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Portfolio Rebalancing – Hype or Hope?

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The present study uses data from the U.S. for the 20-year period 1983-2012 to examine whether there is evidence that statistically significant value exists for various portfolio rebalancing strategies. The study found that the differences in return from various periodic-cum-threshold rebalancing strategies compared to a buy-and-hold strategy is only 11 basis points and that the mean difference of various periodic rebalancing strategies from a buy-and-hold strategy is not statistically significant except for quarterly or semi-annual portfolio rebalancing strategies. Moreover, the cost of rebalancing is substantial. Given taxes on capital gains and monitoring costs, the analysis shows that the gains from portfolio rebalancing are insignificant. The hype associated with such strategies does not withstand the test of data in the long run. There may be a case for portfolio rebalancing, especially for asset rotation during business cycles. But the evidence provided by this study does not support a case for active rebalancing, a finding which is consistent with the existing compelling evidence against active portfolio management.

Keywords: Portfolio Rebalancing, Periodic Rebalancing, Threshold Rebalancing, Sharpe Ratio

JEL Classification: C15, G11

I. Introduction

The virtue of portfolio rebalancing is one of the controversial aspects of portfolio management. In investment decisions, the primary emphasis is on asset allocation decisions. Prior research has shown that asset allocation decisions can explain a substantial portion of the long-term performance variations of funds (Brinson *et al.*, 1986, 1991, 1995; Ibbotson and Kaplan, 2000; Hood, 2005; Assoé *et al.*, 2006). However, the dynamic aspect of the investment decision is the portfolio monitoring strategy, including guidelines (how often, how far and how much) for rebalancing the portfolio when market conditions change (Perold and Sharpe, 1988).

Once the asset allocations are determined (based on the risk-tolerance level of investors), subsequent market movements may change the risk-return trade-off that was originally established by the investor. Rebalancing the portfolio could be accomplished by acquiring more of the best performing asset class at the expense of the lesser performing classes or by rebalancing back to the initial portfolio mix. Then a case for de-risking the portfolio and readjusting the allocation weights of the portfolio to the original level exists. The main virtue of portfolio rebalancing, cited

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in the literature, is the maintenance of the risk-reward profile of the investors and the ability of investors to capture buy-low/sell-high opportunities (Arnott and Lovell, 1993; Buetow *et al.*, 2002; O'Brien, 2006; Daryanani, 2008). Portfolio rebalancing is widely recommended by financial advisors as part of the paradigm of "cracking and preserving the nest egg". At the theoretical level, the efficient market hypothesis (EMH) holds that value from rebalancing is only short-lived; as stock market anomalies are identified, they would lead investors to engage in arbitrage which would result in the anomalies' disappearance over time. Malkiel and Fama's (1970) work shows that once transaction costs are considered, an individual investor cannot beat the market. Similarly, the empirical evidence provided by behavioral finance literature argues that overconfidence of investors in their investing ability and a disposition to hold losing financial assets too long and selling winners too early prevent portfolio diversification and rebalancing (Shefrin and Statman, 1985; Odean, 1998, 1999; Barber and Odean, 2000, 2001). The overconfidence of investors, it is argued, leads to excessive trading, which results in inferior returns in active portfolios; this phenomenon has been called the "active investing puzzle" (Odean, 1999, Barber and Odean, 2000; Biais *et al*. (2005); Barber *et al.*, 2009).

Since the seminal paper by Jensen (1968), academics have debated this issue and have pointed out that portfolio rebalancing results in higher transaction costs and that portfolios with high transaction levels tend to underperform those with passive investment strategies (Jensen, 1968; Malkiel, 1995, 2013; Gruber, 1996; Wermers, 2000; Pástor and Stambaugh, 2002, 2012; French, 2008; Fama and French, 2010; Del Guercio and Reuter, 2014). Given the existence of transaction costs and considerable "layer-on-layer fees" charged by fund managers/marketers/traders, it has been argued that the best way to manage a portfolio is the passive "buy-and-hold"[1] (B&H) strategy as opposed to "active"[2] portfolio management[3]. The argument for the "buy-and-hold" strategy is that active portfolio management is good for brokers and fund managers (as they can fleece the investors) but poses perils to investors. Fund managers have become wealthy mainly because of their ability to appropriate a substantial portion of their funds' annual returns and this represents the deadweight costs of active management. However, empirical studies especially from the practitioners have provided evidence to support the benefits of portfolio rebalancing (Tsai, 2001; Arnott *et al.*, 1990, 1993; Buetow *et al.*, 2002; Harjoto and Jones, 2006; Donahue and Yip, 2003; O'Brien, 2006; Jaconetti *et al.*, 2010). But at the investor (household) level, there is very little evidence that investors rebalance their portfolios. For example, a study by Calvet *et al.* (2009), based on individual households in Sweden (for 1999 and 2002), found evidence of very little rebalancing in the financial portfolios of households.

Studies have also shown that the need for and outcome of rebalancing depend on the market environment (Tokat and Wicas, 2007). In markets that are trending, portfolio rebalancing was found to yield a lower return as compared with less frequently rebalanced portfolios. On the other hand, in a mean-reverting market, the asset drift is likely to be reversed in subsequent periods, decreasing the need to rebalance (Tokat and Wicas, 2007). Given such conflicting evidence, it

[1] Under the strategy of 'buy and hold', the investor (or portfolio manager) buys a strategic portfolio at the beginning of the investment period and nothing else is done until the portfolio is liquidated at the end (see Cesari and Cremonin, 2003).

