

LONG-TERM BUY AND HOLD VERSUS MONTHLY REBALANCING

Steven L. Beach
Department of Accounting, Finance, and Business Law
College of Business and Economics
Radford University
Radford, VA, 24142

Clarence C. Rose
Department of Accounting, Finance, and Business Law
College of Business and Economics
Radford University
Radford, VA, 24142

ABSTRACT

The investment performance of the buy and hold investment strategy is compared to monthly portfolio rebalancing over various time horizons with different portfolio asset allocations to stock index and bond index funds. The portfolios following a buy and hold strategy produced slightly higher average returns over each time period and asset allocation examined, but, also measured a slightly higher degree of risk. The monthly portfolio rebalancing strategy produced a higher risk/return performance as measured by the Sharpe ratio. The results of this analysis reinforce the importance of asset allocation on portfolio returns regardless of the specific investment strategy followed.

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INTRODUCTION

Investors have often heard advice along the lines of: “Make your investment decisions based upon your risk tolerance and investment time horizon and leave your portfolio alone.” This common advice advocates a long-term buy-and-hold strategy. The computational ease of analyzing expected outcomes for rebalanced portfolios has unfortunately confused the terminology between “buy-and-hold” and “rebalancing,” where many assertions to use a buy-and-hold strategy actually assume periodic rebalancing. The outcomes for buy-and-hold strategies will differ dramatically from the expected outcomes using allocations established from risk and return profiles from monthly rebalanced return calculations. Here, we examine both how and why this divergence occurs.

Some questions arise about the true nature of the risks and the return rewards involved in a buy-and-hold strategy. Due to human nature, few investors can take the hands-off approach reflected in a buy-and-hold investment strategy. Most individuals need to feel some control over processes, thus they are inclined to manipulate their portfolios and take some sort of action to change investments (Presson and Benassi, 1996). Other research indicates that to improve investment performance, investors should reduce their investment trading, i.e. not take action to adjust their portfolios with market fluctuations or to adjust their holdings less frequently. This advice is supported by research that indicates that overconfident investors trade too much and that their overtrading leads to long term inferior performance. (Barber and Odean, 2000)

In this study, the risk and return characteristics of several buy-and-hold strategies are compared with a monthly rebalancing investment strategy over various investment time horizons, using stock and bond indexes. Investment analyses, including those used for determining asset allocations, are commonly conducted with an assumed rebalancing strategy that matches the returns frequency, generally monthly returns.

In this analysis, monthly rebalancing and the long-term buy-and-hold results are assessed in examining summary statistics, the Sharpe ratio, and portfolio results using historical data from January 1926 to December 2004. The remainder of the paper is organized as follows: Section 2 provides the Literature Review, Section 3 introduces the data for analysis, Section 4 provides the statistical analysis and interpretation of the results; Section 5 concludes the paper.

LITERATURE REVIEW

Generally accepted investment practice today calls for the proper asset allocation of an investor to be seen as primarily a function of the investor’s time horizon.(Booth 2004). This practice is implemented in the “your age in bonds” advice commonly espoused by financial

planning professionals. As an investor ages, the diminishing investment time horizon dictates a less volatile asset allocation in order to reduce risk. Life-cycle investing theory, beginning with the “state preference” theory of Arrow (1964), attempts to deal with the likelihood that risk aversion will change over time for an individual, because wealth is impounded in human capital (which determines our labor income and changes over time) as well as in asset wealth. Van Eaton and Conover (2002) build on Bodie, Merton, and Samuelson (1992) by including human capital and confirm the advice for decreased equity allocations as individuals move closer to retirement. This practice, however, conflicts with the theoretical assertion by Samuelson (1969) that asset allocation is time invariant. The Samuelson model assumes a constant opportunity set, which leads to the asset allocation decision being based on repeated iterations of a single period problem.

The assumption of time diversification is often cited in support of the “your age in bonds” type of asset allocation strategy. The premise of time diversification is that fluctuations in security returns tend to cancel out through time, thus more risk is diversified away over longer holding periods. As a result, time diversification leads to lower risk than may be expected for higher risk investments like equities. Thus, many financial advisors feel more confident in recommending heavy stock allocations for clients with long investment horizons.

