HOW SUPER FUNDS RATE

THE RISK-REWARD TRADE-OFF

by NORMAN SINCLAIR and PAUL RAFTERY

Trustees of superannuation funds face important investment decisions in aiming for an optimum mix of risk and return.

The extent to which particular investment funds possess superior expertise in security analysis and investment evaluation has long been a preoccupation within the superannuation industry. Fund performance is addressed frequently by several performance measurement agencies using a variety of assessment metrics. However, these techniques often ignore the risk-reward relationship and thereby tend to give biased assessments both between funds and over time for the same fund.

Few would deny the importance and complexity of competently investing the superannuation contributions on behalf of employees, employers and the self-employed[1]. A conceptual model of the existing framework of superannuation fund investment is presented in Figure 1.

From Figure 1, it is clear that the decisions facing fund trustees are complex and involve choices such as: direct versus indirect investment in basic securities such as equities, property and fixed interest; domestic or overseas investment; one or more fund managers; one or more specialised funds; which of the separately marketed sub-units. It is also clear that the role of adviser to the trustee attains considerable importance. This position is usually occupied by firms of consulting actuaries, subsidiaries and service centres of life insurance companies and, in recent times, specialist superannuation investment strategy advisers.

This paper answers two questions that fund trustees might ask of their advisers:

- How well have particular superannuation funds performed over some time horizon?
- Is there any advantage to investing in a number of selected funds (a strategy often referred to as split-funding)? If so, how many and which ones?

In this paper, the performance of 20 superannuation funds is assessed using a risk-adjusted methodology, the results of which indicate that only one fund significantly outperformed market-based controls.

The paper also investigates the feasibility of "split-funding" to achieve desired performance. The results indicate that only six of the 20 funds were required to optimally replicate the performance of any other fund during the period of the study. There appears to be a high level of commonality in both the unadjusted *and* risk-adjusted performance of these superannuation funds.

Methodology

Monthly unit prices were obtained for a sample of 20 reporting super-

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Data for the study were supplied by Morrow Australia Ltd.

annuation funds during the period December 1983 to December 1986 inclusive. These unit prices were established as an average of the buy-in and sell-out prices set by the superannuation funds and incorporate a revaluation of the capital component of the fund plus pro-rata dividends, rents and interest[2]. This data is supplied each month by the reporting funds to consultants for analysis, and provides the basis for their recommendations to fund trustees concerning the performance of the funds[3]. In this paper appropriate risk adjustment is made prior to assessing fund performance.

Factor risk adjustment

There is a widely held view that the returns on risky investments change as a function of a set of common factors and that the returns on these common factors must be extracted from the returns of individual investments before individual performance can be estimated. This process is referred to as risk adjustment, and may involve only one common factor, such as a broad market index, or multiple common factors such as equities, property, interest rates and so on.

Put simply, the method of risk adjustment proposes that for any fund in any month, the factor-based return must first be estimated as:

Expression 1

Return per month due to Factors = b_1 Return on Factor 1 + b_2 Return on Factor 2 + . . + b_k Return on Factor k

where: $b_1, b_2 \ldots b_k$ measure the sensitivity of the returns on the fund to the returns on each factor. For example, a 1 per cent change in returns on Factor 1 will lead to a b_1 per cent change in returns for the fund[4].

The fund-specific performance, which can be attributed to the investment policies of the fund manager, is now easily obtained in any month as:

Expression 2:

Fund Specific Return per month = Actual Fund Return per month − Return per month due to Factors