[2] Under 'active' portfolio management, the investor (or portfolio manager) chooses a tactical trading strategy of buying and selling assets (risky and risk-free assets) to rebalance assets so as to achieve an optimal portfolio for a given investor over his or her investment horizon (see Cesari and Cremonin, 2003).

[3] A recent Bloomberg study found that investors lose 89 per cent of gains from active funds management. See http://www.bloomberg.com/news/print/2013-10-07/how-investors-lose-89-percent-of-gains-from-futures-funds.html (accessed on November 7, 2013).

would be interesting to examine how a long-term investor would perform under different market conditions (business cycles) using different portfolio rebalancing strategies. The present study examines the empirical evidence for the U.S. using data for a substantial period of time (20 years from 1983 to 2012), to examine whether a statistically significant value exists for portfolio rebalancing. In contrast to the extant literature, the study examines the benefits and costs of periodic, as well as threshold, portfolio rebalancing strategies and covers both expansion and contraction periods of the business cycle.

The study is organized as follows. Section II describes the literature on the subject and develops the hypotheses for the empirical investigation. Section III discusses the database and methodology used in the study. Section IV presents the empirical results and explains some of our findings. Section V summarizes the conclusions.

II. Review of Literature and Hypothesis Development

There is considerable theoretical and empirical literature on the virtues and limitations of portfolio rebalancing. The motives for portfolio rebalancing are numerous. Financial theory suggests that an investor who chooses an asset allocation strategy that is optimal (given the investors' risk tolerance relative to the target allocation) would find changes in the weighting of each asset class in the portfolio by the end of the year due to market movements (time-variant asset returns). The realized return on financial assets results in mechanical changes in asset class weights (resulting in overweight or underweight asset classes), leading to the investor being passively exposed. This calls for "trimming" down the positions of performing assets and fortifying the gains of investment. Portfolio rebalancing allows investors to optimize the risk level and "rotate out" of certain asset classes. Thus, rebalancing is the process of buying and selling portions of one's portfolio in order to set the weight of each asset class back to its original level. In addition, if one's investment strategy or tolerance for risk has changed, rebalancing can be used to readjust the weighting of each security or asset class in the portfolio to fulfill a newly devised asset allocation (depending on the phase of the business cycle). The critics of rebalancing argue that "letting winners run" tends to produce higher returns. This may be true in bull phases of the stock market cycle, but stock market crashes like those that occurred in October 1987, in the aftermath of 9/11 and during the financial crash in 2008 have provided evidence that a secular bull phase in stock market activity is not a reality. In a world where "what goes up must come down", there is an active case for trimming a winning position before its downturn (weakness).

At the theoretical level, the case for active management is based on the idea that active managers are forecasters who can generate excess returns (alphas) as future information is not fully reflected in the price of stocks and that such active managers can translate these forecasts into portfolios (Waring and Siegal, 2003). An early study at the empirical level by Arnott and Lovell (1990) using actual return data (for stocks and bonds) for the U.S. during 1973-1988 found that disciplined portfolio rebalancing improves portfolio performance. Studying a long period of time (1968-1991), Arnott and Lovell (1990) found that for a 50/50 stock/bond portfolio, monthly rebalancing generates the highest return of 9.16 per cent compared with a buy-and-hold return of 9.09 per cent. Plaxco and Arnott (2002) extended their analysis to a global portfolio of 11 developed markets for the period 1968 to 2000 (21 years) and found that the return on the global portfolio based on quarterly rebalancing was the highest (10.96 per cent) compared to the U.S. domestic portfolio (10.68 per cent).

On the other hand, Stine and Lewis's (1992) study, based on different asset allocations of stocks, bonds and T-bills (40/40/20 respectively) for the U.S. during the period 1946-1989 on staggered 3-year portfolios found that the buy-and-hold strategy generates the highest return when compared to calendar and threshold rebalancing strategies. Likewise, using data for the U.S. for the period 1986 to 2000, Tsai (2001) concluded that the difference in outcome (like the Sharpe Ratio) is small for various rebalancing strategies even in a highly risky portfolio (with an equity component of 80 per cent). Subsequent studies by Harjoto and Jones (2006), O'Brien (2006), Daryanani (2008) and Jaconetti *et al.* (2010) found that various portfolio rebalancing strategies generate marginally better returns compared with buy-and-hold strategies.

On the other hand, there is a huge academic literature showing that actively managed mutual funds have underperformed those with passive investment strategies (Jensen, 1968; Malkiel, 1995, 2013; Gruber, 1996; Wermers, 2000; Pástor and Stambaugh, 2002, 2012; French, 2008; Fama and French, 2010; Del Guercio and Reuter, 2014). Malkiel and Fama (1970) and Fama (1991, 2014) argue that the stock markets are efficient and that weak and semi-strong tests of efficiency imply that market prices adjust to "publicly-traded information," while strong forms of tests evaluate the market impacts of non-public information. Their work implies that an individual investor cannot beat a market using a buy-and-hold investment strategy. Quoting Jensen's (1968) work, Malkiel and Fama (1970) note that in "89 out of 115 cases, the fund's risk-return combination for a ten-year period is below the market line and the average return over all funds is 14.6 per cent less than the market return" (p. 412). Gruber (1996) finds that the average mutual fund underperforms passive market indices by about 65 basis points per year from 1985 to 1994. Carhart (1997) finds that net returns are negatively correlated with expense levels of mutual funds and are generally higher for actively managed funds.

