

**STOCK MARKET  
EXTREMES  
AND  
PORTFOLIO  
PERFORMANCE  
1926 – 2004**

**A study commissioned by  
Towneley Capital Management  
and conducted by  
Professor H. Nejat Seyhun,  
University of Michigan**

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## LETTER FROM DR. WESLEY G. MCCAIN

In the early 1990's, my colleagues and I at Towneley Capital Management, Inc. were looking at a published chart which illustrated statistically how an investor could suffer from missing periods of a bull market. That chart, which is still fairly well known in the investment community, is usually attributed to the University of Michigan. We wanted some additional information, so we took what we thought was the easiest route: We called the University of Michigan, School of Business Administration at Ann Arbor. While the professors we contacted had seen the chart, they each informed us that no one at the school had ever published those numbers or done such a study. In fact, they said that many other people had called over the years asking about the chart only to be told the same thing. We decided to correct the situation.

In 1994, we commissioned Dr. H. Nejat Seyhun, Professor of Finance and Chairman of the Finance Department at the University of Michigan, to perform a comprehensive study of the effect of daily and monthly market fluctuations on portfolio performance. In measuring the effect of those fluctuations, Dr. Seyhun looked at two time periods -- 1926-1993 and 1963-1993.

That the market does not steadily rise or fall, but can swing widely up or down over the course of days or months, was not news. What surprised us, however, was the conclusion that practically all of the market's gains or losses over several decades occurred during only a handful of days or months. For example, in the original study, 95% of market gains between 1963 and 1993 were generated during a mere 1.2% of the trading days.

Many people have contacted us over the last ten years asking for copies of the study. Recently, however, we began receiving requests for an updated version. Since, we also were curious to see how the last decade might have changed results, we asked Dr. Seyhun to revise the study, incorporating data through the year 2004. The results were virtually unchanged: 96% of market gains between 1963 and 2004 occurred during only 0.9% of the trading days.

The research confirms that market timing continues to be even more difficult and risky than many investors have been led to believe. Every time an investor postpones funding his or her investment account "until the market picks up," that person is trying to time the market. The study illustrates how waiting to invest can cause one to miss the relatively few trading days when the market generates its highest returns -- a narrow window of opportunity most individual investors are ill-equipped to anticipate.

This study does not imply that market timing is impossible or that there are not a few skilled or lucky individuals who are successful at it. At Towneley we believe that investors can best attain their financial goals through a consistent long term investment program incorporating asset allocation, risk management and diversified investment styles. We prefer to leave the market timing to those who feel more comfortable than we do about predicting the future.

Sincerely,



Wesley G. McCain, Ph.D., CFA  
Chairman  
Towneley Capital Management Inc.

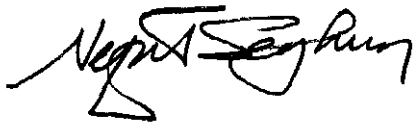
P.S. If you have any questions about Towneley, contact us at [info@towneley.com](mailto:info@towneley.com) or 800-545-4442.

## LETTER FROM DR. H. NEJAT SEYHUN

I am pleased that Wes McCain and his colleagues at Towneley Capital Management, Inc. gave me the opportunity to update our 1994 study. Although more than ten years have passed, the conclusion of my findings is the same. The resulting study has important implications for all investors. It clearly shows that market timing is a double-edged sword, one that can build assets or destroy a fortune.

It is important that investors make well-informed choices regarding the management of their portfolios. We hope that this study makes investors more aware of the difficulties in market timing. If you have questions about this study, please contact Towneley Capital Management, Inc. at [info@towneley.com](mailto:info@towneley.com) or 800-545-4442.

Sincerely,

A handwritten signature in black ink, appearing to read "Nejat Seyhun". The signature is fluid and cursive, with a large initial "N" and "S".

