 1967 to Dec. 31, 2008). Portfolio B's value on Dec. 31, 2008 is $204,180.04, less portfolio B's value on May 1, 1967 of $11,186.67, equaling $192,993.37 dollars of profit earned, from May 1, 1967 to Dec. 31, 2008.

Conclusion for Segment 2: (May 1, 1967 to Dec. 31, 2008). The economic improvement in trading rule heuristic S&P 500 Index portfolio B over buy-and-hold S&P 500 Index portfolio A is $118,678.53 dollars (i.e., $192,993.37 - $74,314.84) or +160%, at just 68% of the risk (B_B = 0.68), as a result of portfolio B being in 3-month T-bills for 154 months out of a total of 486 months.

Splitting the data sets at their midpoints indicate that actively managed portfolio B is +30% superior to buy-and-hold portfolio A, from Jan. 3, 1928 to May 1, 1967—at only 64% of the risk—increasing to +160% superior from May 1, 1967 to Dec. 31, 2008—at just 68% of the risk. The out-of-sample study confirms this research's conclusions.

12. Conclusion

The credit crisis prompts a test of two fundamental economic theories that may have contributed to the financial panic, that is, the Rational Expectations Theory (RET) and the Efficient Market Theory (EMT). All of the EMT theorists' concerns, as listed 1-through-8 in section 3, are specifically taken into account in the design of the technical analysis mathematical model mechanical trading rules and empirical test used in this study. Random unsystemic risk is removed from the individual common stock price data, and S&P 500 Index nine and two month simple moving average (SMA) trend lines smooth out data volatility which gives an overall view of the long-term stock market trend—thereby focusing only on steady, systemic market risk in this research.

Major tenets of the RET and EMT are empirically tested, by exclusively using a deterministic, technical analysis mathematical model—consisting of mechanical trading rules—to determine when portfolio B should be either in a S&P 500 Index no-load mutual fund or out and invested in interest bearing, risk-free 3-month Treasury bills (T-bills), from 1928 to 2008, and compared to a benchmark naïve buy-and-hold policy.

Actively managed S&P 500 Index portfolio B is +146% superior to the buy-and-hold benchmark S&P 500 Index portfolio A (i.e., $82,933.70 vs. $204,180.04 dollars) over 81 years. Additionally, actively managed S&P portfolio B is -34% less risky than the buy-and-hold benchmark S&P portfolio A—as a result of being invested in risk-free 3-month T-bills for 327 out of 972 months.

The rigorous empirical testing of deterministic, technical analysis mathematical model mechanical trading rules conclusively shows that the trading rule heuristics presented are *substantially* superior—by two-and-a-half times—over 81 years—at just two-thirds the risk, which is *significantly* less risky—when compared to a benchmark naïve buy-and-hold policy. The EMT says this should be *impossible* to achieve; consequently, the data do not support major tenets of the RET nor EMT. An out-of-sample study is performed, confirming this research's conclusions.

The explanation offered as to why the mechanical trading rules presented succeed is due to market participants' emotions, that is, investor fear and panic selling plunges stock prices downward below equity intrinsic values at market bottoms—and investor greed brings stock prices above equity intrinsic values at booming market tops—where speculators act with a herd mentality and trade based on the madness of crowd behavior rather than on market fundamentals, resulting in market bubbles—often spurred on by the sensationalism reported on in the financial media at these times.