Malkiel (2003), while reiterating Fama's conclusions, argues that stock markets are efficient and whatever anomalous behavior of stock prices may exist does not create a portfolio of trading opportunities to earn abnormal returns. Citing numerous studies, Malkiel (2003) argues that professional mutual fund investors, on average, underperform the market and index funds. Malkiel (2003) also provides evidence that the above average returns by a portfolio manager in a given year do not guarantee similar performance in subsequent years.

French's (2008) study of all NYSE, Amex and NASDAQ stocks during 1980-2006 found that investors spend 67 basis points more for active management compared with a passive market portfolio. Similarly, the study by Fama and French (2010) of mutual fund performance in the U.S. during 1984 to 2006 also finds that the net returns of mutual funds in the U.S. underperform benchmarks by about the costs in expense ratios. However, Del Guercio and Reuter's study (2014) based on direct-sold retail mutual funds (self-directed) as compared with broker sold retail mutual funds (based on the advice of the broker) during 1992 to 2004 found persistent underperformance only in broker-sold mutual funds as compared with self-directed investor mutual funds. Given the conflicting evidence regarding the outcome of rebalancing portfolios, the present study examines whether *rebalancing strategies generate better risk-adjusted return than a buy-and-hold strategy.*

The literature also discusses various rebalancing strategies: periodic and threshold-based rebalancing (Masters, 2003). The empirical literature on rebalancing strategies are (a) *time calendar* (such as daily, weekly, biweekly, monthly, quarterly, annually, etc.), (b) *threshold strategies* (such as rebalancing whenever asset ratios drift more than 5 per cent, 10 per cent, 15 per cent, etc. from the target ratios), and (c) *time-threshold strategies*[4]. Various authors have proposed different optimal periodic rebalancing strategies based on different time periods. An empirical

[4] For a discussion of the various types of rebalancing strategies, see Daryanani (2008) and Jaconetti *et al.* (2010).

analysis of these rebalancing strategies has yielded mixed results: some have argued that an annual rebalancing strategy produces the optimal portfolio (Daryanani, 2008; Jaconetti *et al.*, 2010), while others provide evidence that a quarterly rebalancing strategy provides the best return-risk adjustment (Arnott and Lovell, 1990, 1993).

III. Database and Methodology

A. Database

The study is based on a hypothetical portfolio of financial assets invested in stocks and bonds from 1993 to 2012 in the United States. The study is cast from the point of view of institutional investors, although the household sector is normally behind much of the holdings of institutional investors. A stock index can be considered as a diversified portfolio of risky assets and hence an ideal candidate for the creation of a "hypothetical" stock portfolio. The market index used in this study is the S&P 500 which consists of large value stocks and is widely used as a benchmark in investment analysis. The portfolio of stocks measured by the S&P 500 index represents the passive component and all deviations from the index are considered as the active component (Petajisto, 2013). The daily returns from the S&P 500 index are used to calculate the returns. Similarly, the 10-year Treasury yields in the U.S. are used as a proxy for bond returns. The compounded returns are calculated from daily returns. Using actual historical data could throw light on various portfolio rebalancing strategies that have outperformed others with varying levels of statistical significance. The daily stock price index (S&P 500) and 10-year Treasury yield were downloaded from S&P Capital IQ.

B. Methodology

We consider a target portfolio with an initial investment of $10 million with various asset-class mixes of stocks and bonds (90/10, 80/20, 60/40, 50/50, 40/60, 30/70, 20/80 and 10/90). However, our baseline study is based on a 50/50 (stock/bond) portfolio[5] as this was found to be the most popular asset allocation in the U.S. (IMF, 2005, 2011). Assuming a well-diversified portfolio, we envisage limited market timing possibilities. We also rule out reinvestment of dividends and other cash flows so as to avoid complications in portfolio rebalancing strategies. We assume a trading cost of a flat $20 a trade and assume that this trading cost is independent of the size of the trade. We also do not consider bundled costs, such as soft dollars, taxes and labor costs. Similarly, we rule out investors' risk tolerance changing over time as well as investors' changing cash flows. The only dynamic component considered in the portfolio is the change in the value of portfolio over the base values. In our estimation, we consider all periodic (daily, monthly, quarterly, annually, etc.) plus various thresholds (magnitude of drift from target asset allocation) of 5 per cent, 10 per cent, and 15 per cent respectively. For each of the abovementioned rebalancing strategies, risk-adjusted returns are compared with buy-and-hold strategies.

In evaluating various portfolio rebalancing strategies, we use the geometric mean to measure return. The use of the geometric mean as opposed to the arithmetic mean is based on the argument that (a) in portfolio selection, one is interested in measuring long-run cumulative wealth effects (returns for each period are reinvested) and the geometric mean is best suited for that (Young and

[5] The most important practical guideline portfolio allocation for life-cycle investing in equities is 100-minus-age strategy (see Bodie and Crane, 1997).