H. Nejat Seyhun, Ph.D.  
Professor of Finance, and Jerome B. and Eileen M. York  
Professor of Business Administration  
Stephen M. Ross School of Business  
University of Michigan

## HIGHLIGHTS OF THE STUDY

This comprehensive study looks at stock market turbulence and how it can affect investment performance.

Professor Seyhun studied stock market returns and risk for all months from 1926 through 2004, and for all trading days from 1963 through 2004. His findings highlight the challenge of market timing, since a small number of months or days accounted for a large percentage of market gains and losses. For example:

- From 1926-2004, a capitalization weighted index of U.S. stocks gained a geometric average of 10.04% annually. An initial investment of \$1.00 in 1926 would have earned a cumulative \$1,919.18. If an investor missed the market's best 12 of the 948 months, the annual return falls to 7.01% and the cumulative earnings to \$196.88. Missing the best 48 months, or 5.1% of all months, reduces the annual return to 2.72% and the cumulative gain to \$6.46.
- Avoiding months when the market plummets can, of course, greatly improve performance. Excluding the single worst month raises the geometric average annual return to 10.53% and the cumulative return to \$2,702.60. Eliminating the 48 worst months lifts the annual return to 20.26% and the cumulative amount to \$1,023,557.70.
- For the 1963-2004 timeframe, the findings were similar. The index gained at a geometric average annual rate of 10.84%, for a cumulative return on \$1.00 of \$73.99 over 42 years. If the best 90 trading days, or 0.85% of the 10,573 trading days, are set aside, the annualized return tumbles to 3.20% and the cumulative gain falls to \$2.70.
- If the 10 worst days are eliminated, the annual return jumps to 12.79%, and the cumulative return increases to \$154.52. With the 90 worst days out, the annual return rises to 19.57% and the cumulative gain to \$1,693.68.

Close examination of the study's data also shows that:

- In the 1926-2004 period, missing the best 5.1% of the months (a total of 48 months) would have created exposure to 85% of the risk of continuous stock market investing, but the average annual return would have been 29% less than the return on Treasury Bills.
- In the 1963-2004 span, missing the best 0.6% of the days (a total of 60 days in all) created an exposure to 95% of the risk of continuous stock market investing. In this situation, the average annual return would have been 19% less than that of Treasury Bills.

# STOCK MARKET EXTREMES AND PORTFOLIO PERFORMANCE

## Introduction

Even a cursory glance at stock market line graphs makes it clear that the market does not rise or fall steadily. For short periods it may skyrocket or plunge. While experience suggests that these short periods are critically important for long-term investment results, Towneley Capital Management decided to actually measure their importance.

At the request of Towneley Capital Management, Professor H. Nejat Seyhun, Professor of Finance and Jerome B. and Eileen M. York Professor of Business Administration at the Stephen M. Ross School of Business, University of Michigan undertook a comprehensive examination of the years 1926-2004 and 1963-2004.

Professor Seyhun looked at the broad market for U.S. stocks during these time frames and produced findings that are current and comprehensive. He quantified both return and risk, and compared the results of continuous full investment and what would happen if an investor was out of the market during the relatively brief periods of sharpest fluctuations. In this study, the months and days with the widest swings are called stock market "extremes."

## The Problem

For a number of investors, an acceptable investment strategy includes market timing -- in other words, owning stocks in a rising market and moving to cash and cash equivalents when the market falls.

But if most of the market's gains come during a very brief time, the risks of market timing are enormous. Substantial payoffs would be rare and easy to miss. Sharp downturns also would be infrequent and hard to avoid. The challenge of moving in and out of the stock market at all the right times would be immense.

The study was designed to throw light on just how difficult it is to time market fluctuations correctly. And while it clearly shows how wonderful results can be for successfully timing the market, it is sobering to consider the penalties for being wrong.

## Market Timing: A Definition

In this study, market timing is defined as an investment strategy that transfers assets from equities to cash equivalents, or from cash equivalents to equities, based on a prediction of the direction and extent of the next price movement in the equity market.