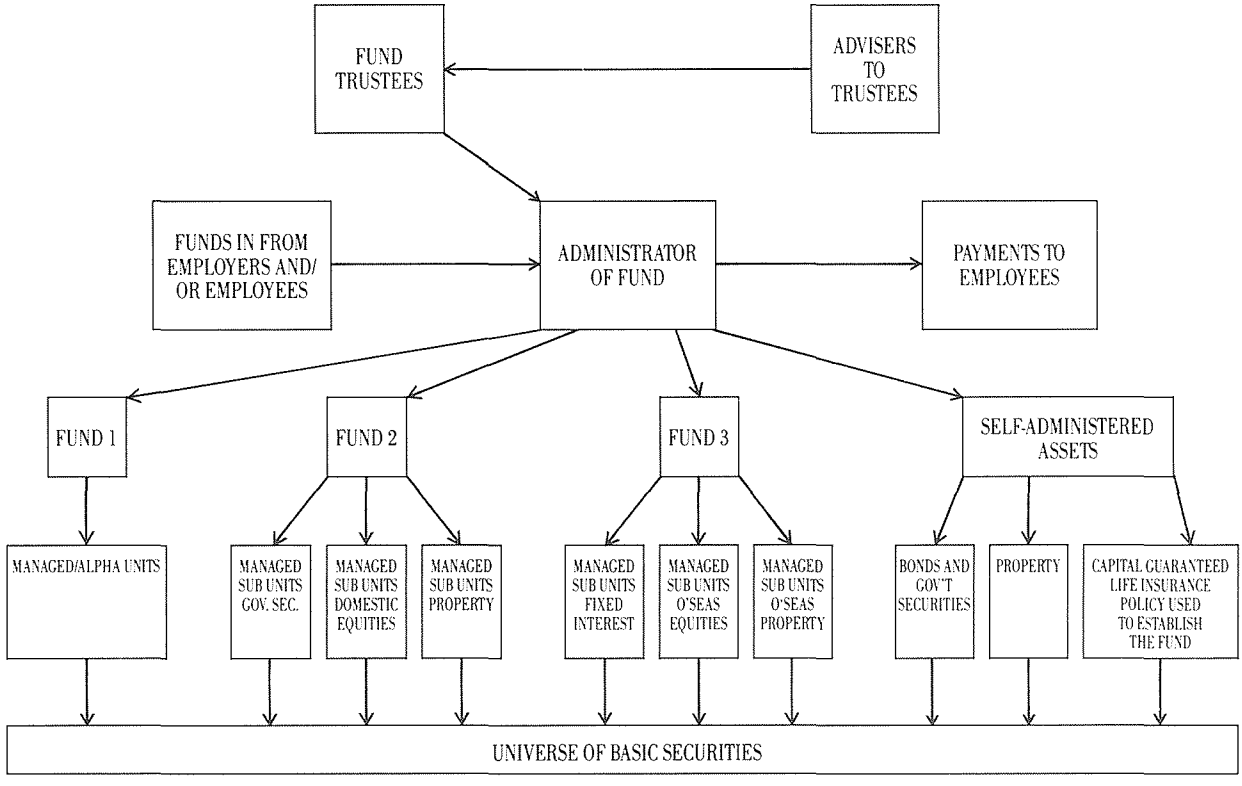
The importance of estimating fund-specific returns is that it is a measure of performance which is not confounded by events that are uncontrollable by the fund manager, such as changes in the general market or particular sectors of the market. For that reason, fund-specific returns reflect the fund manager's ability to outperform the market factors and is clearly the answer to the first question that fund trustees might ask.

Split-funding

Conceptually, split-funding is simple. In terms of Figure 1, the advisers to the trustee undertake to identify which group of fund managers the trustees should appoint on the basis of their investment strategies and forecast performance. However, split-funding is also a strategy that individual fund managers could follow rather than assign the total amount for investment to one fund. As always, there are two dimensions to the problem, risk and return, and advice to adopt a split-funding strategy must consider both of these aspects of performance.

The problem is actually one of portfolio selection. In short, the advisers need to select a portfolio of funds and the amount to invest in each, so that the desired return target is achieved for the minimum risk[5]. However, as the amount invested is spread across different funds, a risk reduction (diversification) will occur *if and only if* the returns on the individual funds are less than perfectly correlated with each other. At the outset, it is more likely that split-funding will

Figure 1: Conceptual structure of superannuation fund investment.



alter the risk characteristics of the trustees' decision than that above-average performance will be maintained[6].