Trent, 1969), and (b) the theoretical argument that a rational investor wants to choose the portfolio that has the greatest probability of being more valuable than other portfolios. Latané (1959, 1963) has shown that the portfolio that has greatest probability of more value is also the portfolio that has a probability distribution of returns with the largest geometric mean. Latané (1959, 1963) used the geometric mean (G) approximation

$$G^2 = A^2 - S^2 \quad (1)$$

where G is the geometric mean, A is the arithmetic mean and S is the standard deviation. The geometric mean is the nth root of the product of X values.

$$G = \sqrt[n]{(X_1)(X_2) \dots \dots (X_n)} \quad (2)$$

Total risk is assessed by a measure of dispersion-standard deviation. In the portfolio choice context, for any given level of expected return, the greater the standard deviation, the riskier the investment. Originating from the mean-variance framework, the most common risk-adjusted return is the "Sharpe Ratio (SR)"[6] which converts total returns into excess returns by subtracting the risk-free rate and then divides the result by the standard deviation to get a measure of "reward per unit of risk" (see Sharpe, 1964, 1966, 1994). In the literature, the SR is used not only to evaluate portfolio performance but also to test the weak form of market efficiency (see Agarwal and Naik, 2004). In our estimation, we used the U.S. one-year T-bill rate as the short-term risk-free rate. The hypothesis will be rejected if the average Sharpe Ratio for the various active rebalancing strategies over buy-and-hold strategies will be higher and statistically different over the period 1993-2012 for the U.S.

Table 1: Descriptive Statistics of Return on Stocks and Bonds in the U.S. 1993-2012

	S&P 500	10-year US Government Bond Yield
Geometric Mean (%)	6.11	4.80
Mean (%)	7.86	4.81
Median (%)	10.89	4.68
Minimum (%)	-38.49	1.89
Maximum (%)	34.11	7.84
Standard Deviation (%)	18.67	1.48

Table 1 reports the return on stocks (based on S&P 500 indices) and yields on 10-year U.S. bonds for 20 years (1993-2012). The cumulative (geometric) return on stocks of 6.11 per cent during 1993-2012 was considerably higher than the return on bonds (4.80 per cent). The variation

[6] Other portfolio evaluation metrics include Jensen's alpha (Jensen, 1968), and the Treynor Ratio (Treynor, 1966). These measures adjust excess returns for the capital asset pricing model's beta.

in return (standard deviation) was also higher for stocks (18.67 per cent) compared with bonds (1.48 per cent). Thus the risk-return profile of stocks was higher relative to bonds.

Most institutional investors such as pension funds, mutual funds, endowments and foundations set an asset allocation policy after considerable analysis and change it only episodically (Sharpe, 2010). We examine three different allocations of stocks and bonds and nine different harvesting rules beside the passive strategy of buy-and-hold, viz. (a) *time calendar* (such as daily, weekly, biweekly, monthly, quarterly, annually, etc.), (b) *threshold strategies* (such as rebalancing whenever asset ratios drift more than 5 per cent, 10 per cent etc. from the target ratios), and (c) *time-threshold strategies*. Portfolio managers generally use heuristics that are either periodic (monthly/quarterly/annually, etc.) or volatility-based such as rebalancing whenever assets ratios are more than 5 per cent from the target ratio (Donohue and Yip, 2003) and hence report threshold rebalancing for 5 per cent and 10 per cent respectively.

We studied the rebalance bands of 0, 5, 10 and 15 per cent from original target allocations. In addition, we looked at different intervals such as daily, weekly, bi-weekly, monthly, quarterly, semi-annually, annually, 2nd-yearly, 3rd-yearly, 4th-yearly, and 5th-yearly.

IV. Empirical Results

Table 2: Descriptive Statistics of Buy-and-Hold Portfolios – 1993-2012

Statistics	Portfolio (Stocks/Bonds)								
	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90
Geometric Mean (%)	5.99	5.87	5.75	5.62	5.49	5.36	5.23	5.09	4.95
Mean (%)	7.48	7.11	6.75	6.41	6.07	5.76	5.47	5.21	4.99
Median (%)	10.30	9.70	9.07	8.32	7.53	6.87	6.36	5.63	4.86
Minimum (%)	-35.61	-32.53	-29.20	-25.61	-21.71	-17.46	-12.83	-7.75	-2.15
Maximum (%)	31.32	28.56	25.84	23.17	20.52	17.95	15.35	12.81	10.31
Standard Deviation (%)	17.28	15.83	14.31	12.71	11.00	9.19	7.25	5.17	3.00
Skewness (%)	-87.90	-89.84	-91.33	-92.20	-92.17	-90.62	-86.05	-73.58	-30.47
Kurtosis (%)	65.56	69.63	73.50	77.10	80.33	83.02	84.64	82.47	56.17

Table 2 reports the descriptive statistics of buy-and-hold portfolios for various asset allocations – stocks and bonds – based on actual return data for 1983 to 2012. Establishing an optimum portfolio is the most important strategic decision facing any investor. As is evident from Table 2, the highest geometric return was for a predominantly stock portfolio (90/10). As the allocation of bonds was increased, the return decelerated and was the lowest for an extreme bond portfolio (10/90). On the other hand, the risk (measured by standard deviation) was highest for extreme stock portfolios (90/10) and decreased as the portfolio allocation of bonds was increased. Almost all portfolio allocations have negative skewness indicating the probability of large negative

rates of return; skewness was lower for extreme bond portfolios (10/90) indicating that much of the negative returns was driven by stock allocations. The period of investigation includes many periods with extreme negative returns for stocks; during 2008, stock returns fell by 38.5 per cent (see Figure 1).

