Determinants of Portfolio Performance II: An Update
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Determinants of Portfolio Performance II: An Update

This article presents a framework for determining the contributions of different aspects of the investment management process—asset allocation policy, active asset allocation, and security selection—to the total return of investment portfolios. Data from 82 large pension plans indicate that asset allocation policy, however determined, is the overwhelmingly dominant contributor to total return. Active investment decisions by plan sponsors and managers did little on average *to improve performance over the 10-year period December 1977 to December 1987. The performance attribution framework is also extended to account for actual and synthetic cash holdings within asset classes.*

IN "DETERMINANTS of Portfolio Performance," published in this journal in 1986, we documented the overwhelming contribution of asset allocation policy to the return performance of a sample of 91 large pension plans.[1] That earlier article developed a systematic framework for the attribution of returns to different types of active investment decisions.

This article, also focusing on **return attribution**, updates the results of the previous study and confirms our original conclusions. Specifically, data from 82 large pension plans over the 1977–87 period indicate that **investment policy** explained, on average, 91.5 per cent of the variation in quarterly total plan returns. In addition, this article provides an expanded performance attribution framework that accounts, not only for security selection and **active asset allocation**, but also for changes in portfolio risk characteristics attributable to risk positioning within individual asset classes.

Neither this article nor its predecessor attempts to evaluate the efficacy of investment policies. Rather, the concentration is on the overwhelming impact of policy—however established—and the incremental effect of active investment strategies.[2]

1. Footnotes appear at end of article.

Framework

Our earlier article outlined a framework for dissecting total plan returns into three components—asset allocation policy, active asset allocation, and security selection. The distinction between asset allocation policy and active asset allocation needs to be delineated. Asset allocation policy involves the establishment of *normal* asset class weights and is an integral part of investment policy. Active asset allocation is the process of managing asset class weights *relative to the normal weights* over time; its aim is to enhance the managed portfolio's risk/return tradeoff. This distinction is material to understanding the importance of investment policy relative to active management.

Figure A illustrates the framework for reporting and analyzing portfolio returns. Quadrant I indicates the total return provided by the investment policy adopted by the plan sponsor. The policy "portfolio" thus represents a constant, normal allocation to passive asset classes. Investment policy, then, identifies the plan's normal portfolio composition. Calculating the policy return involves applying the normal weights of each investable asset class to the respective passive returns.

Quadrants II and III shift the focus to active management. Quadrant II reports the return attributable to a portfolio reflecting both policy and active asset allocation. Whether active allo-

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Glossary

Return Attribution: The process of attributing actual portfolio return to those investment management activities that contribute to the return—investment policy, active asset allocation and security selection.

Investment Policy: Specification of the plan sponsor's objectives, constraints and requirements, including identification of the normal asset allocation mix.

Active Asset Allocation: Temporarily deviating from the policy asset mix in order to benefit from a state of capital market disequilibrium with respect to the investment fundamentals underlying the policy mix.

Coefficients of Determination: The percentage of variability in one random variable that is accounted for by another random variable. The more familiar R^2, indicating the variability of the dependent variable accounted for by a regression model, is identical to the coefficient of determination for univariate regressions.

Risk Positioning: The active allocation out of non-cash assets into cash equivalents at the asset allocation level and the holding of cash within an asset class portfolio.

External Risk Positioning: The allocation into and out of cash-equivalent assets. The term "external" refers to positioning at the asset class level. As segregating the cash component at the asset class level is a rather common aspect of active asset allocation performance attribution, "external risk positioning" is used in a broader sense to mean active asset allocation.

Internal Risk Positioning: The establishment of a position in actual or synthetic cash, typically to control beta or duration risk, within an asset class. The term "internal" refers to positioning within an asset class.

cation involves anticipating price moves (market timing) or reacting to market disequilibria (fundamental analysis), it results in the under or overweighting of asset classes relative to the normal weights identified by policy.[3] The aim of active allocation is to enhance the return and/or reduce the risk of the portfolio relative to its policy benchmark. The policy and active asset allocation return is computed by applying the actual asset class weights to their respective passive benchmark returns.