Results: Unadjusted risk premia

Table 1 contains the average risk premium per month for each fund in the sample where the risk premium is defined to be the rate of return on the fund minus the monthly yield on 90-day Treasury Notes[7]. The average variation of monthly risk premia around the overall mean is the standard deviation which is also a useful measure of risk. The standard deviation of risk premia indicates how volatile the monthly returns on the fund have been. For example, in Table 1, fund 1 is the least risky with a standard deviation of 1.657 per cent per month around an average risk premium of .194 of one per cent per month[8]. Similarly, fund 11 provided the highest risk premium of 1.124 per cent per month but for the highest risk, with a standard deviation of 3.274 per cent per month.

Theories of risk suggest that there is a positive risk-reward relationship such that higher risks will usually be compensated for by higher returns. The relationship suggested is:

Expression 3

$$\text{Average Risk Premia} = a_0 + a_1 \text{ Standard Deviation of Risk Premia}$$
$$= \underset{(-.271)}{-.677} + \underset{(2.232)}{.240} \text{ Standard Deviation of Risk Premia}$$

(The statistical method of Ordinary Least Squares regression is used to estimate a_0 and a_1 while a t-statistic to test if they depart significantly from zero is presented in parentheses. A t-statistic greater than 2.0 in absolute value indicates a statistically significant relationship.)

Since the t-statistic on a_1 (in parentheses) exceeds 2.0, it appears that higher returns are accompanied by higher risk, as the theories of risk predict.

A second issue concerns the relationship between the size of the fund and the riskiness of its returns. That is,

Expression 4

$$\text{Standard Deviation of Risk Premia} = a_0 + a_1 \text{ Size of the Fund}$$
$$= \underset{(12.965)}{3.520} - \underset{(-4.602)}{.240} \text{ Size of the Fund}[9]$$

The t-statistic of -4.602 for a_1 indicates that larger funds had less variability in their monthly returns than their smaller counterparts. Overall, smaller funds are associated with higher risk which is compensated (to some extent) by higher returns.

Of course, these suggestive results on fund performance have not extracted the common factor effects which were discussed earlier.

Results: Factor risk adjusted

Table 2 contains the average risk premia per month for each fund adjusted in accordance with Expression 2. The fund-specific component of returns has been extracted allowing for one common factor taken to be the risk premium per month on the All Ordinaries Accumulation Index[10].

There are two interesting results in Table 2. First, with the exception of fund 1 and fund 14, all funds exhibited a positive fund-specific risk premium. For example, fund 11 earned .728 of one per cent per month risk premium above its factor-related risk premium. In terms of Expression 2 for fund 11, the fund-specific return is calculated as:

Expression 5

$$\text{Fund-specific risk premium} = \underset{\text{(from Table 1)}}{1.124} - \underset{\text{(from Table 2)}}{.379} \times \underset{\text{(the average market risk premium)}[11]}{1.04771}$$

However, due to the relatively high variability in fund risk premia, only fund 2 significantly outperformed the market with an average risk-adjusted risk premium of .568 of one per cent per month and t-statistic of 2.309. All other funds have too much variability in their monthly factor-adjusted risk premia to be considered to have significantly outperformed the market.

Second, the low magnitude of b_1 for each fund implies that the returns on the funds do not vary together with the market index as strongly as may be anticipated. One interpretation of this finding is that the funds in the sample all hold portfolios with relatively low common-factor risk. For example a 1 per cent change in the risk premia on the market index would result in a change of only .209 of one per cent change in the risk premia of fund 1. Some funds exhibit even less sensitivity to general market movements[12].

It could be argued that a one-factor risk adjustment such as in Table 2 could mis-estimate the factor-based performance of funds holding other than average amounts in property investments. Table 3 implements Expression 1 with an "equities-only" market index and an index of property trust returns to proxy for a property factor[13].