Figure 1: Stock Market Returns (S&P 500) – 1993-2012

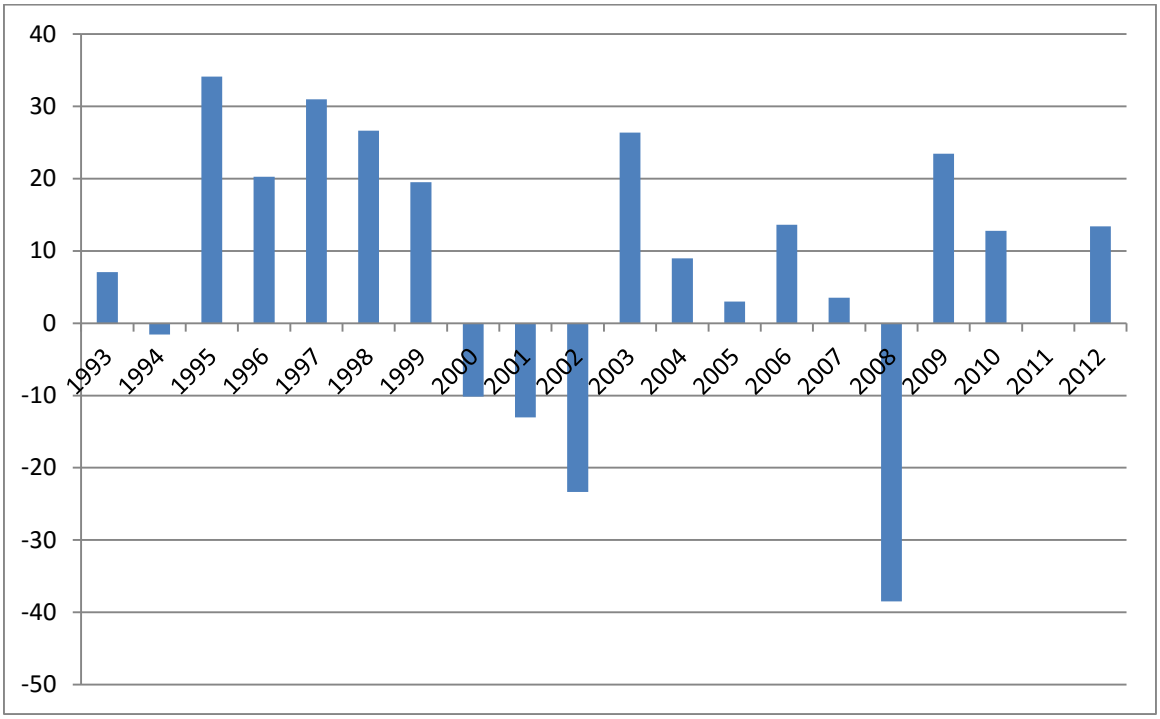


Table 3 (a) to (d) report the results of periodic rebalancing strategies for the period 1993-2012 for different thresholds. For simple periodic rebalancing [Table 3(a)], annual and 2nd yearly rebalancing had the highest reward-risk (Sharpe Ratio). For 5 per cent thresholds, again 2nd year rebalancing was found to have the highest (0.28) Sharpe Ratio [Table 3(b)]. Similar results were found for 10 per cent threshold rebalancing [Table 3(c)]. For 15 per cent rebalancing, however, annual rebalancing was found to have the highest Sharpe Ratio [Table 3(c)].

Table 3 (a): The Effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 0%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.87	6.31	9.57	0.30
Monthly	5.73	6.18	9.73	0.28
Quarterly	5.78	6.23	9.71	0.29
Semi-annually	5.71	6.15	9.65	0.28
Annually	5.78	6.21	9.60	0.29
2nd-yearly	5.86	6.31	9.78	0.29
3rd-yearly	5.46	5.89	9.53	0.26
4th-yearly	5.40	5.90	10.16	0.24
5th-yearly	5.27	5.73	9.86	0.23

Table 3 (b): The Effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 5%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.84	6.29	9.67	0.29
Monthly	5.76	6.22	9.75	0.28
Quarterly	5.74	6.19	9.65	0.28
Semi-annually	5.73	6.16	9.58	0.28
Annually	5.83	6.26	9.46	0.30
2nd-yearly	6.08	6.50	9.44	0.32
3rd-yearly	5.55	5.97	9.43	0.27
4th-yearly	5.40	5.90	10.16	0.24
5th-yearly	5.27	5.73	9.86	0.23

Table 3 (c): The Effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 10%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.98	6.42	9.68	0.31
Monthly	5.86	6.32	9.76	0.29
Quarterly	5.77	6.21	9.67	0.28
Semi-annually	5.84	6.27	9.56	0.29
Annually	5.82	6.25	9.51	0.29
2nd-yearly	6.08	6.50	9.44	0.32
3rd-yearly	5.72	6.16	9.67	0.28
4th-yearly	5.40	5.90	10.16	0.24
5th-yearly	5.27	5.73	9.86	0.23

Table 3 (d): The effect of Portfolio Rebalancing – 1993-2012

Investment Strategy	Rebalance Band 15%			
	Geometric Mean (%)	Arithmetic Mean (%)	Risk (%)	Sharpe Ratio
Buy-and-hold	5.97	6.54	10.87	0.28
Daily	5.98	6.44	9.83	0.30
Monthly	5.85	6.30	9.65	0.29
Quarterly	5.64	6.10	9.77	0.27
Semi-annually	5.65	6.11	9.82	0.27
Annually	6.28	6.68	9.26	0.35
2nd-yearly	6.30	6.77	9.99	0.33
3rd-yearly	5.98	6.41	9.55	0.31
4th-yearly	6.02	6.45	9.62	0.31
5th-yearly	5.40	5.85	9.74	0.25