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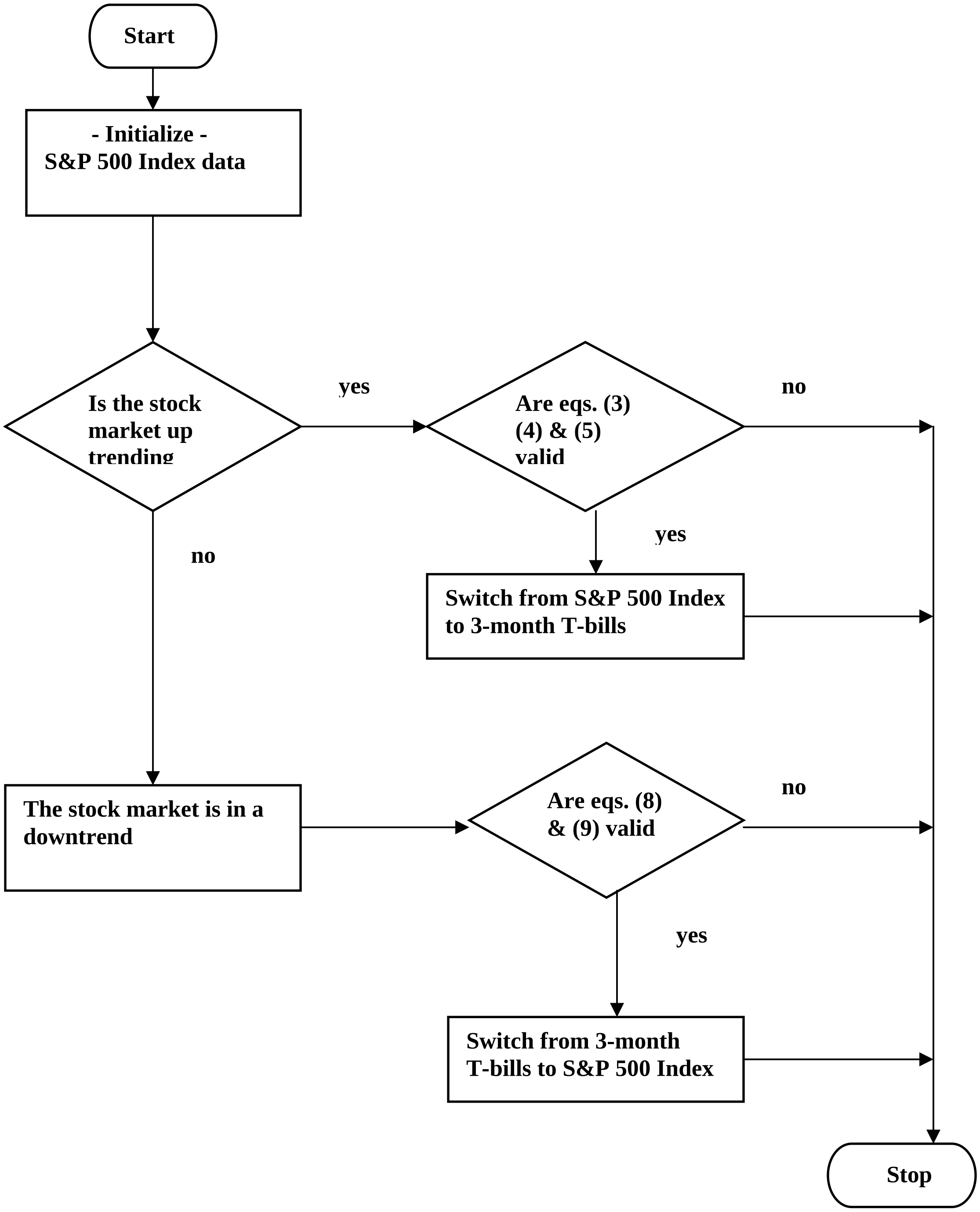

Figure 1: Portfolio B: Mechanical Trading Rule Heuristics Flow Chart

Table 1: S&P 500 Index Portfolio A: Additional Shares – 1928 through 1959

Date	Total Shares (Rounded)	S&P 500 Index Price	Portfolio A Value	Months	Dividend-Interest Diff.	Additional Shares
(R)12/2/29						
(I) 3/1/33	56.306	$5.77	$324.89	27 mo	31.14	5.397
(R) 5/1/34						
(I) 8/1/35	61.703	11.04	681.20	15	36.27	3.285
(R) 8/2/37						
(I) 10/1/38	64.988	12.46	809.75	14	40.24	3.230
(R) 5/1/39						
(I) 12/1/39	68.218	12.29	838.40	8	23.81	1.937
(R) 7/1/40						
(I) 12/1/42	70.155	9.28	651.04	30	69.34	7.472
(R)10/1/46						
(I) 8/1/47	77.627	15.80	1226.51	10	43.54	2.756
(R) 1/2/48						
(I) 7/1/48	80.383	16.70	1342.40	6	28.59	1.712
(R) 4/1/49						
(I)10/1/49	82.095	15.52	1274.11	6	27.14	1.749
(R) 6/1/53						
(I) 3/1/54	83.844	26.25	2200.91	11	85.95	3.274
(R) 2/1/57						
(I) 8/1/57	87.118	47.79	4163.37	6	88.68	1.856
(R)11/1/57						
(I) 8/1/58	88.974	47.49	4225.38	9	135.00	2.843
Totals	91.817 sh			142 mo	$632.32	35.511 sh

(I) Invest in the S&P 500 Index no-load mutual fund
(R) Redemption of S&P portfolio B and start of investment in 3-month T-bills
Average Dividend Yield Less Interest Rate Differential: 4.26% per year or 0.00355 per month

