

# PLAN OF Attack

## Active risk management out of the defensive zone.

BY PHILIPPE JORION

**BY NOW**, most banking institutions have learned how to measure their risk on a forward-looking basis, by incorporating information about current positions in summary measures such as Value at Risk (VAR). On the buy side, institutional investors are also applying these techniques to measure their risk, usually with standard deviation metrics. As shown in Figure 1, this passive application represents the first step in the evolution of risk management. It is used for disclosure to shareholders, for management reports, and for regulatory requirements when needed. These risk measures are also used for defensive purposes. In trading portfolios, risk limits are now routinely allocated at desk levels and on a firm-wide basis. For individual traders, VAR limits are commonly used in addition to traditional limits on notional amounts, on exposures, and to stop-loss limits.

Risk management, however, is still largely viewed as a defensive tool within the broader context of the portfolio

management process. In most institutions, risk managers simply act as “control cops,” setting and enforcing limits for traders or portfolio managers. As a result, risk management is not used to its full potential as an active portfolio management tool. As shown in Figure 1, active risk-management functions include performance evaluation, capital allocation, and strategic business decisions. This article provides several examples where risk management can help improve the investment management process.

### IMPROVING THE RISK/RETURN PROFILE

Position-based risk measures describe the current risk profile of the portfolio. They can also be used to generate marginal VAR numbers, which measure the change in portfolio VAR resulting from taking an additional unit of exposure to a given factor. When VAR is measured using an analytical approach, based on volatility, marginal VAR can be expressed in a simple analytical form. To reduce risk, risk managers should focus on exposures with the highest marginal VAR numbers, which will give the greatest reduction in risk for a fixed change in positions.

**FIGURE 1**  
Evolution of Risk Management



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This measure also leads to a useful risk decomposition of the portfolio, called risk allocation or risk contribution. Risk allocation is a useful complement to the usual capital allocation, which represents portfolio weights. As an example, consider the risk measurement system developed by the California Public Employees' Retirement System (CalPERS).<sup>1</sup> Table 1 lists a capital allocation of 40.4% to U.S. equities. The table, however, shows that the risk allocation attributable to U.S. equities is 59.4%, which is a much higher fraction. So U.S. equities contribute much more to portfolio risk than the capital allocation would indicate. This high risk allocation is due to a number of factors, including high volatility of this asset class and high correlation with the portfolio.

More generally, the portfolio manager should consider both expected returns and risk. Adjustments to expected returns are linear and therefore easy to interpret. For example, shifting 10% of the portfolio toward a sector with an expected return that is 5% higher should increase the portfolio return by 50 basis points. The effect on risk, however, is much more difficult to assess because risk measures are not linear in weights. For small changes, this effect is described by marginal risk measures.

To improve portfolio efficiency, the portfolio manager should increase positions with the highest ratio of expected return to marginal risk, where returns are measured in excess of the risk-free rate. At the optimum, this ratio should be the same for all asset classes. If it is not feasible to move the portfolio directly to the optimal point, due to transaction costs or capacity restrictions, this ratio points to the right direction for portfolio changes. In Table 1, for example, alternatives have the highest marginal risk. To be optimal, the capital allocation to this asset class must be justified by expected returns that are higher than for other assets. If this were not the case, the asset allocation could be improved.

The same type of analysis can be performed at deeper levels, within each asset class or even within specific portfolios. Overall, such risk decomposition provides great insight into the investment management process.

### ALLOCATING FUNDS TO MANAGERS, OR RISK BUDGETING

Once the asset allocation has been decided, the second step is to allocate funds within each asset class. This process should account for manager skill, which is usually represented by the information ratio (IR),

defined as the ratio of alpha to Tracking Error Volatility (TEV), or active risk. Assuming that active returns are independent across managers, the optimal risk budget allocation is proportional to the information ratio of each manager.