Successful market timing would require not only foretelling the future correctly most of the time but also moving back and forth between equities and cash (or cash equivalents) without incurring prohibitive transaction costs.

## METHODOLOGY

Professor Seyhun studied return and risk data for an index of U.S. stocks. Return was measured as total return with dividends reinvested. Risk was measured by calculating the standard deviation of the total returns.

Two periods were examined: 1926-2004 and 1963-2004. The first period covers the full time frame for which monthly data are available. The second period covers all 42 full calendar years for which daily data are available.

The index was a capitalization weighted composite of stocks traded on the New York Stock Exchange (NYSE), American Stock Exchange (ASE) and the National Association of Securities Dealers Automated Quotation system (NASDAQ). NYSE data were available for both periods; ASE data from July 1962; NASDAQ data from December 1972.

The number of stocks in the index and the market value of the index varied over time. The number of firms in the index peaked at 9,149 in 1996. As of December 2004, the data included information on 6,732 stocks with a combined market value in excess of \$16.4 trillion.

The study also looked at the returns on one-month Treasury Bills for all periods.

For each period studied, total return for the index was calculated both as a cumulative figure and as an average annual rate of return. (See Tables A and B for a description of return rate calculations.)

The study examined what would have happened to the index performance and risk data if a number of the market's best and worst months and days - the stock market extremes - were eliminated from the calculations. Naturally, "best" means the months or days with the highest returns; "worst" the lowest or most negative returns.

Results were calculated in three ways: excluding only best days, excluding only worst days and excluding a combination of best and worst days.

A final calculation was the risk and reward of three hypothetical market timers. The perfect timer owned stocks - that is, was "in the market" - in all the periods with positive returns and held Treasury Bills when stock returns were negative. The inept timer owned stocks only when returns were negative and was "out of the market" - that is, owned Treasury Bills - when the stock market was positive. The random timer switched randomly between Treasury Bills and the stock market. This exercise quantifies the ultimate extent that market timing might have rewarded or punished its practitioners.

## FINDINGS FOR THE YEARS 1926 - 2004

The study found that being "out of the market" for just a few months during this 79-year period changed the risk and reward of the index dramatically if the months missed were those with either the highest or lowest returns - that is, the best or the worst.

In the full span of the 948 months from January 1926 to December 2004, the index had a geometric average annual return of 10.04%. The cumulative gain on \$1.00 invested at the start (January 1926) was \$1919.18. Records show that the single best month was April 1933, with a return of 38.3%. Eliminating only that month would reduce the cumulative gain to \$1387.70 and cut the geometric average annual return to 9.60%.

As the number of best months eliminated is gradually increased, the rewards of investing fall sharply. With the 12 best months eliminated, the cumulative gain is \$196.88; with the best 24 months eliminated, the cumulative gain on the \$1.00 stake is \$52.65.

