LONG TERM MOVING-AVERAGE INVESTING: A SOUND STRATEGY FOR DEFINED CONTRIBUTION RETIREMENT PLANS?

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ABSTRACT

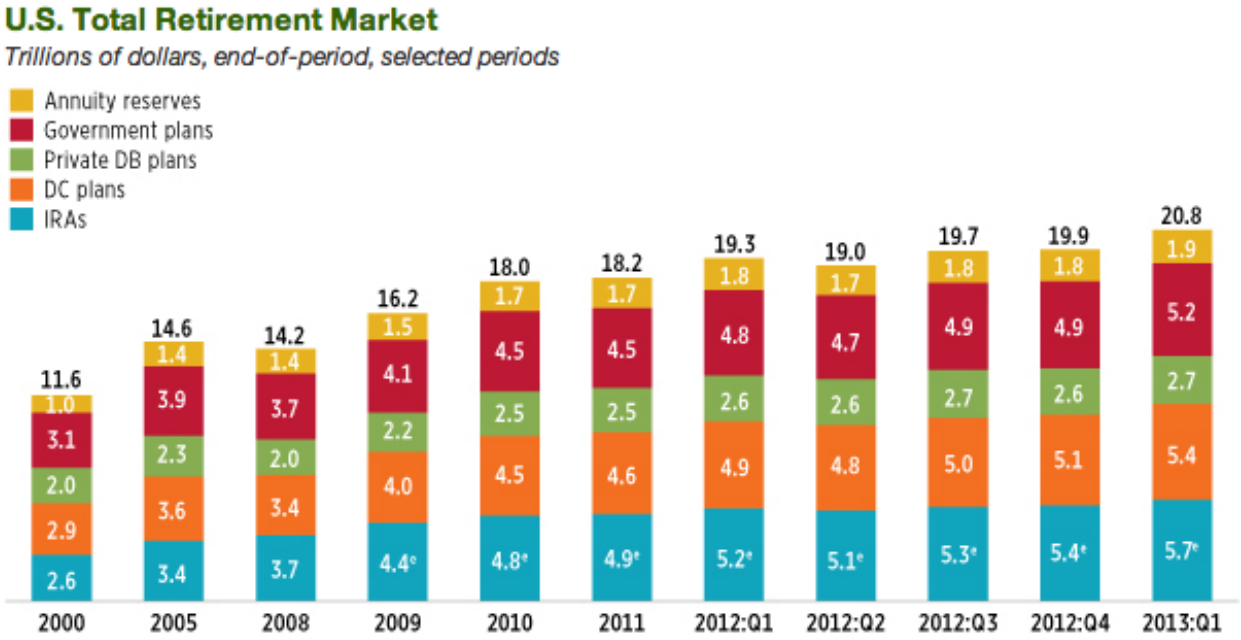
Market timing is a strategy of making buy and sell decisions of financial investments by attempting to predict future market prices through measures of value, market sentiment (bullish/bearish), or moving averages. This study examined the use of the Simple Moving Average (SMA) as an investment guide for employees, having little financial understanding, who are individually responsible for the investments of their personal defined contribution retirement plan. Specifically, the study examined four simple moving averages (SMAs) as a tactical (market) timing strategy for making buy and sell decisions for individuals that have defined contribution plan assets, such as 401(k) plans, 403(b) plans, 407 plans, along with Individual Retirement Accounts (IRAs). The results of the four SMAs (10-month SMA, 12-month SMA, 15/40-weekly SMA, and 50/200-daily SMA) were compared against a buy/hold strategy. The results of this historical post-hoc examination determined that employing the SMA to trigger the decision to be invested or not invested in mutual funds was significantly better than the traditional buy and hold strategy.

Keywords: Simple moving average investing, moving average investing, defined contribution plan investment strategy, buy and hold investing

INTRODUCTION

There are two basic types of retirement benefit plans: defined benefit and defined contribution. In a defined contribution plan, the employee is responsible for investing pre-tax dollars into a fund family of mutual funds approved by the employer. The employee is responsible, or at risk, for choosing how those pre-tax dollars should be invested. And, of course, there is no guaranteed payout benefit when you retire; what you end up with depends on how well your investments perform. On the other hand, a defined benefit plan is a retirement account for which the employer is at risk for a set payout when the employee retires. For this study, our focus centers on an investment strategy for those individuals who have U.S. defined contribution plan assets, *such as 401(k) plans, 403(b) plans, 407 plans, along with Individual Retirement Accounts (IRAs).*

Figure 1. - U.S. Retirement Assets



The dollar amount of "U.S. Retirement Assets" from 2000 through the first quarter of 2013 (Holden & Bass, 2013, p. 2).