Table 4: Difference in Mean Returns of Various Investment Strategies from Buy-and-Hold – 1993-2012

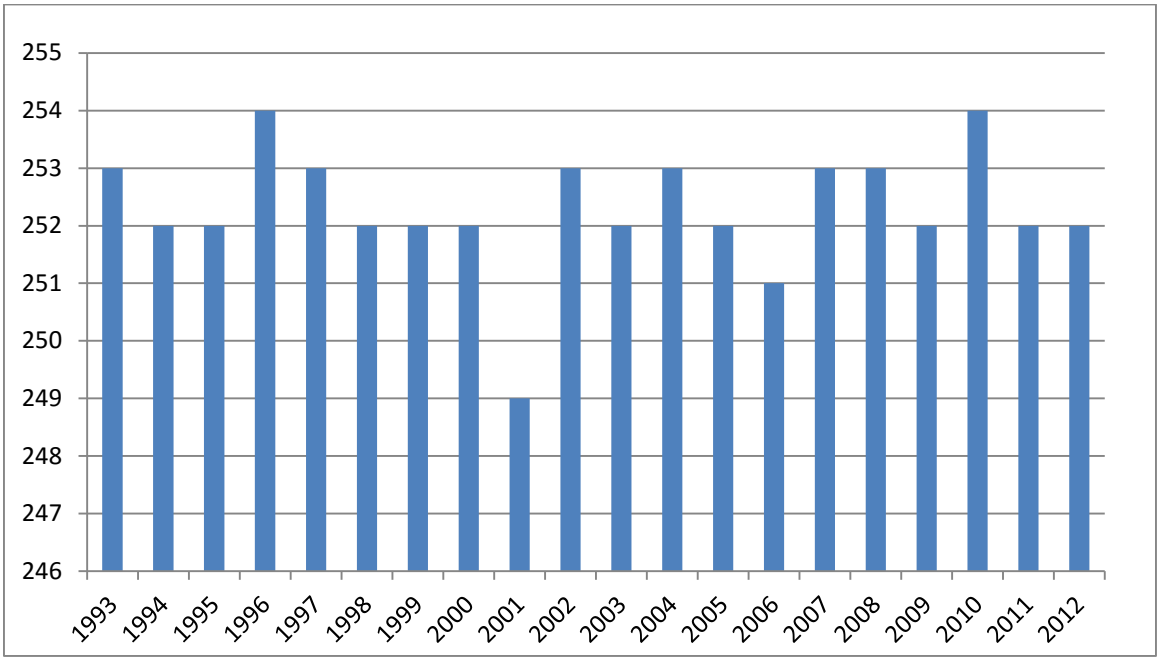
Investment Strategy	Mean Difference	*p*-values
Daily	0.0020	
	(1.34)	0.18
Monthly	0.0543	
	(2.09)	0.03
Quarterly	0.1538	
	(1.93)	0.06
Semi-annually	0.2997	
	(4.20)	0.00
Annually	0.679	
	(1.98)	0.06
2nd-yearly	1.299	
	(1.43)	0.18
3rd-yearly	3.57	
	(2.76)	0.03
4th-yearly	4.53	
	(2.53)	0.06
5th-yearly	6.41	
	(2.94)	0.06

Note: Figures in brackets are *t*-values.

An interesting result reported in Table 3 (a) to (d) is that the difference in return from various periodic-cum-threshold rebalancing strategies compared with buy-and-hold was only 11 basis points except for the 15-per cent threshold, where the difference was 33 basis points. Table 4 shows whether the mean difference of various periodic rebalancing strategies from the buy-and-hold are statistically significant or not. These results showed that for the majority of periodic strategies, the mean differences are not statistically significant except for quarterly or semi-annual portfolio

rebalancing strategies. Moreover, the cost of rebalancing is also substantial; Figure 2 displays the number of rebalancing transactions for a daily rebalancing strategy which was the highest among other periodic and periodic-cum-threshold strategies. On average around 240 rebalancing transactions were involved; for annual rebalancing, the number is around 20. Given the taxes and monitoring costs, the analysis shows that the gains from pursuing rebalancing are minuscule or absent.

Figure 2: Number of Rebalancing Transactions for Daily Rebalancing – 1993-2012



V. Conclusions

The virtue of portfolio rebalancing is one of the controversial issues in portfolio management. Proponents argue for it on the grounds that it de-risks the portfolio and brings value to investors. On the other hand, the critics of portfolio rebalancing argue against it both theoretically and empirically. At the theoretical level, the EMH argues that stock return anomalies are short term and that in the long term, once investors realize the existence of short-term anomalies they will trade on these anomalies and the anomalies will disappear. The argument of the behavioral school is couched on the assertion that overconfidence of investors and a disposition to hold losing assets and sell winners prevent portfolio diversification and constrain portfolio rebalancing. At the empirical level, it provides evidence of behavioral biases leading to "too much trading" which creates layer-on-layer fees for the portfolio managers at the expense of investors. Apart from the existence of transaction costs and considerable layer-on-layer fees charged by fund managers/marketers/traders, it has been argued that the best way to manage one's nest egg (savings) is the passive "buy-and-hold" strategy.