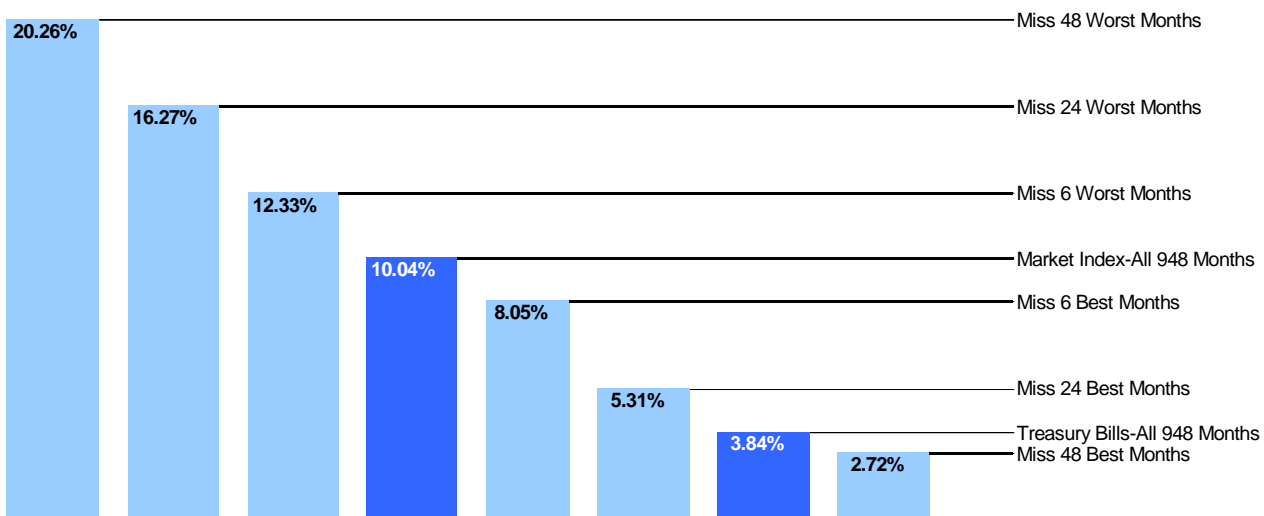
Eliminating the best 48 months -- 5.1% of the 948 months -- lowers the average annual return to 2.72%, a rate below that of Treasury Bills for the study period. As a result, the cumulative gain on \$1.00 is \$6.46, compared to \$1,919.18 for the full span. Besides the small returns, an investment in the index for the less-rewarding 900 months would have incurred 85% of the risk of being in the stock market for all 948 months.

Excluding the worst months, but not the best months, also improves returns. Without the single worst month -- which was September 1931 when the market plunged 29% -- the cumulative gain rises to \$2702.60 and the geometric average annual return improves from 10.04% to 10.53%. Dropping the 48 worst months yields an average annual return of 20.26% and multiplies the cumulative gain 533 times to \$1,023,557.70. Risk is 17% less than that of the full period.

If both best and worst months are excluded, the changes that result are narrower than excluding only the best or only the worst months. In fact, the average annual returns decline when the three best and three worst months are excluded. The cumulative gain also declines when the two best and worst months are eliminated. When the 48 best and 48 worst months are taken out of the calculations, the average annual return rises to 12.38% and the cumulative gain to \$3,976.39.

*(See Table A for data and descriptions of rate of return calculations.)*

**Rewards and Penalties of Market Timing**  
Average Annual Return 1926-2004





## FINDINGS FOR THE YEARS 1963 - 2004

For the 42 years from January 1963 through December 2004, the study focused on the daily data that was available for this period. As in the longer period, eliminating a few of the extremes - in this case best or worst days - radically changed the outcome.

For the entire 42 years of daily data, the index had a geometric average annual return of 10.84% and a cumulative gain of \$73.99 on \$1.00 invested at the start of the period. Excluding the 10 best trading days, or one-tenth of one percent (0.1%) of the total, reduces the average annual return to 9.50% and the cumulative gain to \$43.83 -- a reduction of 41%.