Stangeland and Turtle (1999) provides examples, building on Samuelson (1994), indicating that the benefits of time diversification depend upon the relative risk aversion of the investor. Thus, indications of portfolio risk being reduced over time should not lead to a “one size fits all” assertion for the rate of shift to lower volatility assets. Along these same lines, Hanna and Chen (1997) examine different levels of constant relative risk aversion for one- and five-year investment time horizons, asserting that a 100% small stock portfolio dominates any other portfolio as far as average performance for both one and five year investment periods.

Research by Perold and Sharpe (1988) indicates that a constant mix strategy would outperform a buy and hold strategy in a volatile market, without sustained moves either up or down. Perold and Sharpe define a constant mix strategy as one that buys stocks as their relative value in the portfolio falls and sells stocks as their relative value in the portfolio rises. The greater the market volatility, the greater the advantage of rebalancing over a buy and hold strategy during extended bull or extended bear markets.

In our study, it is assumed that an investor will pursue a diversified investment strategy, choosing to allocate between a broadly diversified stock fund and a long-term corporate bond fund. This diversified investment portfolio broadly conforms to the risk management advice from both classical portfolio theory and behavioral portfolio theory.

DATA DESCRIPTION AND ANALYSIS

For the buy-and-hold analysis, each portfolio’s results assume investment is initiated at the beginning of each year, although monthly data is utilized. For the Jan. 1926-Dec. 2004 period

analyzed – from Ibbotson Associates Stock, Bonds, Bills, and Inflation: Large Stock Index, Long-Term Corporate Bond Index, and Treasury Bills, the following numbers of observations of investment time-periods returns are available: 1-year, 79 observations; 5-year, 75 observations; 10-year, 70 observations; and 20-year, 60 observations.

It is commonly understood that for a regular portfolio rebalancing program, the portfolio will sell those assets which have performed best since the previous rebalancing and purchase more of the assets which have underperformed since the previous rebalancing. For a buy-and-hold program, the better performing assets will grow as a proportion of the portfolio allocation and the lower-return assets will diminish in the portfolio allocation.

Allocations ranging from 100% in stocks to 0% in stocks (i.e. 100% in bonds) are examined with allocations changing in 10% increments. Results from the 100% stock allocations and from the 100% bond allocations are the same for the buy-and-hold strategy and the rebalancing strategy, due to no investment in the other asset class for the two extremes. As a consequence, the comparisons discussed below will often exclude the two extreme allocations.

The Sharpe ratio is calculated using the compound portfolio return minus the compound risk-free return divided by the monthly standard deviation of returns. Hodges, Taylor, and Yoder (1997) confirm that the Sharpe ratio is influenced by the time-horizon. Furthermore, compound returns are used in the analysis to reflect the concerns of a buy-and-hold strategy, which would be focused on the true payoff to the investment, not on the arithmetic average of the monthly returns.

The most practical and useful way to examine these decisions is through quantitative analysis using historical outcomes of investment performance. The two methods most often employed are Monte Carlo simulation and statistical analysis with overlapping periods. The shortcomings of both methods stem from data limitations when examining long-term investment horizons. Monte Carlo simulation deals with the data limitations by repeating iterations applying the sampled underlying distributions of returns. The shortcomings of the Monte Carlo technique, when assuming a normal distribution in analyzing terminal wealth, may not be well understood by many financial planners using the technique in their practices. (Nawrocki, 2001) Overlapping-periods analysis uses the historical data available, but the analysis of risk is hampered by the difficulty of interpreting standard deviation from overlapping period results. Cooley, et al. (2003) analyzes portfolio success rates with historical overlapping periods and with Monte Carlo simulations and finds generally small differences in the results. In conclusion, they recommend the overlapping periods method due to ease of interpretation. In this paper, we use overlapping returns, which provides an accurate representation of potential outcomes from the seventy-nine year timeframe examined.

The interpretation of results is complicated by the fact that for investment horizons over one year, the period sampled for each investment horizon overlaps with the previous observation. Historically, any investor with a predetermined investment time horizon would have faced a completely new starting and ending point for each investment period, thus each of the overlapping periods provides a unique outcome.