The present study re-examines the evidence for the U.S. using data for a substantial period of time (20 years – 1983 to 2012), to establish whether a statistically significant value exists for portfolio rebalancing strategies. The study found that the difference in return from various periodic-cum-threshold rebalancing strategies compared with buy-and-hold is only 11 basis points

and that the mean difference of various periodic rebalancing strategies from buy-and-hold is not statistically significant except for a quarterly or semi-annual portfolio rebalancing strategy. Moreover the cost of rebalancing is also substantial. Given taxes on capital gains and monitoring costs, the analysis shows that the gains from portfolio rebalancing appear to be insignificant. The hype associated with such strategies does not withstand the test of data in the long run. There may be a case for portfolio rebalancing especially for asset rotation during business cycles. But the evidence provided by this study does not support a case for active rebalancing, a finding that is consistent with the existing compelling evidence against active portfolio management and the increased flow of funds to passive investment vehicles such as exchange traded funds and index funds.

References

Agarwal, Vikas, and Narayan Y. Naik. 2004. "Risks and Portfolio Decisions Involving Hedge Funds." *Review of Financial Studies*, 17(1): 63-98.

Arnott, Robert D., and Robert M. Lovell Jr. 1990. "Monitoring and Rebalancing the Portfolio." In *Managing Investment Portfolios*, ed. John L Maggin, and Donald L. Tuttle.

Arnott, Robert D., and Robert M. Lovell Jr. 1993. "Rebalancing: Why? When? How Often?" *Journal of Investing*, 2(1): 5-10.

Assoé, Kodjovi, Jean-Francois L'Her, and Jean-François Plante. 2006. "The Relative Importance of Asset Allocation and Security Selection." *Journal of Portfolio Management*, 33(1): 46-55.

Barber, Brad M., and Terrance Odean. 2000. "Trading is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors." *Journal of Finance*, 55(2): 773-806.

Barber, Brad M., and Terrance Odean. 2001. "Boys Will be Boys: Gender, Overconfidence and Common Stock Investment." *Quarterly Journal of Economics*, 116(1): 261-92.

Barber, Brad M., Terrance Odean, and Ning Zhu. 2009. "Do Retail Trades Move Markets." *Review of Financial Studies*, 22(1): 151-86.

Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean. 2009. "Just How Much do Individual Investors Lose by Trading?" *Review of Financial Studies*, 22(2): 609-32.

Biais, Bruno, Denis Hilton, Karine Mazurier, and Sébastien Pouget. 2005. "Judgemental Overconfidence, Self-Monitoring and Trading Performance in an Experimental Financial Market." *Review of Economic Studies*, 72(2): 287-312.

Bodie, Zvi, and Dwight B. Crane. 1997. "Personal Investing: Advice, Theory, and Evidence." *Financial Analyst Journal*, 53(6): 13-23.

Brinson, Gary, P., L. Randolph Hood, and Gilbert L. Beebower. 1986. "Determinants of Portfolio Performance." *Financial Analysts Journal*, 42(4): 39-44.

Brinson, Gary, P., Brian D. Singer, and Gilbert L. Beebower. 1991. "Determinants of Portfolio Performance II: An Update." *Financial Analysts Journal*, 47(3): 40-48.

Brinson, Gary, P., L. Randolph Hood, and Gilbert L Beebower. 1995. "Determinants of Portfolio Performance." *Financial Analysts Journal*, 51(1): 133-38.

Buetow Jr., Gerald, W., Ronald Sellers, Donald Trotter, Elaine Hunt, and Willie A. Whipple, Jr. 2002. "The Benefits of Rebalancing." *Journal of Portfolio Management*, 28(2): 23-32.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. 2009. "Fight or flight? Portfolio Rebalancing by Individual Investors." *Quarterly Journal of Economics*, 124(1): 301-48.

Carhart, Mark M.1997. "On Persistence in Mutual Fund Performance." *Journal of Finance*, 52(1): 57-82.

Cesari, Riccardo, and David Cremonini. 2003. "Benchmarking, Portfolio Insurance and Technical Analysis: A Monte Carlo Comparison of Dynamic Strategies of Asset Allocation." *Journal of Economic Dynamics and Control*, 27(6): 987-1011.

Daryanani, Gobind. 2008. "Opportunistic Rebalancing: A New Paradigm for Wealth Managers." *Journal of Financial Planning*, 21(1): 48-61.

Del Guercio, Diane, and Jonathan Reuter. 2014. "Mutual Fund Performance and the Incentive to Generate Alpha." *Journal of Finance*, 69(4): 1673-1704.

Donohue, Christopher, and Kenneth Yip. 2003. "Optimal Portfolio Rebalancing with Transaction Costs." *Journal of Portfolio Management*, 29(4): 49-63.

Fama, Eugene F. 1991. "Efficient Capital Markets: II." *Journal of Finance*, 46(5): 1575-1617.

Fama, Eugene F. 2014. "Two Pillars of Asset Pricing." *American Economic Review*, 104(6): 1467-85.

Fama, Eugene F., and Kenneth R. French. 2010. "Luck Versus Skill in the Cross-Section of Mutual Fund Returns." *Journal of Finance*, 65(5): 1915-47.