Of the $20.8 trillion in the U.S. retirement market assets for the first quarter of 2013, $11.1 trillion, or 53.4%, were designated as "Defined Contribution Plans." For 2012, $5.3 trillion, or 50.5% of the dollar amount in "Defined Contribution Plans" were invested in mutual funds for retirement (Investment Company Institute, 2013b, p 2). We consider these are the individuals that require an investment strategy that is easy to follow and removes the psychological emotions of investing.

Therefore, since these individuals serve as their own investment advisors, this paper's focus is on determining a quantitative investment strategy that incorporates a simple trend following methodology that not only minimizes a significant drawdown in the value of financial assets but also removes the psychological emotions involved in making investment decisions. *(Drawdown, as defined in this paper, is the peak-to-trough decline an investor would experience in an investment. As an example of a drawdown, the S&P 500 Index, declined 36.77% in 2008 alone.)*

LITERATURE REVIEW

Virtually all retirement mutual funds, utilized for employee's investment options, are composed of numerous corporate stocks acquired by the mutual fund to diversify holdings and meet the fund investment objective. Each mutual fund investment option is composed of various individual stock positions. The value of an individual stock (held by a mutual fund) is determined by two factors, value and sentiment (Shefrin & Statman, 1994). Most textbooks on Corporate Finance will define a stock's "value" as the present value of the expected dividend and terminal

value discounted at an appropriate rate; yet sentiment is more "mushy" and can be classified as either "bullish" or "bearish." It is the "sentiment" that causes the market to move away from "value." We have seen what happens when sentiment begins to deviate from value, markets can drop in spite of positive economic news, and gain with negative news.

We recall the extremely "bullish" sentiment of the "dot-com" craze, and wonder how did we go so wrong? However, being extremely "bullish" on technology stocks is not new. In the early 1900s the "wireless telegraph" was the newest technology and investors threw caution to the wind "…trying to reap fortunes from the much heralded field… it would be… impossible to estimate the amount of money that has been thrown away by usually sane… people during the past ten years" (Shaw, 1908, p. 631). Following those years of bullish sentiment of the early 1900s was, of course, the bearish sentiment resulting from the crash in 1929.

"Market timing" involves the detection of changing sentiment and subsequently riding the Bull or Bear to increase returns beyond those achieved through a traditional "buy and hold" strategy. Friedman (1953) and Fama (1970) were among the first to research "technical analysis" as a method for trading stocks and forecasting price movements. The forecasting of price movement through the use of technical analysis continues to remain controversial in the literature with influential studies concluding that technical analysis is not useful; while other studies indicate a positive effect upon portfolio returns. Market timing (technical analysis) has long been the subject of much debate and discussion. Various technical analysis "decision rules" have been examined and tested on the stock market, with most indicating that the decision rules do not result in returns higher than the buy and hold strategy. Further, if we include transaction costs, returns could actually be negative (Fama & Blume, 1966; Jensen & Benington1970).

The stumbling block for technical analysis is the "efficient markets hypothesis." The efficient markets hypothesis implies that technical analysis adds nothing to returns because the current price reflects all available relative information. Investors compete to capitalize on their unique understanding of the common knowledge of a stock's price history and in doing so they drive stock prices to a point where the expected rate of return is commensurate with risk, i.e. normal returns (Fama, 1970). The efficient market hypothesis would imply that technical analysts can only achieve superior returns by identifying stocks that react slowly to market information, providing a window of opportunity for the leveraging of returns, an impossible condition if you are operating in an "efficient" market.

In examining whether a market timing strategy is ever a viable alternative to value analysis or to the efficient market theory (where prices often exhibit a random behavior and are not predictable with consistency), Malkiel (2004) noted that the best predictor for a mutual fund to consistently outperform the market, such as the S&P 500 was through low fund expenses and low turnover rate, not a value approach or a market timing strategy. However, other studies have concluded that some simple investment market strategies will outperform a buy-and-hold approach. Shen (2002) noted, with real-time price data from 1970 to 2000, that a low spread between the P/E ratio of the S&P 500 and interest rates did outperform a buy-and-hold strategy. In addition, Fisher and Statman (2006) noted that a Bullish Sentiment Index strategy between 1962 and 2002, switching from TSY Bills to stocks when the bullish sentiment index is lower than its median and vice-a-versa, outperformed a buy-and-hold strategy, and resulted in a higher Sharpe Ratio.

