Semivariance in Asset Allocations: Longer Horizons Can Handle Riskier Holdings

by Steven L. Beach, Ph.D.

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Executive Summary

- The investment horizon of investors is critical in establishing proper asset allocations. This article uses semivariance and standard deviation as risk measures in determining the historically optimal allocations to a bond index or a small stock index with a large stock index over investment horizons of 5, 10, 15, and 20 years.
- Semivariance assesses the downside risk of an investment, so it is helpful in examining the concerns of investors about investment shortfalls.
- The most surprising finding is that the reward-for-semivariance results consistently indicate a higher allocation to the riskier assets than the reward-for-standard deviation (Sharpe ratio) assessments indicate, except for similar allocations by the two metrics for the large stock and corporate bond portfolios at a 20-year horizon.
- Over longer investment horizons, greater allocations to the riskier asset appear to provide the best return for risk. This result is consistent when using either semivariance or standard deviation as the risk measure.
- The results support the common advice of greater allocations to riskier assets for long-horizon investing. Long-term asset allocations based on short-term reward-to-risk assessments could lead to an overweighting on low-risk assets and reduce ending portfolio values.

Asset allocation decisions depend upon the investor's investment horizon; the investor's risk tolerance; and the risk, return, and correlations of the available investments. Although individual investors are primarily concerned with downside risk, the traditional measure used to assess risk is the standard deviation of returns, which combines downside and upside volatility in one measure. In this analysis, historical returns are used in examining asset allocations for 5-, 10-, 15-, and 20-year investment horizons, with risk measured with standard deviation of returns and with below-target semideviation of returns, a downside risk measure. The findings support the common recommendation by investment advisors of higher allocations to riskier investments when the client has a longer investment horizon. These findings, based on the Sharpe ratio and the reward-to-semivariability ratio, hold true even when downside risk is used as the risk measure. So despite investor concerns about downside risk, financial advisors should feel confident in advising clients to increase equity allocations with increasing investment horizons.

Search for Improved Risk Assessments

Investors are concerned about loss (negative returns), underperformance (returns below a benchmark), or falling short of their financial goals (a type of financial disaster). Although standard deviation of returns is regularly used as the risk measure, it is imperfect in assessing the three concerns of investors, all of which consider risk as a shortfall of some kind. Standard deviation is an accurate measure of risk if returns are normally distributed or if investors are as concerned about upside movements as they are about downside risk. Downside risk measures, including semideviation, provide a better assessment of investment risk, as discussed in Swisher and Kasten (2005).

Individual investors are often advised to hold a greater proportion of riskier assets when facing longer investment horizons. As the investment horizon shortens, they are advised to adjust to a more conservative portfolio composition. Supporting arguments often focus on time diversification, whereby more risk is diversified over longer investment horizons as the return fluctuations tend to cancel out. Thus, it is anticipated that potential losses can be overcome by the opportunities for sizeable positive returns in some future period. Many academics, however, do not view time diversification as an appropriate argument for holding riskier portfolios over longer investment horizons (Kritzman 1994 and Samuelson 1963). Their counterargument is based on the fact that the value of the assets at risk increases over time; thus, the total risk increases later in the life of the investment.

Despite the significance of the investment time horizon, many practitioner and academic discussions fail to provide clarification regarding the differentiation between short-term and long-term horizons. Often the defining feature is that long-term investment horizons are associated with cash flows needed in retirement. Garmaise (2006) asserts that "[i]n the framework of standard finance theory, an evaluation based on annual results is considered myopic." Under standard finance models, terminal wealth is a more important focus. Furthermore, Garmaise (2006) identifies a shortening of the decision time frame by investors who have experienced losses in the most recent annual evaluation period; thus, the time horizon for investment decisions is not always fixed.

Since standard deviation is not an appropriate measure of risk when returns do not have a symmetrical distribution, alternative measures, including value-at-risk (Jorion, 2001), shortfall probability (Roy 1952 and Browne 1999), skewness (Kraus and Litzenberger 1976), and lower partial moments (Nawrocki 1999) are sometimes used. Below-target semivariance (SVt) is the specific lower partial moment investigated in this paper because it can provide superior information on the risk in asymmetric returns. The shortest investment horizon examined in this paper is five years because below-target semivariance calculations and the resulting reward-to-risk ratios are biased in small samples.