Quadrant III presents the returns to a portfolio attributable to policy and security selection. Security selection involves active investment decisions concerning the securities within each

Figure A A Simplified Framework for Return Accountability

Asset Allocation	Security Selection: Actual	Security Selection: Passive
Actual	IV Actual Portfolio Return	II Policy and Active Asset Allocation Return
Passive	III Policy and Security Selection Return	I Policy Return (Passive Portfolio Benchmark)

Active Returns Due to:

Active Asset Allocation	II - I
Security Selection	III - I
Other	IV - III - II + I
Total	IV - I

asset class. This framework specifies that the return from policy and security selection is obtained by applying the normal asset class weights to the actual active returns achieved in each asset class.

Finally, Quadrant IV represents the actual return realized by the plan over the period of performance evaluation. This is the result of the plan's actual asset class weights interacting with the actual asset class returns.

Figure B summarizes the calculations required to determine the returns for Quadrants I, II and

Figure B Computational Requirements for Return Accountability*

Asset Allocation	Security Selection: Actual	Security Selection: Passive
Actual	IV $\sum_i$ (Wai • Rai)	II $\sum_i$ (Wai • Rpi)
Passive	III $\sum_i$ (Wpi • Rai)	I $\sum_i$ (Wpi • Rpi)

*Wpi = policy weight for asset class i; Wai = actual weight for asset class i; Rpi = passive return for asset class i; Rai = actual return for asset class i.

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Table I Calculation of Active Contributions to Total Performance

Return Due to	Calculated By
Active Asset Allocation	$\sum_i$ [(Wai * Rpi) − (Wpi * Rpi)] (Quadrant II − Quadrant I)
Security Selection	$\sum_i$ [(Wpi * Rai) − (Wpi * Rpi)] (Quadrant III − Quadrant I)
Other	$\sum_i$ [Wai − Wpi) (Rai − Rpi)] [Quadrant IV − (Quadrant II + Quadrant III) + Quadrant I]
Total	$\sum_i$ [(Wai * Rai) − (Wpi * Rpi)] (Quadrant IV − Quadrant I)

III. Table I provides the computational methodology for determining the sources of active returns. The active contribution to total performance is composed of active asset allocation, security selection, and the effects of a cross-product term that measures the interaction of the security selection and active asset allocation decisions.

Data

Attributing returns to the various aspects of the investment process according to this framework requires historical data on portfolio composition (weights), actual investment results, and returns to the appropriate benchmarks. SEI Corporation provided 10 years of quarterly data, from December 1977 to December 1987, for 82 pension plans in their Large Plan Universe. The seven series available for each plan were four asset-class-weight series for equity, bonds, cash equivalents and "other" and three quarterly rate-of-return series for the total plan and its associated equity and bond components. The focus of this article is on investment performance, so all returns were expressed gross of management fees.

An analysis of the asset class weights indicates that there was no significant shift in asset class preferences over the period covered by the sample data. Figure C demonstrates that the average weights of the asset classes for the sample remained remarkably stable over time, despite market trends and volatility. This is somewhat at odds with other surveys showing increased exposure to equities over similar periods.[4]

Because the composition of the "other assets" category was unknown, its weight was allocated to the equity, bond and cash components in proportion to their respective weights. Table II shows that this component constituted a relatively small percentage (less than 15 per cent) of total plan assets and did not materially affect total plan returns. However, a few plans had extraordinarily large allocations to the "other" category over the period; these "outliers" were omitted from the analysis. None of the sample funds held non-U.S. bonds, and only two held non-U.S. equity. In these cases, the foreign equity was considered part of the equity component, without a material effect on the results.