RESULTS

In the following tables, investment portfolio results are summarized for the 1-year, 5-year, 10-year, and 20-year holding periods from January 1926 to December 2004. In the upper panel of each table, results are given for a buy-and-hold strategy of the initial allocations to stocks and bonds. In the lower panel of each table, results are given for a monthly rebalancing strategy for a portfolio with the various allocations to stocks and bonds.

In Table 1 (and subsequent tables), the first column indicates the allocation within the portfolio to the large stock index. The remaining portion of the portfolio is invested into the corporate long-term bond index. The second column is the average monthly compound return for each portfolio based upon the allocation within the portfolio to stocks and bonds. The third column is the average of the monthly standard deviation of return for each portfolio. The fourth column is the average Sharpe ratio. The fifth through seventh columns provide the average ending value, minimum value, and maximum value for a one dollar (\$1) investment in the respective portfolio. These investment performance results are given in dollar amounts in order to enhance their interpretation.

For the one-year holding period, the buy-and-hold strategy provided higher average compounded returns than the rebalancing strategy. The return differentials over one-year horizons are minimal, but the standard deviations were relatively lower for the buy-and-hold strategy at higher initial stock allocations. Using the average Sharpe ratio as a decision tool, an investor would have been best served, in terms of excess return per unit of risk, by choosing the rebalancing strategy. This result is clearly driven by the up-side potential in the returns shown in the consistently higher maximum ending values from the rebalancing approach. The average monthly standard deviations were lowest for the rebalanced portfolios with 40% in stocks down to 0% in stocks. The average Sharpe ratio was highest for the rebalanced portfolios except at the lowest allocations to stocks at 10%. For both strategies, the highest average Sharpe ratio occurred with the 10% stock allocation, reflecting a low risk / low return investment approach. For the ending values, it is shown that all allocations had some outcomes in which the ending one-year value was less than the original investment made. Using minimum ending values to indicate risk, the buy-and-hold strategy was the lower risk alternative given the same beginning allocation. The highest (maximum) ending values occurred for the rebalancing strategy. For a one-year investment horizon, the results indicate that lower-risk allocations are preferred, with minimal differentials (on average) between the two strategies.

Table 1: 1 year Holding Period Buy and Hold versus Monthly Rebalancing

BuyHold	Ret	SD	Sharpe	Avg.	Min	Max
100%	0.843%	4.743%	.2070	1.124	0.567	1.540
90%	0.821	4.312	.2099	1.118	0.611	1.498
80%	0.796	3.896	.2126	1.112	0.654	1.456
70%	0.768	3.495	.2146	1.106	0.697	1.413
60%	0.736	3.111	.2159	1.100	0.739	1.370
50%	0.702	2.747	.2167	1.093	0.781	1.326
40%	0.664	2.408	.2182	1.087	0.822	1.339
30%	0.624	2.102	.2219	1.081	0.863	1.361
20%	0.580	1.841	.2295	1.075	0.903	1.382
10%	0.533	1.650	.2437	1.069	0.919	1.404
0%	0.483	1.596	.2233	1.062	0.919	1.426

Rebal	Ret	SD	Sharpe	Avg.	Min	Max
100%	0.843%	4.743%	.2070	1.124	0.567	1.540
90%	0.820	4.323	.2113	1.118	0.605	1.505
80%	0.793	3.912	.2151	1.111	0.645	1.467
70%	0.764	3.513	.2180	1.105	0.685	1.428
60%	0.732	3.128	.2197	1.100	0.726	1.386
50%	0.698	2.762	.2204	1.093	0.768	1.343
40%	0.660	2.420	.2212	1.087	0.810	1.341
30%	0.620	2.110	.2240	1.080	0.852	1.362
20%	0.577	1.847	.2305	1.075	0.895	1.383
10%	0.531	1.654	.2421	1.068	0.919	1.404
0%	0.483	1.596	.2233	1.062	0.919	1.426