Risk Assessments Often Misunderstood, Misused

In practice, the use of the Sharpe ratio (excess return / standard deviation) as a portfolio decision tool is often misused due to inattention to the investment time horizon of the investor (Kim and In 2005). The reward-to-semivariance ratio (excess return / semivariance) can be applied in the same manner as the Sharpe ratio, yet the investment time horizon still must be considered. In the past, widespread use of the reward-to-semivariance ratio (R/SV) has been hampered by several factors that are no longer of concern. The first notable barrier, the more difficult calculation of semivariance, is now a trivial matter for any skilled spreadsheet user. The second barrier has been a perceived lack of theoretical foundations for downside risk measures. This concern, however, has been laid to rest, originally in Bawa (1975) and Fishburn (1977), and more recently in Pedersen and Satchell (2002).

In addition to the search for improved assessment of investment risk, another important application of risk measures is in determining an optimal allocation between asset choices. Any reference to optimal allocations in this article reflects a historical result in the highest value of the reward-to-risk measure. The Sharpe ratio and the reward-to-semivariance ratio are examined in assessments of asset allocations over several investment horizons.

Individual investors must take care in all aspects of the investment decision process, including asset allocation, security selection, and potential market timing. Observed market timing and security selection decisions may be driven by rational adjustments by investors to changes in expected returns and investment risk. Arshanapalli, Coggin, and Nelson (2001) showed that superior information was required in tactical allocation decisions to beat a monthly rebalanced portfolio consisting of 60 percent equity, 30 percent bond, and 10 percent T-bills. Leggio and Lien (2003) use the Sharpe ratio and the R/SV ratio in finding that dollar-cost averaging is inferior to lump-sum and value-averaging strategies, contradicting much common investment advice. One caveat to their finding, however, is that dollar-cost averaging may be a strategy that investors are more likely to maintain, providing a form of investment discipline.

Risk Measures and Skewness in Investment Returns

This discussion presents the definitions of standard deviation (SD), below-mean semivariance (SVm), and below-target semivariance (SVt). Nawrocki (1999) provides an excellent summary of downside risk measures in portfolio analysis, with a particular focus on lower partial moments, of which SVm and SVt are members.

Standard deviation is the square root of variance and serves as a measure of the distribution of returns around the mean return of the asset by squaring the deviations from the mean.

Variance: $$V = \frac{1}{N}\sum_{T=1}^{N}[E - R_T]^2$$

Standard Deviation: $$SD = \sqrt{V}$$

where N is the number of observations, R_T is the return in period T, and E is the expected value (mean) of the asset return.[1]

Below-mean semivariance focuses on returns that fall below the mean return.

Below-mean semivariance:

$$SVm = \frac{1}{N}\sum_{T=1}^{N} Max[E - R_T, 0]^2 = \frac{1}{N}\sum_{T=1}^{N} Min[R_T - E, 0]^2$$

Semideviation, downside standard deviation, and semistandard deviation are alternative terms that have been used to indicate below-mean semivariance. Mao (1970), among others, argues that investors are most interested in downside risk. Below-target semivariance provides a measure similar to below-mean semivariance, but the focus is on returns that fall below a target return. Research suggests that below-target semivariance is superior as a risk measure in contrast to SVm and SD (Nawrocki 1999).

Below-target semivariance:

$$SVt = \frac{1}{N}\sum_{T=1}^{N} Max[t - R_T, 0]^2 = \frac{1}{N}\sum_{T=1}^{N} Min[R_T - t, 0]^2$$

where t is a target return.

When returns are normally distributed, they are symmetrical (that is, not skewed). If returns are symmetrical, standard deviation and semivariance provide equivalent information about the distribution (and risk) of the returns. Investors will generally prefer positive skewness, however, in which large positive returns are more common than large negative returns. Investment research shows that stock returns are negatively skewed, in that more than half the returns fall above the mean, but with extreme below-average returns more common than extreme above-average returns. Black (1976) argues that the negatively skewed returns result from a leverage effect, whereby bad news results in lower stock prices, creating higher corporate leverage. With the increase in leverage, stock returns become more volatile. SVt and SVm partially account for skewness in the return distribution.