We defined policy weights for each plan (the

Figure C Average Asset Class Weights, 1977–1987

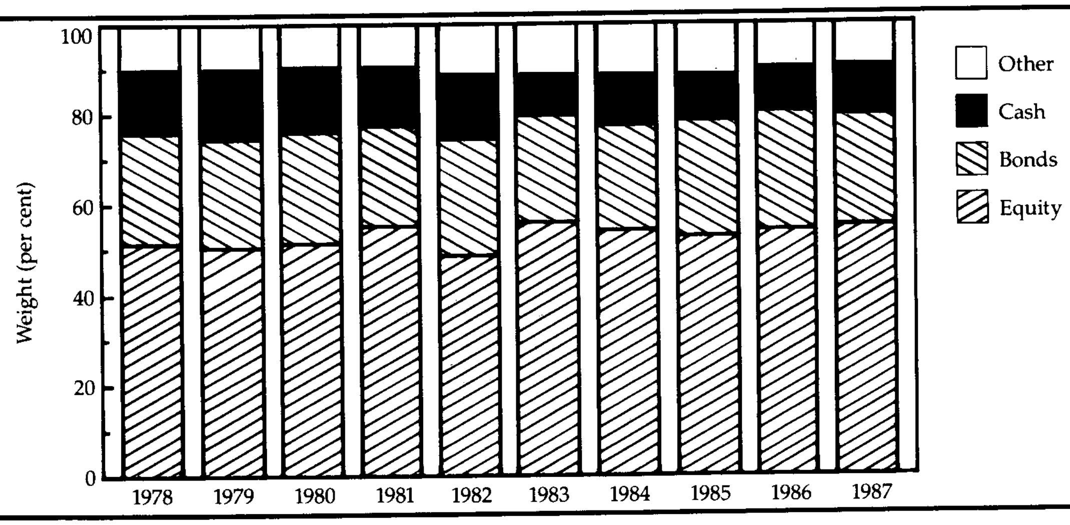

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Table II Analysis of Asset Class Weights, 82 Large Pension Plans, 1977–1987

	Summary of Holdings			
	Average	*Maximum*	*Minimum*	*Standard Deviation*
Equity	53.0%	79.1%	26.0%	10.8%
Bond	24.5%	53.1%	4.0%	10.4%
Cash	12.1%	24.1%	3.0%	4.6%
Other	10.5%	65.4%	0.1%	12.0%
	Summary of Holdings Excluding "Other"			
	Average	*Maximum*	*Minimum*	*Standard Deviation*
Equity	59.6%	83.9%	36.5%	10.5%
Bond	26.9%	54.0%	5.6%	10.2%
Cash	13.6%	24.3%	3.5%	4.9%

normal weights) as the 10-year average of the plan's asset class weights. These funds did not necessarily favor a "typical" mix of assets (such as 60/40 stocks/bonds), although, as Table II shows, the average mix was very close to 60 per cent equity and 40 per cent fixed income. Figure D shows that the observed combinations of equity and bond weights cover almost the whole range of possibilities.

Some plans showed evidence of a change in policy over the 10 years, either by a clear upward or downward trend in the weight of an asset class or a sudden and apparently permanent shift in the level of the quarterly weights. We attempted to account for this in the analysis. In cases where there appeared to be a policy shift, we divided the 10-year period into two periods—prechange and postchange—and calculated returns based on the policy weights in effect in each period.

Results

In addition to the actual reported return for each plan, we defined three return series—policy, policy and active asset allocation, and policy and security selection. The policy return is the passive portfolio benchmark return, calculated as the sum of the policy weighted passive asset class returns, using the 10-year average asset class weights (as discussed above) and a suitable passive index for each asset class. The S&P 500, the Salomon Broad Investment Grade (BIG) bond index and 30-day Treasury bills were used as the passive indexes for the equity, bond and cash components, respectively.

The policy and active asset allocation return is

Figure D Average Equity Weight versus Average Bond Weight, 1977–1987

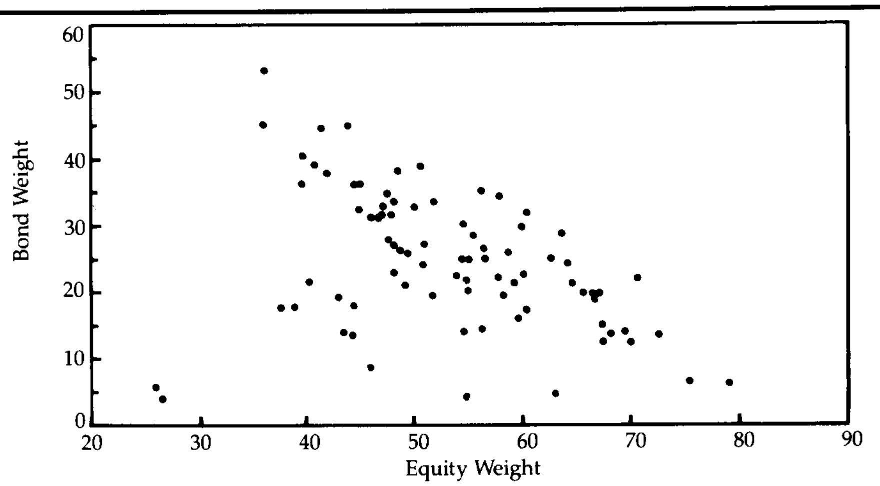

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Figure E Mean Annualized Returns by Activity, 82 Large Pension Plans, 1977–1987