Even though theory and research suggests that there is no gain from the use of technical analysis, Frankel and Froot (1990a) found that professional traders include technical analysis in forecasting the market. This trend toward technical analysis is more clearly demonstrated by visiting one of the many internet financial sites where technical analysis tools are just a click away e.g. http://finance.yahoo.com. Obviously the frequent upgrading of technical analysis services is a response to the demand for technical analysis tools and competition among the financial information service providers. The trend toward readily available technical analysis tools and data has significantly empowered even the average investor. Schrass, Bogdan and Holden (2012) estimated that 44% of American households were investing in mutual funds in 2012.

The main objective of technical analysis is to identify a market trend and invest accordingly. Technical analysis results in an investor investing in the stock or market when it is trending upward and selling a stock or being on the sidelines when the market is trending downward. If the market begins to trend the technical analysis tools provide signals indicating the direction of the trend. The investor's action, driven by the indicators, reinforces the identified trend. With so many investors relying on technical tools, it is possible for the technical traders to "move" the market in the direction of the trend, providing a self- fulfilling prophesy. Froot, Scharfstein, and Stein (1992) termed this self-fulfilling nature of technical trading, a "speculative bubble." Conrad and Kaul (1988) found that weekly returns were positively auto-correlated with technical trading activities. In a related study Frankel and Froot (1990b) suggested that the overpricing of the dollar (US) in the 1980s could be due to the influence of technical analysis. Shiller (1984, 1989, 2005) found that irrational investor behavior resulted in market volatility. Further, Shiller (1989) suggested that the October 1987 world-wide stock market "crash" may have been the result of technical analysis. Fama and French (1989) proposed a "mean reverting model" to explain the movement of stock prices, finding that returns become strongly negative for a 3–5 year horizon. Evidence of technical analysis leveraging the direction of a stock movement was provided by De Bondt and Thaler (1985, 1987) who found that stocks which experienced a significant downward trend over a 3-5 year period experienced returns above the market during following years. Further, that stocks which experienced strong returns tended to experience returns below the market in following years.

Other studies have shown that some fundamental data like price earnings ratio, dividend yields, business conditions and economic variables can predict to a large degree the returns on stocks (Breen, Glosten, & Jagannathan, 1990; Campbell, 1987; Campbell & Shiller, 1988, 1989; Fama & French, 1989). Lo, Mamaysky & Wang (2000) examined "American share prices" for the period 1962-1996 finding that technical patterns were unusually recurrent and sufficient to lead to trading gains; a finding confirmed by Oglesby and DeBauche (2009, 2010) who found that utilizing Exponential Moving Averages (EMA) and/or the P/E ratio to make trading decisions yielded higher gains, provided the investor with lower risk, and a higher Sharpe Ratio. Specifically, the market timing strategy based on EMA outperformed all other strategies tested (P/E, Dividend Yield and buy-and-hold).

As can be seen, a trend following approach to determine when to buy and sell financial assets is not a new investment strategy. Michael Covel's book (2005), *Trend Following: How Great Traders Make Millions in Up or Down Markets*, dealt with trend following, or market timing. Jeremy Siegel's (2008) book, *Stocks for the Long Run: The Definitive Guide to Financial Market Returns & Long-Term Investment Strategies*, analyzes the use of a 200-day simple moving average

(SMA) in timing the Dow Jones Industrial Average (DJIA). His approach bought the DJIA when it closed at least 1% above the 200-day SMA and sold the DJIA and invested in Treasury Bills when it closed at least 1% below the 200-day SMA. He concludes that this investment timing strategy improves the absolute and risk-adjusted returns over a buy-and-hold strategy. When all transaction costs are included (taxes, bid-ask spreads, commissions), the risk-adjusted returns are still higher when employing market timing, though timing falls short on an absolute return measure.