Below-Target Semivariance as the Risk Measure in Portfolio Allocation

Below-target semivariance is investigated in this paper, based on its superior attributes. Ang and Chua (1979) discuss the theoretical superiority of SVt. With SVt, consistent ranking of alternatives is possible, as the fixed target permits useful assessment of investment utility. The findings in Porter (1974) showed important differences in the optimal portfolio selections from SVt and SVm for many target returns.

In this paper, the target returns in all SVt calculations are full-sample (1926–2004) mean returns. Since the analysis uses up to 889 overlapping returns (for the 5-year investment horizon), a fixed target return for each asset allocation provides a consistent target that is based on long-term expectations for that particular allocation, not on a small (as short as 60 months) in-sample mean return. The long-term mean returns can be viewed as benchmark returns within each asset class.

The Roy R/V ratio, which focuses on return above a disaster level, is often used to identify the optimal portfolio allocation (Roy 1952). The Sharpe (1966, 1994) ratio, a specific application of the Roy R/V ratio, is often used to assess portfolio perform-

Table 1: Averages of Monthly Return Statistics for Large Stocks, Corporate Bonds, and Small Stocks

Large Stocks	Return %	SD %	SV %	Skew	Sharpe	R/SV	Comp %	Min %	Max %
5-year	0.977	5.095	3.626	–0.205	.1627	.2462	0.821	–1.576	2.603
10-year	1.022	4.943	3.522	–0.237	.1627	.2326	0.881	–0.422	1.631
15-year	1.017	4.817	3.450	–0.226	.1583	.2235	0.888	–0.034	1.508
20-year	1.022	4.721	3.380	–0.189	.1554	.2177	0.902	0.156	1.407
Corporate Bonds	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**	**Comp %**	**Min %**	**Max %**
5-year	0.491	1.728	1.204	–0.027	.1568	.2160	0.471	–0.195	1.803
10-year	0.484	1.779	1.235	0.062	.1333	.1791	0.464	0.050	1.312
15-year	0.471	1.820	1.260	0.245	.1116	.1510	0.451	0.084	1.111
20-year	0.457	1.873	1.292	0.432	.0906	.1235	0.436	0.111	0.999
Small Stocks	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**	**Comp %**	**Min %**	**Max %**
5- year	1.364	7.544	5.150	–0.117	.1703	.2573	1.011	–3.119	3.819
10-year	1.423	7.366	5.050	–0.152	.1697	.2411	1.095	–0.807	2.248
15-year	1.419	7.190	4.962	–0.101	.1657	.2352	1.118	–0.164	1.851
20-year	1.422	7.063	4.872	0.000	.1630	.2325	1.144	0.441	1.664

- Average of monthly return statistics over sample for each investment horizon, except minimum and maximum monthly compounded returns over the investment horizons
- Observations: 5-year (n = 889), 10-year (n = 829), 15-year (n = 769), 20-year (n = 709)
- Return %: average of investment horizon monthly mean returns
- SD %: average of investment horizon monthly return standard deviations
- SV %: average of investment horizon monthly return below-target semideviations
- Skew: average of investment horizon monthly skewness measure
- Sharpe: average of investment horizon Sharpe ratios
- R/SV: average of investment horizon reward-to-semideviation ratios
- Comp %: average of investment horizon geometric returns
- Min %: minimum monthly geometric return over investment horizon
- Max %- maximum monthly geometric return over investment horizon

ance, using SD as the measure of portfolio risk. Alternatively, R/SV can be used. Note that SV, which can be called the below-target semideviation, is actually the square root of SVt, the below-target semivariance, when used in R/SV. In this paper, the Sharpe ratio and the R/SV ratio are the performance measures applied.