Asset Allocation \ Security Selection	Actual	Passive
Actual	IV 13.41%	II 13.23%
Passive	III 13.75%	I 13.49%

Active Returns Due to:

Active Asset Allocation	−0.26%
Security Selection	+0.26%
Other	−0.07%
Total	−0.08%

calculated using the actual active weights and the appropriate passive index returns. The policy and security selection return is calculated using the policy weights and the actual active returns. We repeated each analysis using a broader market index than the S&P 500; the results were virtually identical.

The overall effect of active management by plan sponsors or investment managers was negligible. This confirms the findings of our earlier study. Figure E and Table III show that the average portfolio underperformed its policy benchmark by eight basis points a year.

Individual effects varied widely, from a 3.4 per cent per annum underperformance to a 6.7 per cent per annum overperformance. The incremental return to active management had a standard deviation of 1.7 per cent. Clearly the contribution of active management is not statistically different from zero (that is, it is most likely attributable to chance). While active asset allocation contributed a net underperformance of 26 basis points, and security selection contributed a gain of 26 basis points, neither figure is statistically different from zero.

Active management not only had no measurable impact on returns, but (in the absence of a proxy for the variability of the respective pension liabilities), it appears to have increased risk by a small margin (Figure F and Table III). Given the higher risk level of the policy and security selection portfolio, it is evident that security selection contributed to actual plan risk. Active asset allocation appears to have had a negligible impact on risk relative to the benchmark policy. The imperfect correlation between the performances of the policy and allocation and the policy and security selection portfolios mitigated some of the increased risk.

None of these observations detracts from the finding that the choice of investment policy dominates the risk/return posture of the plan. It is obvious that the overwhelming factor in determining the basic, long-term return achieved per unit of risk was investment policy.

Because active asset allocation is the process of managing asset class weights relative to the normal weights, active management is conditional on the investment policy. Thus active returns are conditionally distributed on the policy return distribution. This dominance is also demonstrated by the **coefficients of determination** for policy, policy and active asset allocation, policy and security selection, and active returns.

The coefficient of determination is the square

Table III Annualized Returns and Risk by Activity, 1977–1987

	Average Return	*Average Risk*	*Return Minimum*	*Return Maximum*	*X-Sec. Std. Dev.*
Portfolio					
Policy	13.49	11.42	12.43	14.56	0.49
Policy and Active A/A	13.23	11.56	11.26	15.09	0.68
Policy and Selection	13.75	13.75	10.52	19.32	1.66
Actual Portfolio	13.41	11.65	10.34	19.95	1.75
Active Return Components					
Active A/A Only	−0.26		−1.81	0.86	0.47
Selection Only	+0.26		−3.32	6.12	1.52
Other	−0.07		−3.50	1.33	0.80
Total Active Return	−0.08		−3.43	6.73	1.67