Column 1 is the initial allocation to equities (the Large-Stock Index from Ibbotson) for buy-and-hold and monthly rebalancing strategies. The remaining investment is in bonds (the Large-Corporate Bond Index from Ibbotson). Column 2 is the average of the monthly geometric average returns, Column 3 is the average of the (monthly) standard deviations. Column 4 is the average Sharpe Ratio, calculated by taking the average of the Sharpe ratios. Sharpe ratios for each investment horizon are calculated with the monthly geometric average return on the portfolio less the geometric average return on the Treasury bill divided by the standard deviation of the portfolio returns over the investment holding period. Column 5 is the average of the ending dollar amount from a \$1 initial investment, Column 6 is the minimum of the ending dollar amounts resulting from a \$1 initial investment, and Column 7 is the maximum of the ending dollar amounts resulting from a \$1 initial investment.

In the five-year holding period, the buy and hold strategy has slightly higher average returns than the monthly rebalancing strategy. As expected, the standard deviations are higher for both strategies at higher stock allocations. The highest average Sharpe ratio for the rebalanced portfolios is now at the 30% stock allocation, higher than the previous 1 year holding period's 10% stock allocation. For the buy-and-hold strategy, the highest average Sharpe ratio is at a meager 10% allocation to stocks. The lower standard deviations continue for the buy-and-hold strategy allocations with 50% and more to stocks.

The average return and ending values are similar for the two strategies. For allocations between 10% and 50% to stocks, average return standard deviations are lower for the monthly

rebalanced portfolios. The lowest ending values were better for the rebalancing strategy only in the range of allocations between 60% and 40% to stocks. Upside return potential, reflected in the maximum ending values, was superior for the rebalancing strategy for 50% and less in equities, but superior for the buy-and-hold strategy at higher equity allocations. Only for the 30% stock allocation did investors always recoup their initial investment.

Another risk that is evident in extending the holding period from one to five years is observed for the 90% and 100% allocations to stocks, whereby both the buy-and-hold and rebalancing strategies produced lower minimum ending values over the five-year horizon (from \$0.567 to \$0.514 for 100% in stocks and from \$0.611 to \$0.586 (Buy-and-hold) and from \$0.605 to \$0.583 (rebalancing) for 90% in stocks).

Table 2: 5 year Holding Period Buy and Hold versus Monthly Rebalancing

BuyHold	Ret	SD	Sharpe	Avg.	Min	Max
100%	0.819%	5.102%	.1366	1.750	0.514	3.511
90%	0.800	4.605	.1382	1.712	0.586	3.309
80%	0.778	4.154	.1402	1.673	0.658	3.107
70%	0.753	3.732	.1426	1.634	0.731	2.905
60%	0.725	3.333	.1453	1.595	0.804	2.703
50%	0.693	2.955	.1485	1.556	0.877	2.615
40%	0.658	2.600	.1519	1.516	0.950	2.644
30%	0.619	2.274	.1554	1.477	1.008	2.672
20%	0.576	1.992	.1582	1.438	0.970	2.701
10%	0.528	1.785	.1594	1.398	0.932	2.731
0%	0.474	1.726	.1487	1.359	0.894	2.760

Rebal	Ret	SD	Sharpe	Avg.	Min	Max
100%	0.819%	5.102%	.1366	1.750	0.514	3.511
90%	0.798	4.648	.1404	1.707	0.583	3.238
80%	0.774	4.204	.1441	1.665	0.655	2.983
70%	0.747	3.772	.1478	1.624	0.730	2.746
60%	0.717	3.356	.1514	1.583	0.807	2.610
50%	0.684	2.960	.1546	1.544	0.885	2.640
40%	0.648	2.592	.1571	1.506	0.963	2.667
30%	0.609	2.261	.1582	1.469	1.001	2.693
20%	0.567	1.985	.1579	1.432	0.965	2.718
10%	0.522	1.787	.1580	1.395	0.929	2.740
0%	0.474	1.726	.1487	1.359	0.894	2.760

The 10-year holding period returns are again higher for the buy-and-hold strategy, combined with higher average standard deviations. The Sharpe ratios for the rebalanced portfolios are higher for allocations of 30% or more to stocks. The highest Sharpe ratio for the rebalancing strategy has moved up from the 30% allocation for the 5-year horizon to 40% for the 10-year horizon. A comparison of the two highest Sharpe ratio allocations shows that the rebalancing

strategy provided an average compounded return of 0.667% versus 0.597% for the buy-and-hold strategy, also reflected in the ending portfolio values.