Data Description

Using the Ibbotson Associates (2005) monthly data for large stocks, small stocks, and long-term corporate bonds for 1926–2004, the performance results of portfolios for several allocations are analyzed and compared for 5-, 10-, 15-, and 20-year investment horizons. Dividend and interest income reinvestment is assumed in these total return indexes. The T-bill return, also from the Ibbotson data, is used for the risk-free rate. The resulting samples are 889, 829, 769, and 709 observations of 5-, 10-, 15-, and 20-year returns, respectively.2 Returns for monthly rebalanced portfolios were analyzed at 10 percent allocation increments, with excess returns, standard deviation of returns, and semivariance of returns computed for repeated investment for the different investment horizons.

The transaction costs associated with regular rebalancing are not addressed in this paper, though the impact on the results would likely be insignificant. A practical concern is that transaction costs are incurred by any mutual fund attempting to mimic the indexes used in this analysis. Additional transaction costs are incurred through asset class rebalancing; thus, realized returns would be lower than the returns presented in the following tables. To conserve space, results for several allocation percentages are not presented. Preferred allocations to large stocks, small stocks, and bonds are established, based on the historical averages of the Sharpe ratio and the R/SV ratio.

Table 2: Large Stock and Long-Term Corporate Bond (%) Portfolios

5-Year (*n* = 889)	Bond%	Return %	SD %	SV %	Skew	Sharpe	R/SV
	100%	0.491	1.728	1.204	–0.027	.1568	.2160
	90%	0.539	1.790	1.240	0.062	.1659	.2341
	70%	0.636	2.264	1.573	0.037	.1687	.2455
	50%	0.734	2.961	2.078	–0.047	.1690	.2497
	30%	0.831	3.771	2.665	–0.126	.1668	.2498
	10%	0.928	4.643	3.298	–0.184	.1641	.2476
	0%	0.977	5.095	3.626	–0.205	.1627	.2462
10-Year (*n* = 829)	**Bond%**	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**
	90%	0.538	1.824	1.261	0.166	.1518	.2077
	70%	0.645	2.248	1.556	0.111	.1664	.2339
	50%	0.753	2.899	2.028	0.008	.1698	.2409
	30%	0.860	3.669	2.591	–0.106	.1677	.2392
	10%	0.968	4.507	3.204	–0.200	.1644	.2349
	0%	1.022	4.943	3.522	–0.237	.1627	.2326
15-Year (*n* = 769)	**Bond%**	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**
	100%	0.471	1.820	1.260	0.245	.1116	.1510
	90%	0.525	1.850	1.276	0.272	.1358	.1856
	70%	0.635	2.235	1.547	0.182	.1566	.2196
	50%	0.744	2.850	1.997	0.068	.1626	.2299
	30%	0.853	3.587	2.542	–0.071	.1621	.2295
	10%	0.962	4.396	3.139	–0.182	.1596	.2256
	0%	1.017	4.817	3.450	–0.226	.1583	.2235
20-Year (*n* = 709)	**Bond%**	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**
	100%	0.457	1.873	1.292	0.432	.0906	.1235
	90%	0.514	1.888	1.298	0.391	.1202	.1642
	70%	0.627	2.237	1.543	0.260	.1463	.2045
	50%	0.740	2.818	1.972	0.117	.1554	.2185
	30%	0.853	3.528	2.498	–0.028	.1572	.2209
	10%	0.966	4.311	3.078	–0.144	.1563	.2191
	0%	1.022	4.721	3.380	–0.189	.1554	.2177

Monthly statistics, average over sample for each investment horizon, see Table 1 for definitions.

Asset Class Results

Table 1 shows the summary data of averages of investment horizon returns for large stocks, corporate bonds, and small stocks for the different investment horizons. The stocks exhibit negative skewness for all investment horizons, except for small stocks at 20 years apparently having a normal distribution, on average. The long-term bonds have negatively skewed returns for short horizons (5 years) and positively skewed returns for longer horizons (10, 15, and 20 years). The standard deviations and semivariances generally increase for the corporate bonds and decrease for the stocks, the longer the investment horizon. Average skewness appears to be negative for both stock portfolios for all horizons, but generally positive for bonds.