Define  $x_i$  as the weight on manager  $i$  and  $\omega_i$  as the tracking risk of this manager. We wish to achieve a target TEV of 4% for the portfolio. The risk budget is optimally allocated as <sup>2</sup>

$$(x_i, \omega_i) = \frac{IR_i}{\sqrt{\sum_{j=1}^N IR_j^2}} TEV \quad (1)$$

Table 2 illustrates the analysis, taking U.S. equities as an example. Manager 1 has an information ratio of 0.60. Manager 2 has a lower information ratio, at 0.40. Each manager has a TEV of 6%. Note that Grinold and Kahn (1995) assert that the top quartile of active managers typically has a cutoff information ratio around 0.50. The square root term is 0.72. Using Equation (1), we find a risk budget of  $(0.60/0.72)6\% = 3.33\%$  for the first manager, which implies a market weight of  $3.33\%/6\% = 55.5\%$ . Similarly, the risk budget for the second manager is 2.22%, and the market

**TABLE 1**  
Capital Allocation and Risk Allocation

	Capital Allocation	Risk Allocation	Marginal Risk
US Equity	40.4%	59.4%	1.47
Int'l Equity	23.7%	26.3%	1.11
Global Fixed	25.6%	-0.3%	-0.01
Real Estate	5.1%	6.0%	1.18
Alternatives	4.7%	8.6%	1.83
Cash	0.5%	0.0%	0.00
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	

**TABLE 2**  
Risk Budgeting within an Asset Class

	Info Ratio	TEV	Risk Budget	Capital Weight
Manager 1	0.60	6.00%	3.33%	55.5%
Manager 2	0.40	6.00%	2.22%	37.0%
Index	0.00	0.00%		7.5%
<b>Portfolio</b>	<b>0.72</b>	<b>4.00%</b>	<b>4.00%</b>	<b>100.0%</b>

weight is 37%. Note that the two risk budgets add up to more than the target total TEV of 4%, which reflects diversification effects. However, the square root of the sum of squares of these risk budgets gives 4.0%, as required. Also note that the market weights allocated to the two active managers sum to 92.5%. As a result, the residual of 7.5% must be allocated to a passive investment in the index, which has no tracking error, to achieve the targeted TEV ratio.

managers and may have newer ideas for trades, for instance taking advantage of new markets or new financial instruments.

The problem with emerging managers is that, by definition, they have very short track records. This makes it impossible to evaluate their performance and risk profile from return data. In addition, they are more prone to failure, as failure probability has been shown to

## INVESTORS CAN NOW BALANCE THE VALUE ADDED COMING FROM ASSET CLASSES AND MANAGERS AGAINST THE CONTRIBUTION TO TOTAL PORTFOLIO RISK.

This type of analysis is being applied systematically by large pension funds, with growing success. It gives investors a useful structure that emphasizes the tradeoff between value added and risk allocation.

The table also shows that the portfolio itself has an information ratio of 0.72. This is higher than the information ratios for each manager due to diversification benefits. Similarly, these effects explain why funds of hedge funds can have very high information ratios. Such funds combine multiple markets and management styles into well-diversified portfolios including typically 50 managers. For instance, the HFR fund of funds index returned a net average return of 5.2% in excess of 1-month LIBOR over the period 1990 to 2007, with volatility of 5.4%, and little systematic risk. This gives a Sharpe ratio close to 1.0. Over the same period, a passive index of U.S. equities had excess returns of 6.5% with volatility of 14%, which translates into a Sharpe ratio of 0.5 only. With leverage of two, and lower risk budget, a fund of funds investment would return 10.4%, which is 3.9% higher than investing in U.S. stocks.

### EVALUATING NEW OPPORTUNITIES

Risk management tools are also useful for evaluating new opportunities. These include emerging markets or managers. Investing in emerging managers is rationalized by the search for superior returns. Indeed, the empirical evidence indicates that emerging hedge fund managers generate excess returns, even when adjusting for the typical biases in hedge fund databases.<sup>3</sup> This is because incentive effects should be stronger for this class of hedge fund managers. In addition, due to their size, they may be more nimble than established

be higher for smaller and younger funds by Chan et al. (2007). So, how can investors take advantage of emerging opportunities while controlling their risks?

Portfolio transparency provides the answer. This requires reporting current positions on a regular basis to the investor, or fund of funds. Portfolio transparency mitigates many of the issues with investing in emerging managers. As a start, it allows verification of reported asset values by comparing them against independent sources. Such verification decreases the possibility of operational risk problems.

Portfolio transparency allows the construction of forward-looking risk measures, including total risk, contribution to portfolio risk, concentration, systematic risk, and sector exposures. This makes it feasible to monitor changes in styles, using these risk measures and behavioural characteristics. Some managers, for example, profess to follow momentum-based strategies. These involve buying equities after their prices have gone up. This style can be confirmed by checking how new positions correlate with changes in past prices. Any breakdown in this pattern would require a discussion with the manager about the investment process. Sometimes, the portfolio management process changes as a result of internal reorganization, or even due to growth in assets under management. Such changes can be flagged quickly using position information. It would take years to detect such structural changes from returns data.