Table 2: S&P 500 Index Portfolio B: Gain From Trading - 1928 through 2008

Date	Total Shares (Rounded)	S&P 500 Index Price	Portfolio B Value
(I) 1/3/28	56.306	$ 17.76	$1000.00
(R) 12/2/29		20.95	1179.61
(I) 3/1/33	204.438	5.77	
(R) 5/1/34		10.46	2138.42
(I) 8/1/35	193.697	11.04	
(R) 8/2/37		17.07	3306.41
(I) 10/1/38	265.362	12.46	
(R) 5/1/39		10.86	2881.83
(I) 12/1/39	234.486	12.29	
(R) 7/1/40		9.87	2314.38
(I) 12/1/42	249.394	9.28	
(R)10/1/46		14.92	3720.96
(I) 8/1/47	235.504	15.80	
(R) 1/2/48		15.34	3612.63
(I) 7/1/48	216.325	16.70	
(R) 4/1/49		14.94	3231.90
(I) 10/1/49	208.241	15.52	
(R) 6/1/53		24.15	5029.02
(I) 3/1/54	191.582	26.25	
(R) 2/1/57		44.62	8548.39
(I) 8/1/57	178.874	47.79	
(R) 11/1/57		40.44	7233.66
(I) 8/1/58	152.320	47.49	
(R) 3/1/60		56.01	8531.44
(I) 2/1/61	137.826	61.90	
(R) 6/1/62		59.38	8184.11
(I) 4/1/63	122.425	66.85	
(R) 7/1/66		85.61	10480.80
(I) 5/1/67	111.652	93.87	
(R) 8/1/69		93.47	10436.11
(I) 3/1/71	107.589	97.00	
(R) 1/3/72		101.67	10938.57
(I) 4/3/72	101.773	107.48	
(R) 7/2/73		102.90	10472.44
(I) 6/2/75	113.118	92.58	
(R) 5/2/77		98.93	11190.76
(I) 9/1/78	107.936	103.68	
(R) 10/1/81		117.08	12637.15
(I) 12/1/82	91.098	138.72	
(R) 3/1/84		158.19	14410.79
(I) 12/3/84	88.507	162.82	
(R) 12/1/87		232.00	20533.62
(I) 9/1/88	79.480	258.35	
(R) 6/1/90		363.16	28863.96
(I) 3/1/91	77.912	370.47	

(R) 5/2/94		453.02	35295.69
(I) 2/1/95	75.033	470.40	
(R) 11/1/00		1421.22	106638.40
(I) 7/1/03	108.558	982.32	
(R) 2/1/08		1395.42	$151484.00
(C) 12/31/08	167.710	903.25	

(I) Invest in the S&P 500 Index no-load mutual fund
(R) Redemption of S&P portfolio B and start of investment in 3-month T-bills
(C) Portfolio B redeemed for cash on 12/31/08

Table 3: S&P 500 Index Portfolio B: Additional Shares – 1960 through 2008

Date	Total Shares - Table 2	S&P 500 Index Price	Portfolio B Value	Months	Interest-Dividend Diff.	Additional Shares
(R) 3/1/60						
(I) 2/1/61	137.826	$ 61.90	$8531.43	11 mo	$183.00	2.956
(R) 6/1/62						
(I) 4/1/63	122.425	66.85	8184.11	10	159.59	2.387
(R) 7/1/66						
(I) 5/1/67	111.652	93.87	10480.77	10	204.38	2.177
(R) 8/1/69						
(I) 3/1/71	107.589	97.00	10436.13	19	386.66	3.986
(R) 1/3/72						
(I) 4/3/72	101.773	107.48	10938.56	3	63.99	0.595
(R) 7/2/73						
(I) 6/2/75	113.118	92.58	10472.46	23	469.69	5.073
(R) 5/2/77						
(I) 9/1/78	107.936	103.68	11190.80	16	349.15	3.368
(R)10/1/81						
(I) 12/1/82	91.098	138.72	12637.11	14	344.99	2.487
(R) 3/1/84						
(I) 12/3/84	88.507	162.82	14410.71	9	252.91	1.553
(R)12/1/87						
(I) 9/1/88	79.480	258.35	20533.66	9	360.37	1.395
(R) 6/1/90						
(I) 3/1/91	77.912	370.47	28864.06	9	506.56	1.367
(R) 5/2/94						
(I) 2/1/95	75.033	470.40	35295.52	9	619.44	1.317
(R)11/1/00						
(I) 7/1/03	108.558	982.32	106638.69	32	6654.25	6.774
(R) 2/1/08						
C-12/31/08	167.710	903.25	151484.05	11	3249.33	3.597
Totals				185 mo	$13804.31	39.032sh

(I) Invest in the S&P 500 Index no-load mutual fund
(R) Redemption of S&P portfolio B and start of investment in 3-month T-bills
C - Portfolio B is redeemed for cash on 12/31/08
Average Interest Rate Less Dividend Yield Differential: 2.34% per year or 0.00195 per month