In addition, the rebalancing portfolio also provided more upside potential, with an ending portfolio value of \$4.881 versus \$4.641 for the buy-and-hold portfolio. For all allocations below 100% to stocks, an investor now would have received a positive return, evidenced by the minimum ending values greater than one (\$1), with the rebalancing strategy providing a greater minimum payoff for all allocations, indicating lower risk. Another indication of the risk accumulating in the buy-and-hold strategy is in the lower maximum payoffs for all but the 90% and 80% equity allocations. Despite higher average expected payoffs, the increasing volatility in a buy-and-hold portfolio has reduced the maximum potential payoff.

Table 3: 10 year Holding Period Buy and Hold versus Monthly Rebalancing

BuyHold	Ret	SD	Sharpe	Avg.	Min	Max
100%	0.882%	4.976%	.1382	3.194	0.915	6.223
90%	0.857	4.525	.1399	3.064	1.018	5.726
80%	0.829	4.112	.1418	2.934	1.121	5.226
70%	0.799	3.723	.1440	2.803	1.162	4.903
60%	0.767	3.351	.1465	2.672	1.173	4.852
50%	0.731	2.994	.1493	2.540	1.183	4.800
40%	0.691	2.653	.1525	2.407	1.193	4.747
30%	0.647	2.333	.1560	2.275	1.204	4.695
20%	0.597	2.046	.1590	2.141	1.214	4.641
10%	0.538	1.828	.1574	2.007	1.225	4.588
0%	0.469	1.780	.1265	1.872	1.103	4.534

Rebal	Ret	SD	Sharpe	Avg.	Min	Max
100%	0.882%	4.976%	.1382	3.194	0.915	6.223
90%	0.853	4.537	.1422	3.028	1.048	5.415
80%	0.821	4.108	.1461	2.872	1.167	5.062
70%	0.787	3.691	.1500	2.726	1.183	5.027
60%	0.750	3.291	.1535	2.587	1.196	4.991
50%	0.710	2.913	.1563	2.456	1.208	4.942
40%	0.667	2.564	.1577	2.330	1.218	4.881
30%	0.621	2.255	.1566	2.210	1.225	4.809
20%	0.573	2.001	.1520	2.093	1.231	4.727
10%	0.522	1.826	.1447	1.981	1.234	4.635
0%	0.469	1.780	.1265	1.872	1.103	4.534

For the 20-year investment time horizon, some strong trends are well established. For similar beginning allocations, average returns are greater for the buy-and-hold strategy and standard deviations are lower for the rebalancing strategy. For the 20 year investment time period, the higher minimum payoffs are for the rebalanced portfolios with 40% or more in stocks and the higher maximum payoffs are for the buy-and-hold portfolios with 20% or more in stocks.

The rebalancing strategy exhibits higher Sharpe ratios for allocations of 50% and more to stocks, with its highest Sharpe ratio now at the 50% stock allocation. The buy-and-hold strategy has its highest Sharpe ratio at the 20% stock allocation. A comparison of these two “recommended” strategies reveals higher average returns (0.70% to 0.61%), average ending portfolio value (\$6.027 to \$4.901), minimum ending portfolio value (\$2.579 to \$2.060), and maximum ending value (\$15.190 to \$11.624). This comparison may not be completely fair to the buy-and-hold strategy, however it highlights the fact that the risk reduction in the rebalancing strategy is dominating the analysis.