The average monthly compound returns exhibit a slightly different pattern from the average monthly mean returns. As the Minimum and Maximum columns show, investors would have needed an investment horizon of over 15 years to have been assured of achieving a positive return from a stock portfolio investment. For an investor in corporate bonds, the investment horizon required to avoid a loss would have been between five and ten

Table 3: Large Stock and Small Stock (%) Portfolios

5-Year (*n* = 889) Sm Stock %	Return %	SD %	SV %	Skew	Sharpe	R/SV
100%	1.364	7.544	5.150	–0.117	.1703	.2573
90%	1.325	7.214	4.955	–0.156	.1731	.2596
70%	1.248	6.595	4.586	–0.229	.1777	.2628
50%	1.170	6.044	4.253	–0.280	.1795	.2636
30%	1.093	5.580	3.963	–0.289	.1772	.2606
10%	1.015	5.225	3.722	–0.245	.1691	.2526
0%	0.977	5.095	3.626	–0.205	.1627	.2462
10-Year (*n* = 829) Sm Stock %	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**
100%	1.423	7.366	5.050	–0.152	.1697	.2411
90%	1.383	7.040	4.857	–0.196	.1721	.2432
70%	1.302	6.430	4.491	–0.275	.1760	.2462
50%	1.222	5.885	4.157	–0.328	.1776	.2471
30%	1.142	5.426	3.865	–0.334	.1755	.2447
10%	1.062	5.073	3.621	–0.283	.1684	.2380
0%	1.022	4.943	3.522	–0.237	.1627	.2326
15-Year (*n* = 769) Sm Stock %	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**
100%	1.419	7.190	4.962	–0.101	.1657	.2352
90%	1.379	6.871	4.771	–0.150	.1677	.2366
70%	1.298	6.273	4.410	–0.239	.1709	.2386
50%	1.218	5.739	4.081	–0.302	.1721	.2386
30%	1.137	5.290	3.790	–0.317	.1700	.2357
10%	1.057	4.944	3.547	–0.271	.1635	.2287
0%	1.017	4.817	3.450	–0.226	.1583	.2235
20-Year (*n* = 709) Sm Stock %	**Return %**	**SD %**	**SV %**	**Skew**	**Sharpe**	**R/SV**
100%	1.422	7.063	4.872	0.000	.1630	.2325
90%	1.382	6.747	4.684	–0.053	.1648	.2335
70%	1.302	6.155	4.327	–0.154	.1675	.2347
50%	1.222	5.627	4.001	–0.231	.1685	.2341
30%	1.142	5.183	3.715	–0.263	.1666	.2306
10%	1.062	4.844	3.476	–0.230	.1604	.2233
0%	1.022	4.721	3.380	–0.189	.1554	.2177

Monthly statistics, average over sample for each investment horizon, see Table1 for definitions.

years. The greater negative skewness for the large stocks is exemplified by the minimum return tilting more to the downside, relative to the average and maximum returns, for the large stock portfolio. The –1.576 percent minimum monthly return for the large stocks and the –3.119 percent minimum monthly compound return for the small stocks represent 5-year periods with total losses of 61.45 percent and 85.06 percent over the investment period.

Both the average Sharpe ratios and reward-to-semivariability ratios decrease with longer investment horizons. In comparing across the asset classes, the Sharpe ratio and the R/SV ratio indicate that small stocks would be preferred for investors with 5-, 10-, 15-, and 20-year investment horizons.

Asset Allocation Portfolio Results

Now the analysis turns to portfolios combining the large company stocks, are taken as the base asset selection, with either the long-term corporate bonds or the small company stocks. The analysis begins with portfolios combining large company stocks and long-term bonds (see Table 2). For all investment horizons, the return and the risk (measured by either SD or SVt) is greater for larger stock allocations. These negative results, also reflected in the negative skewness, may be expected to influence the optimal portfolio selections toward greater bond allocations. This expectation is further reinforced in the five-year investment horizon, where skewness turns from negative to positive for the portfolios with greater bond allocations (except at 100 percent in bonds). Positive skewness for portfolios with 80–100 percent in bonds is also observed at the 20-year investment horizon. But this growing propensity for positive skewness should not lead to increasing optimal allocations to bonds. By the Sharpe ratio and the R/SV ratio, the optimal allocations increase the proportion invested in the riskier stocks with the increase in the investment horizon, except for a slight reversal at the 10-year horizon based on the R/SV ratio.