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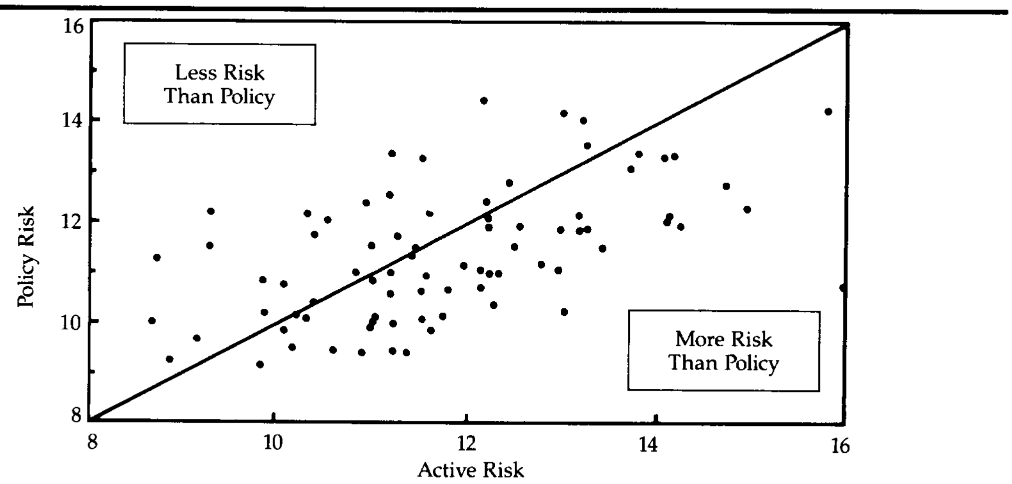
Figure F Policy Risk versus Active Risk, 1977–1987



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of the correlation coefficient between two jointly distributed random variables. It is used to describe the amount of variability in one variable that can be accounted for by another variable. In this instance, we are concerned with the percentage of variability in actual returns that is accounted for by policy, by policy and active asset allocation, and by policy and security selection.

Figure G shows that, on average, policy returns accounted for 91.5 per cent of the variance of actual returns. Being conditionally distributed on the policy returns, active asset allocation and security selection combined could have accounted for only a small residual portion of the variance of actual returns. In fact, policy and active asset allocation combined accounted for 93.3 per cent and policy and security selection combined accounted for about 96.1 per cent. Again, the dominance of investment policy is clear.[5]

Although each level of risk was associated with a range of plan returns, active returns generally increased with plan risk. Figure H shows that, for a given risk level, the difference in performance between the best and the worst plans was as much as 3 per cent annually. The two plans with extraordinarily low risk had higher allocations to the "other asset" class—perhaps real estate, given the low volatility. Three other plans had unusually strong returns, with each showing extraordinary returns from both stock and bond components over the entire 10 years.

There are several possible explanations for these irregularities. First, the analysis did not account for the liability exposure of each plan. The inclusion of a liability proxy might shift these performance statistics. Second, the use of 10-year average weights for the passive benchmark may have created an inefficient bench-

Figure G Percentage of Variation Explained, 1977–1987

		Security Selection: Actual	Security Selection: Passive
Asset Allocation	Actual	IV 100.0%	II 93.3%
	Passive	III 96.1%	I 91.5%

	Average	Minimum	Maximum	Std. Dev.
Policy	91.5%	67.7%	98.2%	6.6%
Policy and Allocation	93.3%	69.4%	98.3%	5.2%
Policy and Selection	96.1%	76.2%	99.8%	5.2%

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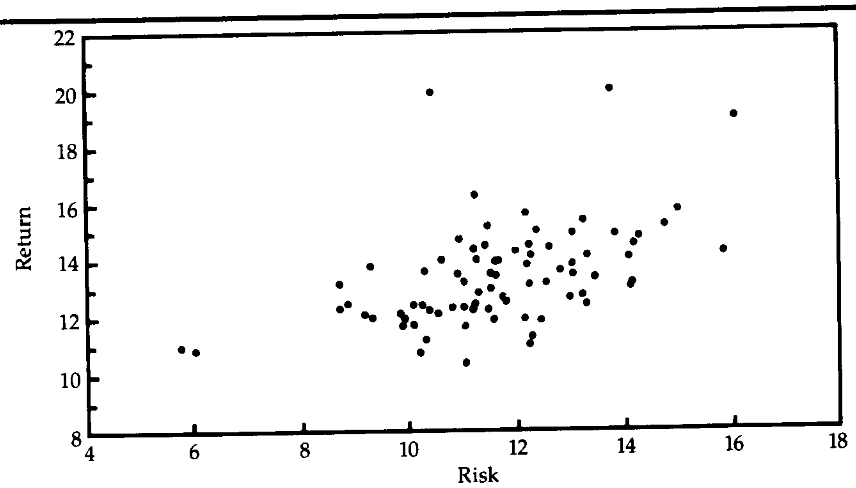
Figure H Average Return versus Average Plan Risk, 1977–1987



Source: SEI Corporation

mark. While the impact was probably not great, some bias was introduced.