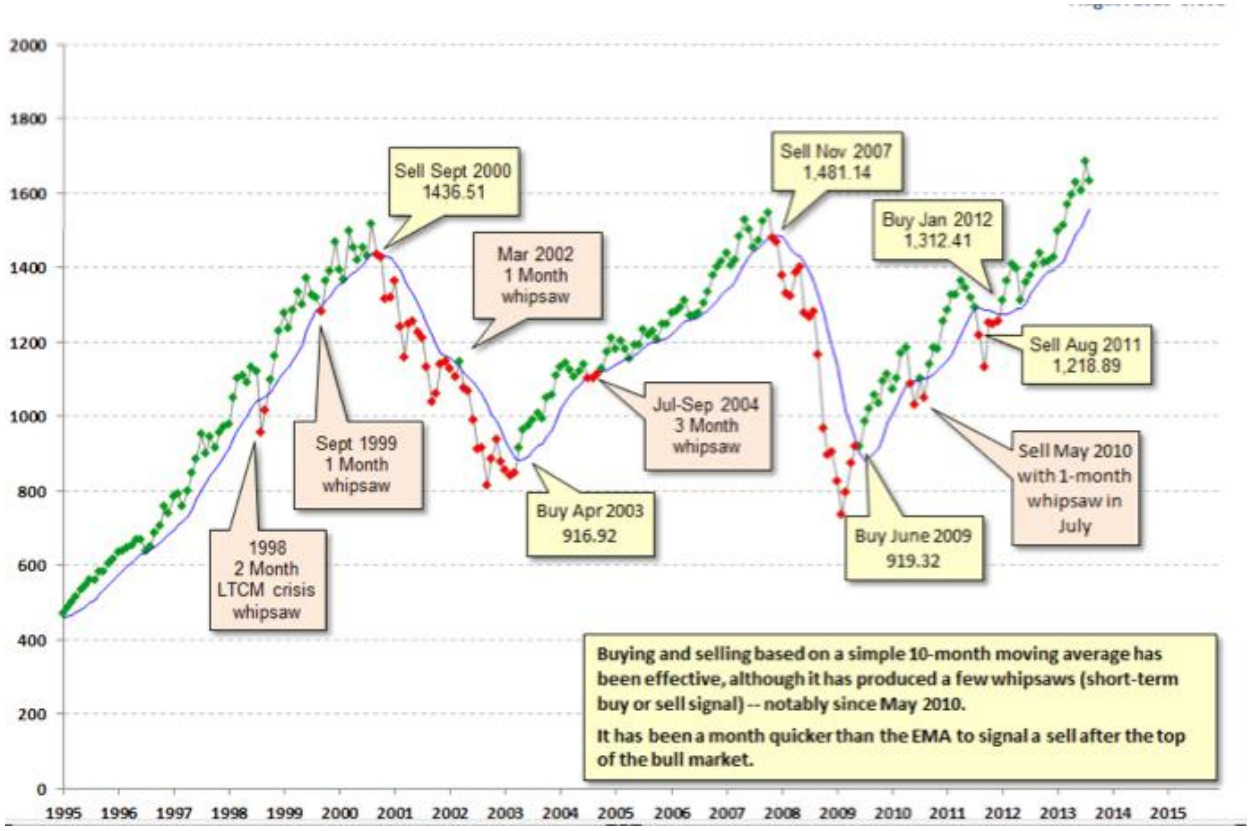
Faber (2013) uses the monthly equivalent of Jeremy Siegel's (2008) 200-day SMA, which is the 10-month SMA and a 12-month SMA. Faber's investment approach is to remain or purchase an equity index, such as the S&P 500, when the monthly close of the index is above the 10- or 12-month SMAs. When the 10- or 12-month SMAs are below the equity index, the investor moves to a cash position. He concludes that the 10- or 12-month SMA improves the return over a buy-hold strategy. However, Faber and Richardson (2009, p. 146) in examining the most recent 15-years concluded that a trend following model (10 or 12 month SMA) did underperform a buy-and-hold strategy during the 1990s. Further, the authors stated that the ability of the 10- or 12-month SMA model to add value to a portfolio must be incorporated over the course of the entire business cycle.

Doug Short (2013a) in his "Moving Averages Month-End Update" on the psychology of momentum signals states that market timing as an investment strategy works because of a human trait. That is, individuals want to imitate successful investment behavior. When individuals hear of others making money in the stock market, they purchase stocks. When the stock market trend changes from bullish to bearish, successful investors sell early. The imitators of such a pattern eventually turn the previous bullish trend (buying equities) into a bearish trend (selling equities).