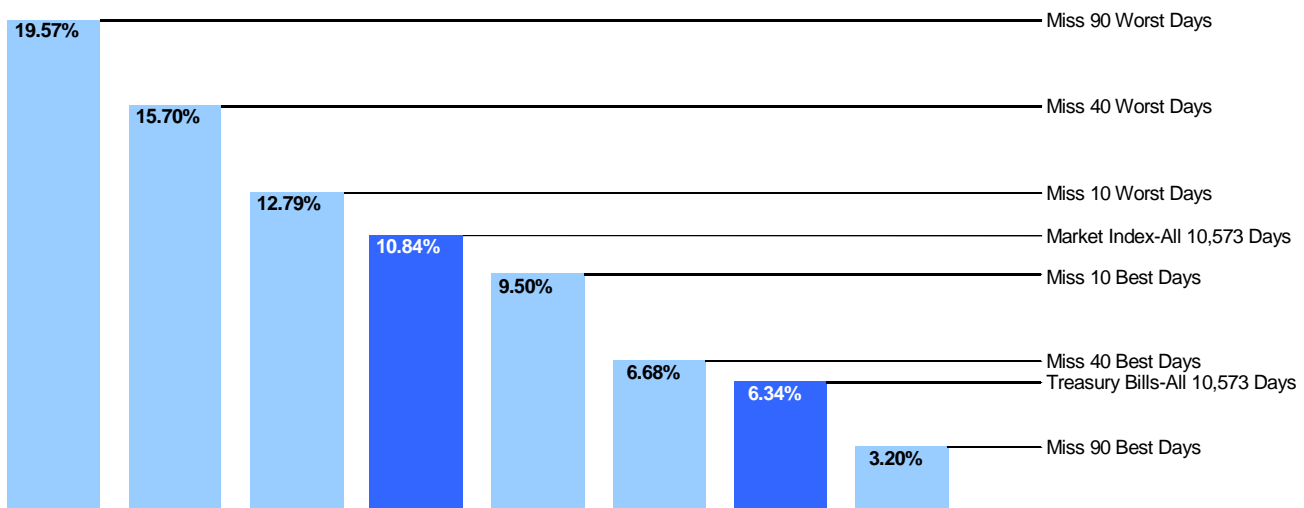
As additional best days are eliminated, returns fall substantially. For example, eliminating the best 90 days, or 0.85% of total days, produces a cumulative return of \$2.70 on \$1.00 invested 42 years earlier. It also reduces the average annual return to 3.20%, which is 50% less than the 6.34% return on Treasury Bills for the period. To put it another way, the data show that an investment in the index for these 10,483 days incurred 94% of the risk of a full-period stock market investment, for which the investor would have received barely half of the reward of an investment with no significant risk.

Excluding the worst 10 days raises the average annual return to 12.79% and the cumulative gain to \$154.52, an increase of 108%. With the worst 90 days eliminated, the cumulative gain is \$1,693.68 - 23 times higher than the full-period gain - and the average annual return is 19.57% compared with 10.84% from continuous stock market investing.

The study found that eliminating both the 10 best and 10 worst days, the 20 best and worst, etc., up to 60 days, raised the cumulative return to a narrow range of \$91.74 to \$91.96. With the 90 best and 90 worst days excluded, the cumulative return was \$82.71. In the last case, although the investor would have missed the 1.7% of the trading days with the highest and lowest returns, an investment in the index nevertheless incurred 85% of the risk of being "in the market" for the full period.

*(See Table B for data and descriptions of rate of return calculations.)*

### Rewards and Penalties of Market Timing Average Annual Return 1963-2004



## PERFECT TIMING: PAYOFF AND PROFITABILITY

Let us examine the cases of the perfect market timer and the inept market timer. The perfect timer is always right, anticipating down markets and switching into short-term Treasury Bills whenever market returns are negative. The inept timer holds the market portfolio when the market returns are negative and Treasury Bills when the market returns are positive.

Monthly data shows that the perfect timer would have turned a \$1 investment in January 1926 into \$20 billion in December 2004. In contrast, the inept timer would have turned \$100 million into \$1,000 by December 2004. In comparison, a \$1 investment in the market index would have grown by \$1919.18, while \$1 invested in Treasury Bills would have grown by \$17.64. (See Table C)

The financial results of perfect timing are indeed attractive; yet they are virtually unreachable. In terms of the monthly data, for example, if a market timer is right 50% of the time, the probability of executing a perfectly timed investment strategy is 0.5 raised to the 948th power -- or nearly zero.

## RANDOM TIMERS: COSTS AND BENEFITS

What about the investors who were neither perfect nor inept? What if investors tried to time the market when they had no particular ability to do so? After all, ability to time the market requires information about future direction of the market. Who has this kind of information?