French, Kenneth R. 2008. "Presidential Address: The Cost of Active Investing." *Journal of Finance*, 63(4): 1537-73.

Gruber, Martin J. 1996. "Another Puzzle: The Growth in Actively Managed Mutual Funds." *Journal of Finance*, 51(3): 783-810.

Harjoto, Maretno A., and Frank J. Jones. 2006. "Rebalancing Strategy for Stocks and Bonds Asset Allocation." *Journal of Wealth Management*, 9(1): 37-44.

Hood, Randolph, L. 2005. "Determinants of Portfolio Performance-20 Years Later." *Financial Analysts Journal*, 61(5): 6-8.

Ibbotson, Roger G., and Paul, D Kaplan. 2000. "Does Asset Allocation Policy Explain 40, 90, or 100 Percent of Performance?" *Financial Analyst Journal*, 56(1): 26-33.

International Monetary Fund. 2005. "Aspects of Global Asset Allocation." Chapter III, *Global Financial Stability Report*, September, pp. 65-102.

International Monetary Fund. 2011. "Long-Term Investors and Their Asset Allocation: Where Are They Now." Chapter II, *Global Financial Stability Report*, September, pp. 1-48.

Jaconetti, Colleen M., Francis M. Kinniry Jr., and Yan Zilbering. 2010. "Best Practices for Portfolio Rebalancing." *Vanguard Research*, July.

Jensen, Michael C.1968. "The Performance of Mutual Funds in the Period 1945-1964." *Journal of Finance*, 23(2): 389-416.

Latané, Henry Allen. 1959. "Criteria for Choice Among Risky Ventures." *Journal of Political Economy*, 67(2): 144-55.

Latané, Henry Allen. 1963. "Investment Criteria: A Three Asset Portfolio Balance Model." *Review of Economics and Statistics*, 45(4): 427-30.

Malkiel, Burton G. 1995. "Returns from Investing in Equity Mutual Funds 1971 to 1991." *Journal of Finance*, 50(2): 549-72.

Malkiel, Burton G. 2003. "The Efficient Market Hypothesis and Its Critics." *Journal of Economic Perspectives*, 17(1): 59-82.

Malkiel, Burton G. 2013. "Asset Management Fees and the Growth of Finance." *Journal of Economic Perspectives*, 27(2): 97-108.

Malkiel, Burton G., and Eugene F. Fama. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance*, 25(2): 383-417.

Masters, Seth J. 2003. "Rebalancing." *Journal of Portfolio Management*, 29(3): 52-57.

O'Brien, John. 2006. "Rebalancing: A Tool for Managing Portfolio Risk." *Journal of Financial Service Professionals*, 60(3): 62-68.

Odean, Terrance. 1998. "Are Investors Reluctant to Realize Their Losses?" *Journal of Finance*, 53(5): 1775-98.

Odean, Terrance. 1999. "Do Investors Trade Too Much?" *American Economic Review*, 89(5): 1279-98.

Pástor, L'uboš, and Robert F. Stambaugh. 2002. "Mutual Fund Performance and Seemingly Unrelated Assets." *Journal of Financial Economics*, 63(3): 315-49.

Pástor, L'uboš, and Robert F. Stambaugh. 2012. "On the Size of the Active Management Industry." *Journal of Political Economy*, 120(4): 740-81.

Perold, André F., and William F. Sharpe. 1988. "Dynamic Strategies for Asset Allocation." *Financial Analysts Journal*, 44(1): 16-27.

Petajisto, Antti. 2013. "Active Share and Mutual Fund Performance." *Financial Analysts Journal*, 69(4): 73-93.

Plaxco, Lisa M, and Robert D. Arnott. 2002. "Rebalancing a Global Policy Benchmark." *Journal of Portfolio Management*, 28(2): 9-22.

Sharpe, William F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance*, 19(3): 425-42.

Sharpe, William F. 1966. "Mutual Fund Performance." *Journal of Business*, Part 2, 39(1): 119-38.

Sharpe, William F. 1994. "The Sharpe Ratio." *Journal of Portfolio Management*, 21(1): 49-58.

Sharpe, William F. 2010. "Adaptive Asset Allocation Policies." *Financial Analysts Journal*, 66(3): 45-59.

Shefrin, Hersh, and Meir Statman. 1985. "The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence." *Journal of Finance*, 40(3): 777-90.

Stine, Bert, and John Lewis. 1992. "Guidelines for Rebalancing Passive-Investment Portfolios." *Journal of Financial Planning*, 5(2): 80-86.

Tokat, Yesim, and Nelson W. Wicas. 2007. "Portfolio Rebalancing in Theory and Practice." *Journal of Investing*, 16(2): 52-59.

Treynor, Jack L.1966. "How to Rate Management Investment Funds." *Harvard Business Review*, 43(1): 63-75.

Tsai, Cindy Sin-Yi. 2001. "Rebalancing Diversified Portfolios of Various Risk Profiles." *Journal of Financial Planning*, 14(10): 104-110.

Waring, M. Barton, and Laurence B. Siegel. 2003. "The Dimensions of Active Management." *Journal of Portfolio Management*, 29(3): 35-51.

Wermers, Russ. 2000. "Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs and Expenses." *Journal of Finance*, 55(4): 1655-95.

Young, William E., and Robert H. Trent.1969. "Geometric Mean Approximations of Individual Security and Portfolio Performance." *Journal of Financial and Quantitative Analysis*, 4(2): 179-99.