It is difficult, given these data, to determine conclusively which asset classes generated good or bad relative performance. It should be noted, however, that 76 of the 82 equity funds underperformed the S&P 500 on an equity-only basis. A complete 10-year bond performance was not available for several funds, because their bond weights were zero for several quarters. For the 70 cases with complete bond histories, almost two-thirds outperformed the passive bond benchmark. Of those plans that underperformed their policy benchmarks, over 75 per cent underperformed in the bond component. As one would expect, the median cash manager outperformed the 30-day T-bill index.

Limitations

Our analysis lacks some precision because of performance data limitations. First, as noted, the composition of the "other asset" category was unknown; in many cases, however, this category constituted only a small percentage of the total portfolio. Second, policy portfolios were inferred from the long-term average asset class weights, and there is no assurance that they reliably represent the actual benchmarks. In terms of assessing the importance of the benchmark to investment returns, however, this is probably not a serious problem. Adjusting for apparent shifts in policy weights had very little effect on the analysis. In fact, using a simple 60/40 stock/bond mix as a passive benchmark for all the funds resulted in virtually the same *average* results as indicated in Figure G. Given the average portfolio composition in Table II, this is not too surprising.

Finally, we do not know the actual number of different money managers used by these 82 pension plans. While it is highly unlikely that the data represent only a few managers, the study does reflect the performance of individual managers, not necessarily pension fund performance in general. Furthermore, we know nothing about the styles of the managers or their use of futures and options. Some almost certainly altered internal risk positions by hedging during the last quarter of 1987; this is indicated by the positive equity returns at a time when the market as a whole was down by almost 25 per cent. The issue of hedging, and the broader issue of **risk positioning,** is treated in more depth below.

Internal versus External Risk Positioning

Besides shifting asset class weights—i.e., **external risk positioning**—a manager or sponsor can change exposure to an asset class within a portfolio component—**internal risk positioning.** Internal methods include altering the component's beta or duration by using long or short futures positions, carrying cash or hedging the currency component. Looking at any single risk-positioning activity, external or internal, will not

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Table IV Attribution of Internal and External Risk Positioning

	Equation (1)	Equation (3)
Security Selection	(Ra − Rp)Wp	(Rs − Rp)Wp
Risk Positioning	(Wa − Wp)(Rp − R)	(Wa − Wp)(Rp − R) + c(Rh − Rp)Wa
External	(Wa − Wp)(Rp − R)	(Wa − Wp)(Rp − R)
Internal	0	c(Rh − Rp)Wp
Cross Product	0	c(Wa − Wp)(Rh − Rp)
Cross Product	(Wa − Wp)(Ra − Rp)	[(1 − c)Wa − Wp](Rs − Rp)

give a complete or accurate measure of the active portfolio management effect.

The performance-attribution framework outlined above defines the extra return, E, to a multi-asset portfolio attributable to a particular asset class as:

$$E = (R_a - R_p)W_p + (W_a - W_p)(R_p - R) + (W_a - W_p)(R_a - R_p), \tag{1}$$

where

W_p = the normal weight of the asset class,
W_a = the actual weight,
R_p = the total passive return on the asset class index,
R_a = the total active return on the asset class, and
R = the total portfolio benchmark return.

The first term on the right-hand side of Equation (1) defines the contribution of security selection and the second gives the portion attributable to external risk positioning (active asset allocation). The third term isolates the interaction of security selection and allocation. Within this definition of return, the contribution of risk positioning is limited to changes in the weights of asset classes.

This is an unnecessary constraint. We can subdivide the actual active return on each asset class into a pure selection component, R_s—indicating the equity-only return—and a component that isolates the effect of internal risk positioning, R_h—indicating the actual or synthetic cash return:

$$R_a = (1 - c)R_s + cR_h, \tag{2}$$

where c equals the proportion of the fund held in cash. Inserting Equation (2) into Equation (1) provides a framework for determining the effect of asset class performance, in terms of both security selection and explicit internal risk activity, on the extra return of the entire portfolio:

$$E = (R_s - R_p)W_p + [(W_a - W_p)(R_p - R) + c(R_h - R_p)W_a] + [(1 - c)W_a - W_p](R_s - R_p). \tag{3}$$

Table IV compares Equations (1) and (3), showing the contribution to the extra return of a multi-asset portfolio from security selection, active asset allocation (external risk positioning) and internal risk positioning. The effect of internal risk positioning indicated in the table is equal to the difference between the return on the cash position and the return on the asset class index ($R_h - R_p$), adjusted by the implied weight of the risk-adjusted position in the total index (cW_p).

