Once upon a time, all we had were the “league tables” showing fund managers ranked according to their returns over the last “x” months or years. Then came the now-familiar risk/return diagrams with standard deviation of return on the horizontal axis as a proxy for risk.

These diagrams were a great step forward and allowed explicit trade-offs to be made between return and the variability of that return. Their greatest limitation, however, is that they present a single snapshot in time — one which shows the average performance over a set period, often three years.

As we will see, some fund managers undergo quite significant, even dramatic, changes over such periods. Unfortunately, the traditional risk/return “snapshot” fails to highlight changing performance.

Rather than presenting a static snapshot of several managers, a dynamic history of a single fund manager’s performance can be shown. To do this, the first point on the risk/return graph is plotted as usual. The beginning and end points of the period are then rolled forward by one month and the return and risk for the new period calculated and plotted on the same graph. By repeating this process, a trajectory is traced out dynamically in risk/return space.

This type of risk/return history is useful in portraying how a fund manager’s performance has varied over time, but it fails to reveal how much of that performance is due to the manager’s unique skills and how much is due to fortuitous market movements enjoyed by most managers.

A very good indication of the skill component can be obtained by constructing a relative risk/return history, where the median risk and median return (for an appropriate universe of fund managers) are subtracted from the results. This process highlights a manager’s value-adding and risk-reduction skills relative to its peer group.

A relative risk/return history for the MLC Balanced Fund is shown in Figure 1 as an example of the results of such an analysis.

Showing results relative to the median or average fund manager is clearly not only a reasonable approach, but a very powerful tool for comparing fund managers.

To be clear on the interpretation of relative risk/return histories, let us first be clear on exactly what is being plotted and what is not.

Relative return is plotted on the vertical axis. In Figure 1, three-year periods are used, as in many industry standard analyses. The first three-year period starts in August 1986.

After the compound average an-
nual return over the three-year period is calculated, the median return for the same period for the universe of pooled superannuation funds (over $15 million) is subtracted to give the relative return. Figure 1 shows that the relative return for the first period is about 1 per cent per annum above the median.

Relative risk is plotted on the horizontal axis. While there are a number of alternative proxies for, or measures of, risk, the most commonly accepted, standard deviation of return, has been chosen for these analyses.

The standard deviation of monthly returns over the three-year period is calculated and annualised using the standard √12 factor (which implicitly assumes a random walk stochastic model for the return series). The relative risk is then calculated by subtracting the median standard deviation for the group of fund managers and is plotted on the horizontal axis. In Figure 1, the relative risk for the first period is about 2 per cent per annum, ie, 2 per cent below median.

It is important to note that the horizontal axis is not the standard deviation of the relative return but the relative standard deviation of the total return.

Use of the former would show how well a particular fund manager tracked the median. This might or might not be a useful measure depending on one’s purpose. A low figure would simply indicate that the manager was nicely tracking the median, which itself might be undesirably volatile.

On the other hand, a low figure for relative standard deviation, as defined in this paper, implies low volatility of returns in the absolute sense, which is clearly desirable.

Rolling periods

After the first point is plotted, the three-year period is rolled forward one month and the calculations repeated. This entails calculating a new median return and a new median standard deviation. The period of analysis is then rolled forward another month and the calculations are repeated.

The importance of using rolling periods results from the fact that performance analyses are often sensitive to end-point effects. For example, financial year figures often differ noticeably from calendar year results. One of the major advantages of the above rolling approach is that, except for intra-month effects, all results are revealed—good or bad.

The performance figures used in this paper are both “after tax” and “after fees”.

One way of visualising the relative risk/return histories is to think of fixing the median “crosshairs” on a conventional risk/return diagram in the centre of the page and then watching how a manager moves in relation to them as the period of analysis is rolled forward in time.

Fairly obviously, desirable above-median returns appear above the horizontal median return line and less-desirable below-median results appear below it. Similarly, below-median volatility appears on the left of the diagram and above-median volatility on the right. The most desirable region is the top left “high return/low risk” quadrant, while the least desirable is the bottom-right “low return/high risk” quadrant.

Irrespective of the absolute position of a set of points on the graph, the tightness of their grouping is a direct indication of the consistency of a manager’s risk/return performance.

Examples of three-year histories

Figure 1 demonstrates that relative risk/return histories are useful in displaying consistent performance over changing market conditions. But are they also useful in revealing changing performance?

Figure 2 shows an example of a major fund manager whose performance has been falling steadily over recent years, while Figure 3 shows another major manager whose performance has fallen more rapidly. (The letters “D”, “H” etc. denote the same funds as in Table 1.)

Clearly, relative risk/return histories can play a valuable role in capturing and displaying the dynamics of changing fund-manager performance.

One year histories

In Figure 3 we saw the performance history of a fund manager who “got the 1987 stockmarket crash right” but whose performance in the post-crash period has been poor.

With a three-year rolling period, the dramatic change in performance does not show up until October 1990. Hardly early warning!

Figure 4, however, shows the risk/return history for the same manager using a one-year rolling analysis. The fall-off in performance becomes obvious much earlier than in Fig. 3.