Prechter and Parker (2007) propose that in the financial realm investors are ignorant of what other investors will do. Therefore, the pricing of investments is mostly motivated by the unconscious herding instincts of investors. In other words, prices of investments are induced by mood impulses, waves of optimism and pessimism, of investors in the aggregate to buy and sell stocks.

The following Figure 2 of the S&P 500 monthly closes since 1995, developed by Doug Short (2013), shows that a 10-month SMA strategy would have insured that investors did participate in most of the bull markets while reducing losses during bear market.

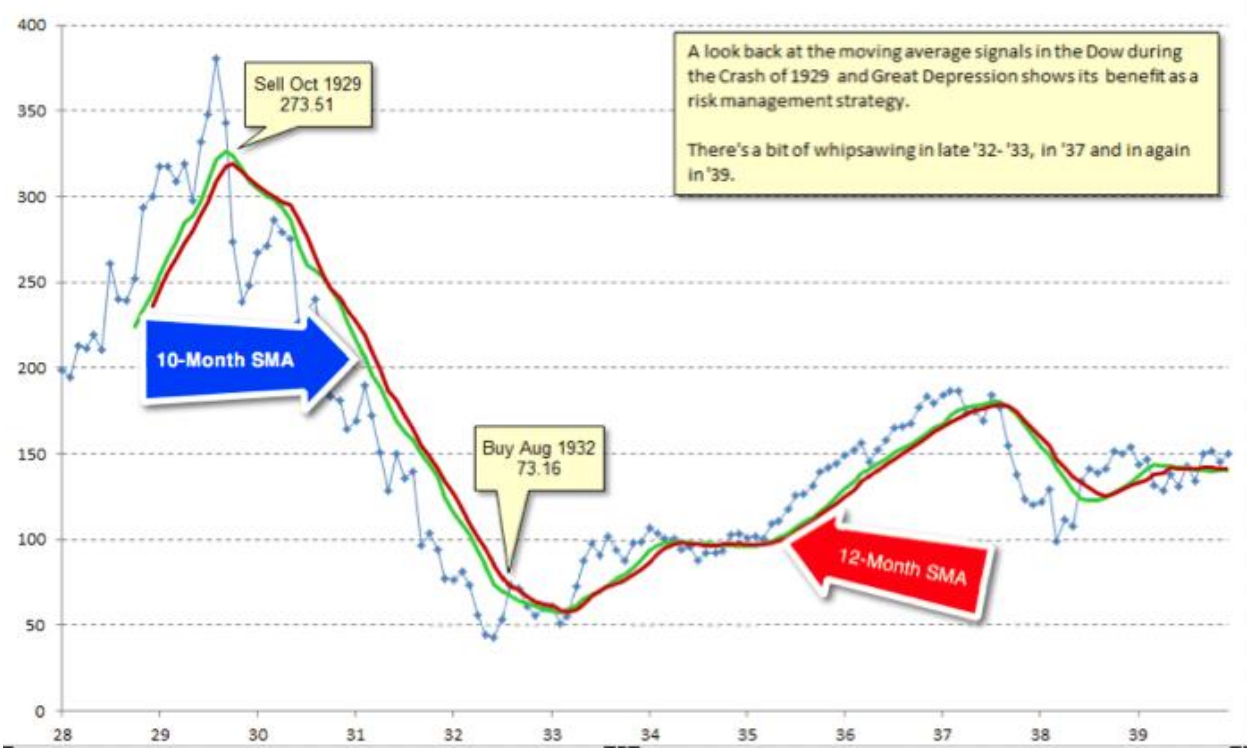
Figure 2. – S&P 500 monthly close since 1995 with 10 month simple moving average



Short's conclusion is that buying and selling based on a 10-month SMA is an effective, simple investment strategy. His strategy can be summed up as follows: Buy when monthly price > 10-month SMA and Sell and move to cash when monthly price < 10-month SMA. Therefore, from Figure 2, these simple moving-average signals have a good track record for potential long-term gains while avoiding major losses. Of course, these simple moving averages are not foolproof timing signals, but they essentially took investors out of equity positions during the 2000-2002 and 2007-2009 bear markets and have captured significant gains since the initial buy signals after the March 2009 low.

In Figure 3, Short (2013b) looks back at the 10- and 12-month SMA averages in the Dow Jones Industrial Averages (DJIA) during the "Crash of 1929 and the Great Depression."