In Table 3, similar analyses are reported for a combination of large stocks with small stocks. Returns and risk measures increase for all horizons with increasing allocations to small stocks. Negative skewness is indicated for all portfolios, with the exception of the 100 percent small stock allocation at the 20-year investment horizon. Thus, the likelihood of a large negative return was greater than the likelihood of a large positive return for the stock portfolios. In most cases, the highest Sharpe and R/SV ratios are observed at approximately 50 percent allocations to the large and small stocks. Based on R/SV at the 20-year horizon, however, the highest reward-to-risk was for a portfolio consisting of about 70 percent in small stocks.

In Table 4, a summary of the indicated optimal allocations for the various horizons is provided, based on both the Sharpe ratio and R/SV. For the Sharpe ratio, the optimal allocations call for a smaller investment in the long-term bonds at longer horizons. The maximum R/SV calls for between 40 and 50 percent in bonds through the 15-year horizon, with a significant reduction to 32 percent at a 20-year investment horizon. Up to the 20-year horizon, which calls for 68 percent to the large stocks (compared with 70 percent to the large stocks according to the Sharpe ratio), the optimal allocation is consistently more aggressive based on the R/SV. In Figure 1, the average reward-to-risk ratios, with the highest value indicated, are graphed for the four investment horizons.

For both decision metrics, the indication would have been to include more small stocks over increasing investment horizons, except for the small reversal for the R/SV at the ten-year horizon. Due to the high correlation between the large stock and small stock investments, the reward-to-risk ratios show small variation over most of the allocations. The optimal portfolios chosen by the R/SV are more aggressive in all cases. This result may be surprising, as the focus on downside risk may have been expected to call for more conservative portfolio allocations.

Table 4: Allocations Resulting in Highest Average Reward-to-Risk Ratio

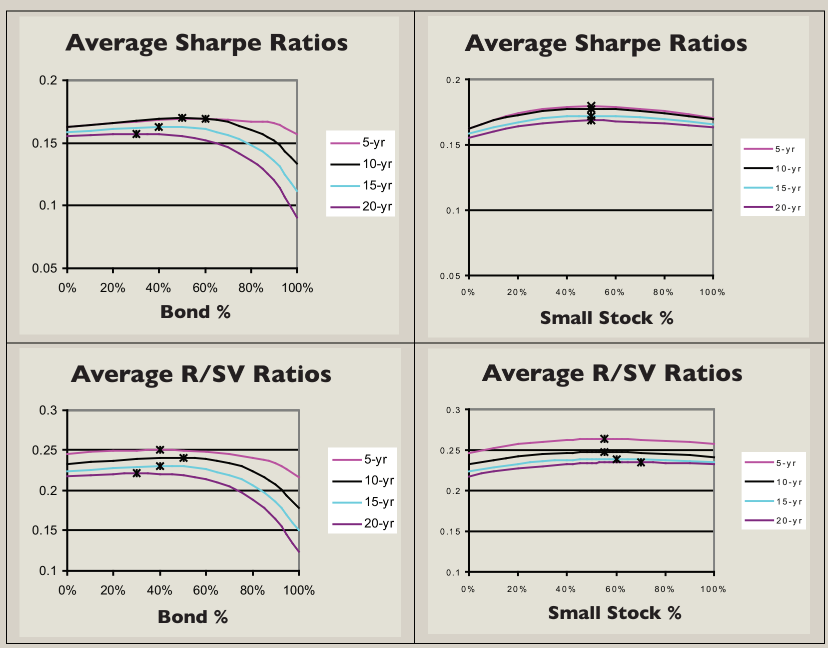
Large Stock and Bond Portfolios

	Sharpe Ratio		Reward-to-Semivariance	
Horizon	**Large Stocks**	**Bonds**	**Large Stocks**	**Bonds**
5-year	41%	59%	60%	40%
10- year	48%	52%	53%	47%
15- year	56%	44%	58%	42%
20- year	70%	30%	68%	32%