At a broader level, portfolio transparency requires the investor to keep up with financial markets. The investor must be able to evaluate the risks and potential profit opportunities of new instruments that appear in the underlying portfolios. This constant flux of new ideas is essential to keep up alpha generation capabilities.

## RISK-CENTRIC PORTFOLIO MANAGEMENT

This risk-centric view is leading to structural changes in the portfolio management process. Investors can now balance the value added coming from asset classes and managers against the contribution to total portfolio risk.

As a result, we are seeing higher allocations to active risk (alpha) and lower allocations to market risk (beta). Alpha strategies, such as global tactical asset allocation, currencies, commodities, and hedge funds, are taking increasing importance. At leading endowment funds such as Harvard and Yale, allocations to traditional equities are now below 30%, and to fixed income below 10%. High allocations to other asset classes (hedge funds, private equities, real estate and commodities) have largely contributed to their excellent performance over the last 10 years. More generally, Brown et al. (2008) examine the asset allocation decisions of a large sample of 709 endowments and find that the presence of a “self-imposed passive risk budget is ultimately hurting the performance of endowments that are less committed to active management.”

The search for alpha will also push some traditional managers into the shorting space. For example, 130/30 funds represent one of the most successful new product categories in recent years. The strategy was launched in 2005 and has grown to more than \$80 billion. These funds are extensions of traditional equity investments that allow leverage, with long positions extended to 130% of capital, offset by short positions of 30%. This approach gives the portfolio manager greater freedom to exploit both positive and negative views on stocks. The rationale for this extension is perfectly sound: removing restrictions on the investment management process should increase the potential value added from active management. On the other hand, because these 130/30 funds require quantitative models to control risk, most of these funds are quantitatively managed, which creates little diversification in style. In essence, this strategy is equivalent to investing in an equity market neutral hedge fund, superimposed on a passive beta portfolio. So, 130/30 funds represent only a timid step forward in the search for alpha.

Finally, a logical consequence of these structural changes is that the asset management function will tend to be reorganized into a risk-centric function supervising the management of alpha and beta, as shown in Figure 2. In the past, investment organizations were typically structured in separate silos with traditional asset classes, such as domestic stocks, foreign stocks,

FIGURE 2  
Risk-Driven [Organizational] Structure



fixed-income, and others. This approach, however, does not yield the most efficient allocation of risk to alpha and beta sources.

As an example, CalPERS recently instituted a new macro overlay account program that reports directly to the chief investment officer. The goal of this fund is “to efficiently reduce risk and to attempt to generate additional returns.” Rebalancing will reduce risk by moving weights closer to policy targets. At the same time, the fund will tactically incorporate market views. This approach is a logical application of a top-down, risk-centric approach to the entire portfolio.

Overall, it is fair to conclude that risk management has evolved into much more than a defensive tool. It should be viewed as an active tool that can be used to manage the portfolio. Evidently, leading institutional investors are already using active risk management tools to improve their investment management process. ■

## ENDNOTES

1. This information was available from CalPERS public Web site.
2. For more details, see Berkelaar (2006) or Jorion (2006).
3. See Aggarwal and Jorion (2008).

## REFERENCES

- Aggarwal, Raj and Philippe Jorion, 2008, “The Performance of Emerging Hedge Fund Managers,” working paper, UC Irvine.
- Berkelaar, Arjan, Adam Kobor, and Masaki Tsumagari, 2006, “The Sense and Nonsense of Risk Budgeting,” *Financial Analyst Journal* (September).
- Brown, Keith, Lorenzo Garlappi, and Cristian Tiu, 2008, “The Troves of Academe: Asset Allocation and Investment Performance of University Endowment Funds,” working paper, UT-Austin.
- Chan, Nicholas, Mila Getmansky, Shane Haas, and Andrew Lo, 2007, “Systemic risk and hedge funds,” in Mark Carey and René Stulz, eds., *The Risks of Financial Institutions and the Financial Sector*, University of Chicago Press, Chicago.
- Jorion, Philippe, 2006, *Value at Risk: The New Benchmark for Managing Financial Risk*, McGraw-Hill, New York.