Figure 3. Dow Jones monthly close 1928-1940 with 10 month and 12 month moving averages



The above chart illustrates the investment merits of both the 10- and 12-month SMA approach. An investor would have received a sell signal based on both the 10- and 12-month SMA on October 1929. Subsequent to the next buy signal, the DJIA declined 73.25%. In other words, an investor following this investment timing strategy would have avoided a 73.25% drawdown from October 1929 to August 1932. The strategy did render a buy signal in August 1932; however, the strategy did have four subsequent sell signals that did produce whipsaws.

MEASUREMENT

A moving average trading system is one of the most popular and easy to use investment tools available to an investor. The system is simple, and, since it is mechanical, it removes the emotions involved in making subjective, investment decisions. The system employs two basic trading rules: (1) Buy Rule: Buy when the price > moving average and (2) Sell Rule: Sell when the price < moving average. To determine the most profitable moving average, we tested the following averages of SPY: (1) 10-month SMA, (2) 12-month SMA, (3) 15/40 weekly SMAs, and (4) 50/200 daily SMAs. SPY is an exchange trade fund (ETF) that seeks to provide investment results that, before expenses, generally correspond to the price and yield performance of the S&P 500 Index. ETFs are bought and sold like stocks. Investors can employ traditional stock trading techniques; including stop orders, limit orders, margin purchases, and short sales.

This study utilized back testing by employing a tool available on the "Exchange Traded Funds (ETF) Replay" website (2013) to measure the performance of each of the above moving average from January 2003 to August 2013. Performance returns were based from the first moving

average cross over point. That is, if the price of SPY is above its respective moving average, a buy occurs. If the price of SPY is below its respective moving average, a sell occurs and the proceeds are moved into Barclays Short-Term (3 month) Treasury Bill (SHV) Exchanged Traded Fund. All performance returns are total returns, which includes dividends and distributions. Taxes and commissions are excluded because the focus is on tax-deferred retirement plans. In addition to calculating the compounded annual growth rates (CAGR) for each moving average, we also calculated the Sharpe Ratio, Coefficient of Variation, and the maximum drawdown.

The following Table 1 provides the performance results (CAGR, Sharpe Ratio, and Coefficient of Variation) for the 10-month SMA, 12-month SMA, 15-40 weekly SMA, and the 50-200 daily SMA.

Table 1. Results for long term moving-average market timing strategy
January 2003 to August 2013

	10-Month Simple Moving Average	12-Month Simple Moving Average	15/40 Weekly Simple Moving Average	50/200 Day Simple Moving Average
SPY Market Timing Strategy Cross-Over Date[1]	October 31, 2007	July 31, 2009	October 5, 2007	October 19, 2007
SPY's CAGR[2]	8.11%	10.91%	9.14%	9.04%
Buy/Hold's CAGR[2]	3.78%	6.84%	3.64%	4.07%
Sharpe Ratio[3]	.58	.86	.69	.76
Coefficient of Variation (CV)[4]	1.54	1.15	1.44	1.30

Notes: [1]Performance returns are based from the first "Moving Average Cross-Over Point." That is, if the SPY is above its respective moving average, a switch to the SPY will occur. If the SPY is below its respective moving average, a switch to Barclays Short-Term (3 month) Treasury Bills (SHV) Exchange Traded Fund (ETF) will occur. All returns are total, which includes dividends and distributions.

[2]CAGR is the "Compounded Annual Growth Rate" that is calculated from the first Moving Average Cross-Over Point.

[3]Sharpe Ratio measures return to risk. It is useful in comparing two or more investment alternatives (strategies) in terms of risk-adjusted returns. A higher ratio means that investment returns are being compensated for the risk taken. The Sharpe ratio is calculated as follow: $(r_p - r_{SHY})/\sigma_p$. Where: r_p = Performance return (CAGR); r_{SHV} = Return on Barclays Short-Term (3 month) Treasury Bills; σ_p = Standard deviation. A good rule of thumb is that risky asset classes should have Sharpe ratios that cluster around 0.20, while a diversified portfolio is around 0.40.

[4]The Coefficient of Variation (CV) allows one to determine how much volatility (risk) you are assuming in comparison to the amount of return you can expect from an investment. Therefore, the lower the ratio of standard deviation to its mean return, the better the risk-return tradeoff is. The CV is calculated as follows: (σ/CAGR). Where: σ = Standard deviation of total returns and CAGR is the compounded annual growth rate.