Is there any cost to random market timers? Would good returns just cancel out the bad returns and would the investor be just indifferent to timing? Or, is there a hidden loss when trying to time the market randomly? To answer these questions, a simulation exercise was conducted with 100,000 iterations to ensure reliable results. In fact, there are several important costs to random market-timers. First, historically more months show positive returns than negative returns. Over the past 948 months, 569 had positive returns and 379 had negative returns (Table C). Thus, if an investor switches into T-Bills for a randomly chosen month, she is likely to miss out on a positive return. Second, the average magnitude of the difference between market returns and T-Bill returns has been 6.16% over the past 948 months, since the market return averaged 10.04%, while T-Bills averaged 3.82% (Table A). Thus, switching out of the stock market into T-Bills will cause an average loss of 6.16% per year.

To the extent an investor cares about expected future wealth, losing out on the positive market risk-premium is costly. Moreover, this cost goes up with the number of months the investor switches out of the market and into the T-Bills. The total cost is modest when the investor stays away only a few months over the 948 month period. However, when the investor stays away an average of 48 months (5.1% of the time), the total expected wealth loss because of the lost market risk-premium grows to 26.5% of end-of-period expected wealth. When the investor stays away an average of 96 months (or 10.2% of the time), total end-of-period expected wealth loss grows to 46.2%. Hence, these costs are real and substantial (See Table D).

Second, the typical investor is risk-averse. Consequently, for the typical investor, a \$1 loss is more important than a \$1 gain. Since market timing involves loss of wealth, this will make the risk-averse investor much worse off. An offsetting consideration is that switching into T-Bills also reduces portfolio risk relative to fully investing and thus benefits the market timer. The net effect can be positive or negative depending on which factor dominates. Table D also computes the effects on portfolio risk, expected wealth, and expected investor utility as the number of months an investor stays away are varied.

The simulation exercise with 100,000 iterations suggests the following conclusions. First, market timing does reduce portfolio risk, especially if the investor stays away for a long time, such as 48 or 96 months. When the investor switches only a few months, portfolio risk can actually increase. Random market timing always reduces expected wealth. The reduction of wealth is small at low levels of switching. At high levels of switching, loss of wealth grows up to 46%. On net, random market timing reduces investors' utility, since the net effect of wealth loss dominates the offsetting benefit of risk reduction. The overall conclusion is that random market timing always makes investors worse off.

## CONCLUSION

The impact of the study can be seen in what it found when it measured the size of the windows of opportunity at which market timing aims. They are quite small.

Two examples illustrate the point. Between 1926 and 2004, more than 99% of the total dollar returns were "earned" during only 5.1% of the months. For the 42-year period from 1963 to 2004, a scant 0.85% of the trading days accounted for 96% of the market gains.

While stock market history teaches us that some market timing techniques are better than others, the study nevertheless shows that -- to optimize returns -- a constant, intensive, and highly accurate approach is needed. Indeed, the data assembled and the calculations done provide compelling evidence that even a few lapses may thwart the accumulation of wealth for which a stock market participant may elect to take on the risk of equity investing. In other words, the data show that the returns from trying and failing to be an outstanding market timer are highly likely to be less than simply owning Treasury Bills.

The implications of this study could well be critical for the average investor. By being "out of the market" for as few as even one or two of the best performing months or days over several decades, a portfolio's return is significantly diminished. Since the study also shows that most of the damage to portfolio performance occurs during a very few months or days, if an investor could avoid such periods, the result would be to sidestep losses and substantially grow one's portfolio.

But one look at the data and the realities of the stock market makes it abundantly clear that such a course of action would expose the investor to investing's biggest -- and potentially most costly -- "if."