Table 4: 20 year Holding Period Buy and Hold versus Monthly Rebalancing

BuyHold	Ret	SD	Sharpe	End	Min	Max
100%	0.901%	4.751%	.1313	10.302	1.844	26.817
90%	0.876	4.378	.1331	9.632	1.916	24.945
80%	0.850	4.034	.1351	8.961	1.987	23.063
70%	0.821	3.707	.1370	8.289	2.058	21.169
60%	0.790	3.390	.1390	7.615	2.129	19.263
50%	0.754	3.081	.1409	6.939	2.200	17.347
40%	0.715	2.779	.1427	6.261	2.271	15.419
30%	0.669	2.485	.1443	5.582	2.283	13.490
20%	0.613	2.204	.1449	4.901	2.060	11.624
10%	0.543	1.953	.1402	4.218	1.836	10.609
0%	0.441	1.871	.0845	3.533	1.305	9.868

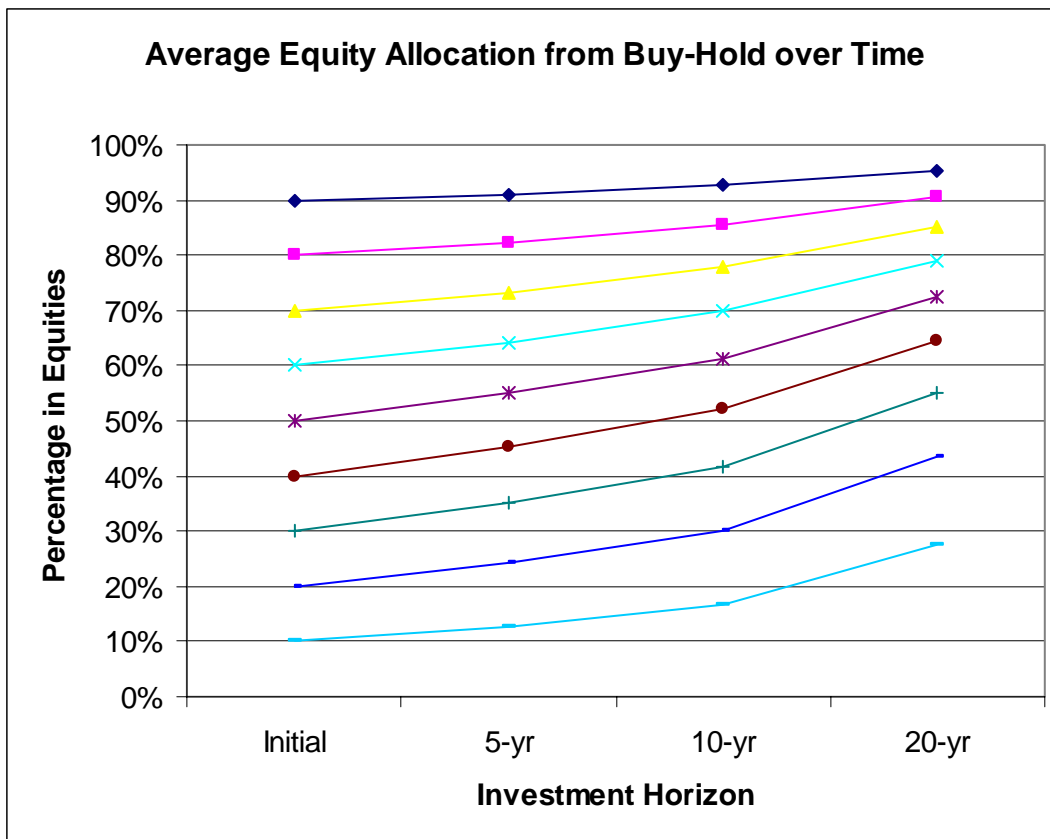
Rebal	Ret	SD	Sharpe	End	Min	Max
100%	0.901%	4.751%	.1313	10.302	1.844	26.817
90%	0.865	4.338	.1343	9.233	2.053	24.137
80%	0.828	3.936	.1372	8.287	2.247	21.620
70%	0.787	3.547	.1396	7.447	2.419	19.275
60%	0.745	3.177	.1414	6.698	2.561	17.104
50%	0.700	2.831	.1420	6.027	2.579	15.190
40%	0.653	2.515	.1408	5.424	2.364	13.431
30%	0.603	2.242	.1367	4.880	2.158	12.179
20%	0.552	2.025	.1282	4.387	1.964	11.403
10%	0.497	1.887	.1134	3.940	1.659	10.630
0%	0.441	1.871	.0845	3.533	1.305	9.868

Table 5: Equity allocations with the highest Sharpe Ratios

Investment Horizon	Rebalancing	Buy and Hold
1 year	10%	10%
5 years	30%	10%
10 years	40%	20%
20 years	50%	20%