Large Stock and Small Stock Portfolios

	Sharpe Ratio		Reward-to-Semivariance	
Horizon	**Large Stocks**	**Bonds**	**Large Stocks**	**Bonds**
5- year	50%	50%	45%	55%
10- year	50%	50%	46.5%	53.5%
15- year	49%	51%	41%	59%
20- year	48%	52%	34%	66%

Figure 1: Average Sharpe Ratios and R/SV Ratios



Summary and Conclusions

The results of this study support the common investment advice calling for riskier portfolio allocations for longer investment horizons. This support is consistent whether the risk measure of interest is standard deviation or semivariance, with optimal portfolio allocation suggestions based on the Sharpe ratio and the reward-to-semivariability ratio. For investment horizons from 5 to 20 years, the reward-to-semivariabity ratio suggests more aggressive allocations for portfolios with large and small stocks. For portfolios of large stocks and long-term corporate bonds, more aggressive allocations are suggested for investment horizons through 15 years, based on the reward-to-semivariability ratio. At the 20-year investment horizon, the Sharpe ratio indicates a 70 percent large stock and 30 percent long-term bond portfolio as optimal, compared with the R/SV recommended allocation of 68 percent to large stocks.

Investors may benefit from reducing their investment risk by allocating approximately 50 percent to bonds when the investment horizon is only five years (a 59 percent bond allocation based on the Sharpe ratio and 40 percent based on R/SV). A 50 percent bond allocation, however, on average, would have reduced portfolio-ending value by approximately 50 percent, on average, compared with an all-large stock portfolio over a 20-year investment horizon. Investment time horizons are a significant consideration in the asset allocation decision and should not be ignored. Investment advisors should take heed and base asset allocation recommendations on reward-to-risk measures derived from investment horizons similar to those of their client.

Two concerns arise as advisors apply this research in helping individuals build successful portfolios. First, the positive skewness that is desired in asset returns is very difficult to achieve with the naively diversified index stock and bond portfolios used here. Portfolios may be constructed with more efficient methods, reducing a potential bias toward holding equity investments (or the equity index as used here). Harlow (1991) presents international evidence of country-level investments regarding this opportunity.

Second, investors often change their investment horizon, whereby they are more comfortable with a long horizon when it appears that risk is low, but with a shorter horizon when risk appears high. It is difficult to mimic or assess these changes in investment horizon, which can be accompanied by changes in risk aversion. The empirical results may be driven by the response to risk through changing investment horizons of investors. While "market timing" strategies would include the option of investing in T-bills alone when risk aversion is high or the investment horizon is shortened, the analysis of this paper focuses on the returns available in the risky asset classes.

Financial advisors can assist their clients by being alert to changes in the investment horizon, which can make it difficult to focus on long-term investment goals. Changes in expected returns, however, may be a useful justification for changes in asset allocations or stock selections. The evidence in this paper indicates that, on average, the reward for larger equity allocations has been sufficient for the risks over long horizons (up to 70 percent allocation to large stocks over a 20-year horizon), whether risk is measured as standard deviation or as below-target semivariance. The most surprising finding is that the use of semivariance as the risk measure may support choices of higher allocations to the riskier assets. In summary, average historical Sharpe ratios and reward-to-semivariance ratios support the common investment advice of higher allocations to riskier assets for longer investment horizons.

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Endnotes

1. Sample variance =

$$\frac{1}{N-1}\sum_{T=1}^{N}[E-R_T]^2$$

is commonly used as a risk measure for samples from a larger population. Sample variance is the measure tested in the CFP exam; however, population variance is examined in this paper to maintain consistency with the literature related to downside risk measures.

2. For all horizon summaries, the January 1926 and the December 2004 returns are sampled only once. In the five-year returns analysis, each month of the January 1931 through December 1999 returns are sampled 60 times. In the 20-year returns analysis, each month of the January 1946 through December 1984 returns are sampled 240 times each. These sampling differences are due to the overlapping observations methodology.

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