## TABLE A

### Returns excluding extreme monthly observations for the period January 1926 to December 2004 (79 years).

Condition	Number of Months	Geometric Average Annual Return on Index	Standard Deviation of Returns	Average Annual Return on T-Bills	Cumulative Holding Return on Index
All months	948	10.04%	18.92%	3.82%	1,919.18
Exclude best 1 month	947	9.60	18.46	3.82	1,387.70
Exclude best 2 months	946	9.18	18.02	3.83	1,016.11
Exclude best 3 “	945	8.80	17.66	3.83	762.95
Exclude best 6 “	942	8.05	17.26	3.83	436.44
Exclude best 12 “	936	7.01	16.91	3.85	196.88
Exclude best 24 “	924	5.31	16.46	3.83	52.65
Exclude best 36 “	912	3.95	16.21	3.83	17.94
Exclude best 48 “	900	2.72	16.03	3.84	6.46
Exclude worst 1 month	947	10.53	18.63	3.82	2,702.60
Exclude worst 2 months	946	10.92	18.43	3.83	3,541.24
Exclude worst 3 “	945	11.30	18.25	3.83	4,571.62
Exclude worst 6 “	942	12.33	17.76	3.83	9,192.76
Exclude worst 12 “	936	13.82	17.25	3.85	24,346.91
Exclude worst 24 “	924	16.27	17.25	3.85	109,757.71
Exclude worst 36 “	912	18.38	16.10	3.86	371,899.88
Exclude worst 48 “	900	20.26	15.72	3.88	1,023,557.7
Exclude best & worst 1	946	10.09	18.16	3.84	1,954.28
Exclude best & worst 2	944	10.06	17.51	3.83	1,875.31
Exclude best & worst 3	942	10.03	16.94	3.84	1,818.23
Exclude best & worst 6	936	10.30	15.99	3.85	2,093.46
Exclude best & worst 12	924	10.70	15.01	3.88	2,508.06
Exclude best & worst 24	900	11.30	13.68	3.86	3,065.40
Exclude best & worst 36	876	11.90	12.76	3.88	3,666.98
Exclude best & worst 48	852	12.38	12.04	3.91	3,976.39

The value-weighted index of NYSE, AMEX, and NASDAQ stocks is used to measure the market returns. All geometric returns are computed by annualizing cumulative wealth.

Cumulative return measures the holding period dollar returns to \$1 invested at the beginning of the period. Hence, the cumulative return of 1919.18 means that an initial wealth of \$1 grows to a cumulative wealth of \$1920.18 if invested continuously from January 1, 1926 to December 31, 2004.

## TABLE B

### Returns excluding extreme daily observations for the period January 2, 1963 to December 31, 2004 (42 years).

Condition	Number of Days	Geometric Average Annual Return on Index	Standard Deviation of Returns	Average Annual Return on T-Bills	Cumulative Return on Index
All days	10573	10.84%	14.1%	6.34%	73.99
Exclude best 10 days	10563	9.50	13.9	6.34	43.83
Exclude best 20 “	10553	8.47	13.7	6.34	29.15
Exclude best 30 “	10543	7.53	13.6	6.34	19.89
Exclude best 40 “	10533	6.68	13.5	6.34	13.91
Exclude best 50 “	10523	5.88	13.4	6.34	9.88
Exclude best 60 “	10513	5.15	13.4	6.34	7.13
Exclude best 90 “	10483	3.20	13.2	6.34	2.70
Exclude worst 10 days	10563	12.79	13.6	6.34	154.52
Exclude worst 20 “	10553	13.87	13.4	6.34	229.65
Exclude worst 30 “	10543	14.80	13.3	6.34	321.54
Exclude worst 40 “	10533	15.70	13.3	6.34	442.64
Exclude worst 50 “	10523	16.54	13.2	6.34	595.01
Exclude worst 60 “	10513	17.33	13.1	6.34	784.89
Exclude worst 90 “	10483	19.57	13.0	6.34	1693.68
Exclude best & worst 10	10553	10.84	13.3	6.34	91.96
Exclude best & worst 20	10533	11.43	13.1	6.34	91.74
Exclude best & worst 30	10513	11.45	12.8	6.34	88.84
Exclude best & worst 40	10493	11.38	12.6	6.34	87.22
Exclude best & worst 50	10473	11.36	12.5	6.34	85.43
Exclude best & worst 60	10453	11.31	12.3	6.34	84.21
Exclude best & worst 90	10393	11.33	12.0	6.34	82.71

The value-weighted index of NYSE, AMEX, and NASDAQ stocks is used to measure the market returns. All returns are computed by annualizing end-of-period cumulative wealth.