With neither internal nor external risk positioning, the contribution of the asset class manager to the extra return on the total portfolio is given by the extra return from selection only. That is, setting R_a equal to R_s, W_a equal to W_p and c equal to zero in Equation (3) gives:

$$E_s = W_p(R_s - R_p). \tag{4}$$

The decision to risk-position internally within the asset class alters this result, and the contribution to relative performance becomes:

$$E_h = W_p(R_a - R_p). \tag{5}$$

Subtracting Equation (4) from Equation (5) gives the total effect of the internal hedging decision being imposed on preexisting selection performance:

$$E_h - E_s = W_p(R_a - R_s) = c(R_h - R_p)W_p - c(R_s - R_p)W_p. \tag{6}$$

The second term is the portion of the cross-product term introduced by the explicit decision to hedge the asset holdings. That is, the first term isolates the pure effect of the hedge and the second measures the effect of the interaction

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of the hedge and the results of the selection strategy.

Equation (6) shows that, even if the hedge does protect the fund from an adverse return on the asset class (i.e., $R_h > R_p$), the net effect might be negative. If selection within the fund is also successful (i.e., $R_s > R_p$), the second term in Equation (6) could be larger than the first. The more effective the selection process, the less attractive internal hedging is.

Rearranging terms in Equation (6) shows that the total effect of the hedge on the performance of the total portfolio is equal to:

$$c(R_h - R_s)W_p.$$

If R_s exceeds R_h, an internal hedge will detract from performance of both the fund and a multi-asset portfolio, even when the return on cash exceeds the return on the index ($R_h > R_p$).

Our data do not allow us to go into a detailed analysis of performance attribution. A general proxy for the amount of internal risk positioning, however, could be the beta of the active returns with respect to a passive benchmark. As data become available, it would be useful to explore further the impact of internal risk positioning on performance attribution.

Conclusion

For our sample of pension plans, active investment decisions by plan sponsors and managers, both in terms of selection and timing, did little to improve performance over the 10-year period from December 1977 to December 1987. Although individual results varied widely, in general it was difficult to find positive explanatory relations between performance and investment behavior. For example, extra returns seemed to be unrelated to the level of active management. Moreover, it seemed to be harder for managers to outperform equity benchmarks than bond and cash benchmarks; many more plans had positive contributions from the bond and cash portions of their portfolios.

A more detailed history of portfolio compositions would help to specify better the contributions of investment decisions to overall performance. In particular, the extent of internal risk positioning used by managers could significantly alter attributions.[6] ■

Footnotes

1. G. P. Brinson, L. R. Hood and G. L. Beebower, "Determinants of Portfolio Performance," *Financial Analysts Journal*, July/August 1986.
2. C. R. Hensel, D. D. Ezra and J. H. Ilkiw ("The Value of Asset Allocation Decisions," *Russell Research Commentaries*, March 1990) provide alternative support for the conclusion that the policy decision dominates other aspects of the investment process. They offer a useful extension of this methodology for evaluating policy allocations.
3. G. P. Brinson, "Asset Allocation vs. Market Timing," *Investment Management Review*, September-October 1988.
4. D. Gallagher, "The Sixty-four Billion Dollar Question," *Global Investor*, June 1988.
5. One potential drawback to the use of correlation coefficients arises from the fact that the return series may not be normally distributed. In fact, an actively managed portfolio is likely to have a chi-square component. This arises from the fact that the return to an actively managed portfolio is the product of normally distributed weights and normally distributed returns. The product of two normally distributed random variables follows the chi-square distribution. A discussion of this phenomenon appears in P. H. Dybvig and S. A. Ross, "Differential Information and Performance Measurement using a Security Market Line," *Journal of Finance*, June 1985.
6. We thank Matthew R. Smith for his valuable assistance in the preparation of this article.

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