Theoretically, the statistical reliability of any single point on the graph is reduced because of the reduction in the number of monthly samples from 36 to 12. From a practical point of view, however, the absence of extreme outliers on the graph tends to indicate adequate statistical reliability. Pragmatically, any concern about statistical reliability is more than outweighed by the increased speed of response to changing performance.

A very dramatic example of changing performance is shown in Figure 5. Until recently, this fund manager had been near or at the top of the league table of returns. Figure 5, however, shows how dangerous it can be to neglect either the risk dimension or the history of a manager’s risk/return performance.

The value of displaying the dynamic history of both risk and return is clear. In fact, this example shows that the single snapshot approach can be quite misleading.

How consistently do Australian fund managers add value and reduce volatility?

Figure 6 shows the proportion of time which the medium and large balanced pooled super funds have spent in the top left quadrant of the rolling one-year relative risk/return histories. Only seven funds have been able to stay in this quadrant for more than 50 per cent of the time.

Split funding and mixing managers

Relative risk/return histories clearly provide a very powerful aid to understanding and selecting individual fund managers. An obvious extension is to use them to analyse split funding arrangements and multiple managers.

Figure 7 shows the relative risk/return history for a major balanced fund managed with an aggressive style at both the asset-allocation and security-selection levels. Higher-than-median returns are achieved, but at the expense of higher-than-median volatility.
Figure 8 then shows the results when this fund is mixed 50/50 with the quite different fund shown in Figure 1. Volatility is pulled back noticeably and uncertainty of return reduced. Figure 8 provides a clear example of the power of relative risk/return histories in graphically displaying the benefits of mixing complementary mangers.

Figure 8 also shows that peak returns are reduced. Is this too high a price to pay? No, but the history needs to be complemented by some conventional calculations. In this example, the total post-crash cost is half a percentage point of return per annum, while the ‘cost’ for calendar 1990 is minus 1.5 percentage points - a significant increase in return.

In general, this probably means that the benefits of reduced volatility can be achieved without any significant cost to returns, or possibly even with enhanced returns.

Other than laboriously trying promising combinations by trial-and-error, how can one narrow the search for good combinations of managers?

While individual risk/return histories give a good indication of those managers who should be on a shortlist, they give only a limited indication of which managers are likely to complement others in split-funding arrangements.

A common approach is to assess managers by style and then to select a complementary mix of styles. However, style is only a partial indicator of the complementarity of investment returns.

Another approach could be to treat managers as asset classes and determine the optimal mixes of managers lying on the efficient frontier. This approach is far more complex for relative risk and return than it is for total risk and return. In fact, it cannot be done simply using a standard asset optimiser. The latter presupposes a relationship between portfolio variance and constituent asset variances which does not apply in the case of relative risk as defined in this paper.

The simplest approach is to look for fund managers having negative correlations of relative returns with other managers.

Correlation of relative returns

Table 1 presents the results of a correlation analysis of the relative returns of ten major funds. The analysis includes all pooled superannuation funds over $250m, provided that the manager has a total of at least $2,500m under management. Where a manager has more than one qualifying fund, only the balanced fund is included.

The results shown in Table 1 are surprising in two ways. First, the relative returns of eight of the ten funds are positively correlated with each other even though their investment styles differ markedly in many cases. Second, the negative correlation of one fund (MLC) with all but one of the majors will surprise many.

How important are the results in Table 1? The relative returns of eight of the ten funds are positively correlated with each other even though their investment styles differ markedly in many cases. Second, the negative correlation of one fund (MLC) with all but one of the majors will surprise many.

How important are the results in Table 1? The theoretical basis for seeking a mix of managers with negative correlations is considered later. The practically important point, however, is that superior risk reduction is achieved when managers with negative correlations in Table 1 are mixed together.

Figures 7 and 8 showed the reduction in volatility which could have been achieved by mixing the negatively correlated Fund B and the MLC Balanced Fund. On the other hand, mixing the positively correlated pair, B and I, would have achieved only minimal reduction in volatility, as shown in Figure 9.

Relative versus total returns

Should not total, rather than relative, returns be correlated? They could be, but the results would be less illuminating. Mathematically, negative correlations of relative returns are necessary but not a sufficient condition for risk or volatility reduction.

At a practical level, a balanced equity portfolio contains a number of stocks in an attempt to diversify risk. In split funding, the aim is to diversify risk by using multiple managers.

But just as there is a residual or undiversifiable “market” risk in an equity portfolio, so there is also a residual undiversifiable risk when mixing managers. A convenient proxy for the undiversifiable risk is the median or average manager. Removing the median return effectively removes the undiversifiable component and focuses attention on the diversifiable.

Thus correlations of relative returns provide greater insight. To torture an innocent metaphor, “using total returns is like putting the bath water back before looking for the baby”.