To assess the benefits of each strategy, we can examine the risk associated with each expected payoff. For example, at 80% allocations for the rebalancing strategy and 70% allocations in the buy-and-hold strategy, the average returns and average ending values are very similar. The rebalancing strategy is superior in terms of minimum ending portfolio value (\$2.247 to \$2.058) and maximum ending value (\$21.620 to \$21.169). The two average Sharpe ratios are very similar. Comparing a 30% stock allocation with rebalancing to the 20% buy-and-hold portfolios shows similar average returns and average ending portfolio values. The rebalancing portfolio, however, is superior in terms of minimum ending portfolio value (\$2.158 to \$2.060) and maximum ending portfolio value (\$12.179 to \$11.624). In summary, for similar expected ending payoffs, the rebalancing portfolio provided preferred ranges of payoffs. On the upside, however, the risk of a buy-and-hold strategy appears to be obtaining a return payoff, with all maximum payoffs for similar initial allocations being higher.

Exhibit 1



EVOLVING EQUITY ALLOCATIONS IN BUY AND HOLD

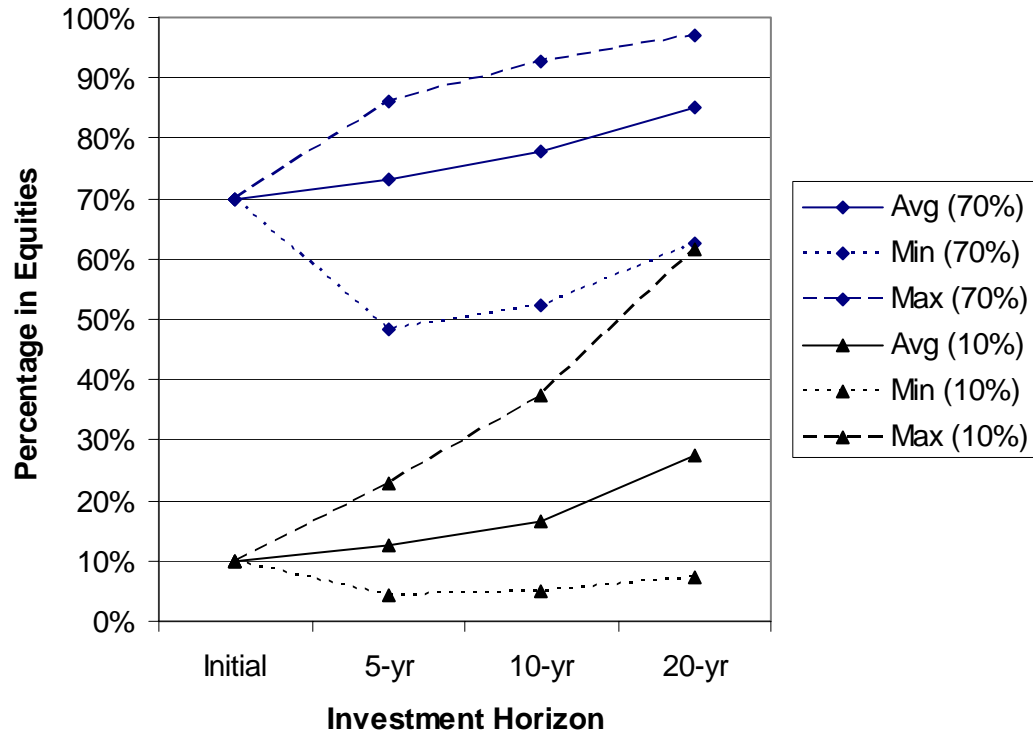
How do we account for the increasing returns and increasing risk in the buy-and-hold strategy? Exhibit 1 shows the increase in average equity allocations for all initial buy-and-hold allocations as the investment holding period extends to twenty years. This result is intuitive and expected as the higher returning equities increase in dollar value more than the bonds, on average. This increase in the average allocation to equities is not the complete story, however. In Table 6, the average, minimum and maximum ending equity allocations are shown for the 10%, 40%, and 70% initial equity allocations for a buy-and-hold strategy. By twenty years, the ending allocations to equities vary dramatically from the initial allocations. For example, note that an initial 10% equity allocation could have risen to 61.7% in equities, while a 70% allocation to equities could have fallen to 62.7% in equities. For a 40% initial allocation to equities, the ending allocations ranged from 32.5% to 90.6%. The 32.5% “low-end” ending allocation in equities nears the average ending allocation from the 10% initial equity buy-and-hold strategy (at 27.5%), while the 90.6% ending allocation far exceeds the expected allocation for the 70% initial equity buy-and-hold strategy (at 62.7%). At the 20-year mark, the allocations in a buy-and-hold strategy may differ greatly from the initial allocation. Exhibit 2 gives a graphical representation of this phenomenon for the 10% and 70% equity allocations.