Cumulative return measures the holding period dollar returns to \$1 invested at the beginning of the period. Hence, the cumulative return of \$73.99 means that an initial wealth of \$1 grows to a cumulative wealth of \$74.99 if invested continuously from January 1, 1963 to December 31, 2004.

**TABLE C****Performance of Perfect Timer/Inept Timer  
For the period January 1926 to December 2004**

Condition	Number of Months	Geometric Average Annual Return on Index	Standard Deviation of Returns	Average Annual Return on T-Bills	Cumulative Holding Return on Index
All months	948	10.04%	18.92%	3.82%	1,919.18

Condition	Number of Stock Returns	Number of Risk-free Returns	Average Annual Return on Index	Standard Deviation Of Returns	Cumulative Holding Returns
Perfect timer	569	379	35.88%	11.92%	2.02 x 10 <sup>10</sup>
Inept timer	379	569	-14.84%	11.3%	-0.99999
Treasury Bills – all months	---	948	---	---	17.64
Stock index – all months	948	---	---	---	1,919.18

The perfect timer invests in the value-weighted index when returns are greater than T-Bill returns and in one-month Treasury Bills when market returns are less than T-Bill returns. From January 1926 to December 2004, there were 569 months when the value-weighted index had positive (greater than T-Bill) returns and 379 months when the value-weighted index had negative (less than T-Bill) returns. The inept timer does the converse, investing in Treasury Bills when market returns are high and in stocks when market returns are low.

## TABLE D

**Losses for Switching out of the Market for randomly chosen monthly observations for the period January 1926 to December 31, 2004 (79 years).**

Condition: Switch out of the Market into T-Bill randomly for	Number of Months in Market	Number of Months in T-Bills	Average % Gain (+) or Loss (-) in <b>Risk</b> Relative to Fully Investing at all times	Average % <b>Wealth</b> Gain (+) or Loss (-) Relative to Fully Investing at all times	Average % <b>Utility</b> Gain (+) or Loss (-) Relative to Fully Investing at all times
Never	948	0	-	-	-
For 1 month	947	1	11.86%	-2.51%	-2.18%
For 2 months	946	2	14.40	-0.83	-1.84
For 3 months	945	3	-1.86	-3.22	-2.51
For 6 months	942	6	-1.29	-3.95	-3.35
For 12 months	936	12	-6.63	-8.82	-7.04
For 24 months	924	24	0.12	-13.28	-11.56
For 48 months	900	48	-29.06	-26.49	-21.94
For 96 months	852	96	-51.12	-46.15	-39.53

Investor was assumed to randomly switch out of the market and earn the T-Bill rate for that month. The cost of buying and selling stocks and T-Bills, as a result of switching, is assumed to be zero. This exercise was repeated 948 times, with the selected number of months in market and T-Bills shown above. Wealth and utility levels at the end of 948 randomly chosen months are recorded. This entire experiment was then repeated 100,000 times, and average wealth level, average utility and the standard deviation of wealth levels (risk) were observed. The risk-averse investor's utility is modeled as:

$U = 1 - \exp(-\text{Wealth}/RT)$ , where exp stands for the exponential function, RT=risk tolerance, RT is taken equal to 100,000 and Wealth is the end of period wealth if the investor started out with \$1.

This risk-averse investor is approximately indifferent between earning \$100,000 or losing \$50,000 with equal probability, or earning zero for sure. The results are qualitatively similar using RT=10,000 and RT=1,000.

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