The results show that the best performing average is the 12-month SMA with a CAGR of 10.91%, Sharpe Ratio of .86, and Coefficient of Variation of 1.15. The 12-month SMA outperformed the Buy/Hold strategy, 10-month SMA, 15-40 weekly SMA, and the 50-200 daily SMA in all categories.

The following Table 2 provides the total number of trades and maximum drawdowns for the 10-month SMA, 12-month SMA, 15-40 weekly SMA, and the 50-200 daily SMA.

Table 2. Total number of trades and drawdowns for long term moving-average market timing strategy
January 2003 to August 2013

	10-Month Simple Moving Average	12-Month Simple Moving Average	15/40 Weekly Simple Moving Average	50/200 Day Simple Moving Average
Trades[1]	9	8	7	7
Maximum Drawdown for Timing Strategy[2]	(16.7%)	(16.7%)	(17%)	(17.3%)
Maximum Drawdown for Buy/Hold[2]	(48.8%)	(46.3%)	(54.6%)	(54.7%)

Notes: [1]Total number of trades (buys and sells) from the first "Moving Average Cross-Over Point."

[2]Maximum Drawdown is the percentage drop an investor would experience from the high (based on the daily closing prices) to a sell signal.

The results from Table 2 reveals that the 12-month SMA had a maximum drawdown of 16.7%, which was the lowest of the SMAs. The lowest maximum drawdown for a Buy/Hold strategy was 46.3%.

CONCLUSIONS AND RECOMMENDATIONS

This study examined four simple moving averages (SMAs) as a tactical (market) timing strategy for making buy and sell decisions for individuals that have defined contribution plan assets, such as 401(k) plans, 403(b) plans, 407 plans, along with Individual Retirement Accounts (IRAs). The results of the four SMAs (10-month SMA, 12-month SMA, 15/40-weekly SMA, and 50/200-daily SMA) were compared against a buy/hold strategy.

To determine the merits of this tactical timing strategy, we tested four moving averages of SPY, which is an exchange-traded fund that acts as a proxy for the S&P 500, back to 2003. We back-tested each of the four simple moving averages (SMAs) using the software provided by "ETF Replay" to determine which, if any, of the moving averages achieved superior results to a buy/hold strategy. (ETF Replay only allowed back-testing for a period of ten years.) In essence, the SPY was purchased when its price > SMA; SPY was sold and proceeds moved to SHV (Barclays Short Term (3 month) Treasury Bills ETF) when its price < SMA.

We found that the 12-month SMA achieved superior results to the 10-month SMA, 15/40-weekly SMA, 50/200-daily SMA, and a buy/hold strategy. In particular, the 12-month SMA had a compounded annual growth rate (CAGR) of 10.91% versus the Buy/Hold strategy of 6.84%. The 12-month SMA had a Sharpe Ratio of .86, which was superior to the other moving averages. In addition, the coefficient of variation for the 12-month SMA was lower than the other three moving averages. Further, the maximum drawdown for the 12-month SMA was (16.7%) versus (46.3%) for the Buy/Hold strategy.

The results of the study bring us to the following conclusion:

Investors, with limited investment/financial acumen, can employ the SMA as an investment tool to leverage returns in their individual retirement portfolios. Specifically the findings indicate that:

- The 12-month SMA leads to returns in excess of a Buy/Hold strategy when traded according to the decision criteria presented.
- The 12-month SMA leads to lower drawdowns and volatility than a Buy/Hold strategy when trades according to the decision criteria presented.
- The 12-month SMA leads to positive risk-adjusted rates of return as measured by the Sharpe Ratio.

The study leads to the following recommendations:

- Since this study was limited to ten years of back-testing data, then future research may want to focus on longer time horizons for tactical trading effects.
- Since this study waited until SPY crossed above its respective SMA before making the first purchase, then future research may want to focus on an immediate purchase of SPY if it is above its respective SMA.
- Since this study employed non-leveraged ETFs, then future research may want to incorporate leveraged (derivatives) ETFs along with inverse ETFs.
- Since this study employed only one asset class of ETFs on the buy side, then future research may want to incorporate additional asset classes of ETFs, such as international equities, international bonds, emerging market equities, and commodities.

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