Table 6: Ending Allocations for a Buy-and-Hold Investment Strategy over 20 years

Initial Allocation to Equities	Average Ending Allocation to Equities	Minimum Ending Allocation to Equities	Maximum Ending Allocation to Equities
70%	85.1%	62.7%	97.1%
40%	64.4%	32.5%	90.6%
10%	27.5%	7.4%	61.7%

Exhibit 2

Average, Minimum, and Maximum Equity Allocations
for Buy and Hold



SUMMARY AND CONCLUSIONS:

The results of comparisons of a buy-and-hold strategy and a monthly rebalancing strategy reinforce the importance of asset allocation on average portfolio returns for each investment time horizon examined. The buy-and-hold strategy produced slightly higher average returns over each of the time periods and also measured a higher degree of risk, given initial asset allocations. For investors seeking higher returns through higher stock allocations, the rebalancing strategy provides greater safety for each investment time horizon examined.

At twenty years, the average ending equity allocations in the buy-and-hold strategy diverged significantly from the initial allocations. The ending allocations also varied broadly from the average. In summary, the increasing equity allocations over time increase the risk of the buy-and-hold portfolios. Additionally, the uncertainty of the ending allocations magnifies the risk of the buy-and-hold strategy. As a result, for a twenty-year investment horizon, the preferred equity allocations based on historical Sharpe ratios are far higher for the rebalancing strategy (50% to stocks) than for the buy-and-hold strategy (20% to stocks). The higher average monthly returns from this rebalancing strategy would result in \$15.19 average ending balance for each \$1 of initial investment, while the buy-and-hold strategy would result in an \$11.62 average ending balance. The importance of the asset allocation on portfolio returns is thus also confirmed.

The rebalancing strategy, with the higher stock allocations and lower standard deviations, may provide investors with a preferred choice, where they use consistent allocations that fit with their risk tolerance. Furthermore, evidence from maximum Sharpe ratios supports the common practice of lowering stock allocations as the time to retirement decreases. The results provide individual investors and financial planners with additional tools for making allocation decisions as the investor's life cycle progresses.

Individual investors and financial planners need to understand how asset allocation, buy-and-hold investment strategies, and monthly rebalancing portfolio strategies may influence investment outcomes. At longer investment time horizons, the returns for the buy-and-hold portfolio are consistently higher, but the risk is clearly higher in portfolios with greater stock allocations and lower in portfolios with greater bond allocations, compared to equivalent beginning allocations in rebalancing portfolios. Due to the greater risk, the optimal portfolios for the buy-and-hold strategy have higher initial proportions in bonds for investment horizons of ten or twenty years.

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ABOUT THE AUTHORS

Clarence C. Rose, PhD, is a Professor of Finance and Director of the MBA and Academic Outreach Programs in the College of Business and Economics at Radford University in Radford, VA. He has published numerous articles on personal financial planning, real estate finance and investment analysis, and investment strategies. Dr. Rose can be reached at crose@radford.edu or (540) 831- 5185.

Steven L. Beach, PhD, is an Associate Professor of Finance in the College of Business and Economics at Radford University in Radford, VA. He received his Ph.D. in Finance from Washington State University. Dr. Beach has published articles on asset pricing, asset allocation, behavioral finance, global portfolio management, and emerging market investments. Dr. Beach can be reached at slbeach@radford.edu or (540) 831-5087.