Period for correlation analysis

The analysis in Table 1 deals with the post-crash period. There are (at least) three reasons for restricting...
First, a number of managers overtly or covertly changed their style significantly following the events of October 1987. Some adopted more conservative asset-allocation strategies, some implemented more disciplined systems for security selection — for example the BARRA system — while some saw significant changes in key staff. It is unrealistic to pretend that such changes have not altered the performance of a number of managers.

Second, including returns for the month of October 1987 distorts what are otherwise “statistically well-behaved” data.

Third, including an event like the crash in a, say, five-year analysis implicitly specifies that a similar event will occur every five years. This is unrealistic.

Consequently, the analysis in Table 1 focuses on the post-crash period.

### Rolling returns

The use of rolling returns in the correlation analysis is a little unusual. The analysis for the risk/return histories, however, is performed in a rolling risk/return space. Hence the use of non-rolling correlations would be inappropriate. In any case, the real test is whether the results are useful or not in practice. Our results show that they are a good indicator of where real risk reduction can and cannot be expected. This overrides any concerns about unequal weighting of monthly results at the extremes of the period of analysis and other technicalities.

### Technical issues

Some detailed technical issues need to be addressed for anyone wishing to apply the powerful tools presented in this paper.

Care must be taken in constructing relative risk/return histories for combinations of fund managers. While relative returns do add linearly, relative standard deviations do not.

### Relative returns for combinations of managers

Consider a situation where two fund managers, A and B, each manage half of a super fund, F. Denote the total return in rolling period t by \( r(t) \). The return for the fund is then

\[
\begin{align*}
  r_F(t) &= 0.5r_A(t) + 0.5r_B(t) \\
  \text{(1)}
\end{align*}
\]

If relative return is denoted by \( R(t) \) then by definition

\[
R(t) = r(t) - r_M(t)
\]

where the subscript \( M \) denotes the median return for the relevant universe of fund managers.

The relative return for the fund is then

\[
R_F(t) = r_F(t) - r_M(t) = 0.5r_A(t) + 0.5r_B(t) - r_M(t)
\]

Clearly, the linear relationship in Equation (2) applies to mixes other than 50/50 and for more than two managers. Hence relative returns can be added linearly in the same way as normal returns.

### Relative standard deviations for combinations of managers

If the standard deviation of the total (not relative) return during the \( t \)-th rolling period is denoted by \( \sigma(t) \) then the relative standard deviation, \( \sigma_F(t) \), of total return is defined as

\[
\sigma_F(t) = \sigma(t) - \sigma_M(t)
\]

where \( \sigma_M(t) \) is the median standard deviation for the universe of fund managers, not the standard deviation of the median return, \( \sigma_M(t) \).

Hence the relative standard deviation for fund F is

\[
\sigma_F(t) = \sigma_F(t) - \sigma_M(t)
\]

where \( \sigma_F(t) \) is the standard deviation of the total fund return found from Equation (1), with the proportions varied as necessary.

The standard deviation of the total return of the fund is a nonlinear function of the standard deviations of the individual managers. Consequently, relative standard deviations cannot be added linearly. The simplest approach is to construct the return series for the fund using Equation (1) and then to calculate its standard deviation directly.

### Correlations

The case for correlating relative returns was argued at an intuitive level earlier. In this section, some precise mathematical relationships are presented.

It is possible (but tedious) to show that the relative standard deviation of the total return of the fund is related to the covariances of both relative and total returns. For example,

\[
\begin{align*}
  S_{RF} &= \frac{0.25\sigma_A^2 + 0.25\sigma_B^2}{\sigma_M} \\
  \quad+ 0.5\text{cov}(r_A, r_B) \\
  \text{(5)}
\end{align*}
\]

and

\[
\begin{align*}
  S_{RF} &= \frac{0.25\sigma_A^2 + 0.25\sigma_B^2}{\sigma_M} \\
  \quad+ 0.5\text{cov}(R_A, R_B) \\
  \quad+ \text{cov}(R_B, r_M) + \sigma_M^2 \\
  \text{(6)}
\end{align*}
\]

where \( \text{cov}(\ldots) \) denotes covariance.

From these relationships a number of conclusions can be drawn or proven. First, mixing managers with low total or relative standard deviations results in low relative standard deviation for the fund.

Second, the minimum and maximum relative standard deviations for the fund can be shown to be bounded by

\[
\begin{align*}
  S_{F,\text{max}} &= (S_A + S_B)/2 \\
  S_{F,\text{min}} &= |S_A - S_B|/2
\end{align*}
\]

depending on the degree of correlation between A and B. The upper bound confirms that at least an “averaging” effect occurs when managers are mixed. The minimum bound also clearly shows the relative standard deviation of the fund can be lower than that of either of the two fund managers under certain circumstances. Since the \( \sigma^2 \) terms in equations (5) and (6) must be positive, any reduction in total or relative volatility can only occur through low or negative covariances and hence low or negative correlations.

Negative correlation of relative returns is clearly a necessary but not a sufficient condition. Separate analyses indicate that negative correlation with most managers tends to coincide with negative correlation with the median. Hence negative correlation of relative returns tends to be a good pointer to diversification of risk. It should be complemented by constructing the risk/return history for the proposed combination.

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