The variation in estimates of b_2 for each fund indicates that to some extent the funds had different exposures to property investment. However, the dominant result in Table 3 is that fund 2 still statistically outperformed the other funds whether performance is assessed with a one or two factor benchmark.

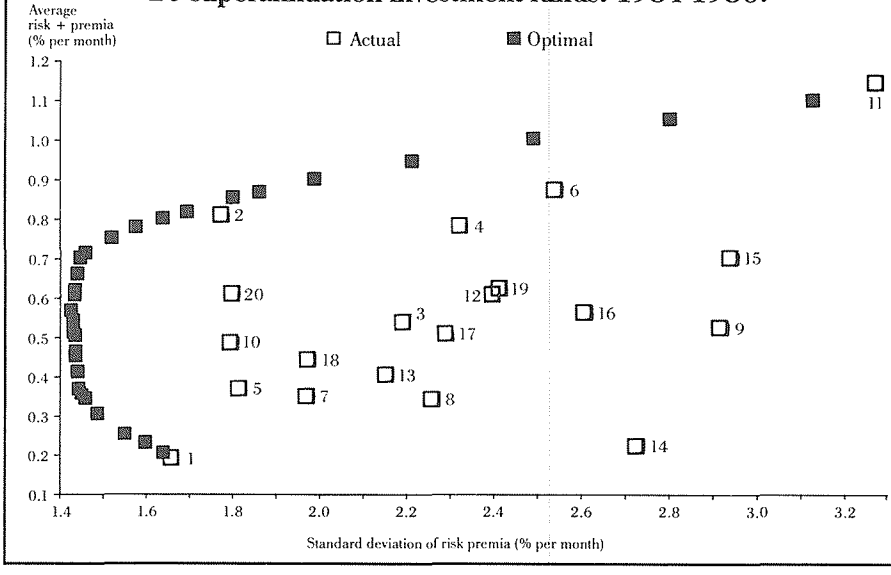
Did smaller funds outperform the larger funds on a risk-adjusted basis? To answer this question, using Table 2 data estimate,

Expression 6

$$\text{t-statistic on fund-specific risk premia} = a_0 + a_1 \text{ Size of fund}$$
$$= \underset{(.786)}{.479} + \underset{(.516)}{.060} \text{ Size of fund}$$

A t-statistic of .516 clearly indicates that for this sample of funds during the

Figure 2: Actual and optimal risk-return combination for 20 superannuation investment funds: 1984-1986.



1984-86 period there is no evidence of an association between risk-adjusted performance and fund size. Smaller funds did not typically outperform the larger funds after appropriate risk adjustment is made.

Results: Split-funding

The results in Tables 2 and 3 also have implications for the split-funding question. If the objective of split-funding was simply to "pick the winners" from among the fund managers, then the results in Tables 2 and 3 are not encouraging, since fund 2 was the only fund that outperformed the market factors.

Table 1: Fund type, size and unadjusted performance, 1984-86 inclusive

Fund [a.]	Type	Size at 31-12-86 ($ million)	Average risk premium % per month	Standard deviation % per month
1	A	2929	.194	1.657
2	A	280	.818	1.772
3	M	667	.534	2.189
4	G	263	.777	2.317
5	A	454	.364	1.815
6	A	85	.867	2.523
7	A	537	.344	1.970
8	A	42	.335	2.260
9	N	6	.509	2.899
10	A	555	.478	1.790
11	M	60	1.124	3.274
12	U	164	.610	2.398
13	N	44	.397	2.150
14	M	57	.216	2.721
15	N	62	.690	2.918
16	G	78	.553	2.601
17	M	184	.500	2.287
18	M	219	.435	1.971
19	M	152	.616	2.413
20	A	n/a	.605	1.791

a. Fund types are: **A** at fund manager's discretion; **G** guaranteed minimum return; **M** managed; **N** international; **U** unit-linked. It should be noted that funds in categories A, M and U have slightly different characteristicts depending on the degree of discretion held by the fund manager. However, such funds may have very similar investment strategies over time.

Table 2: Fund-specific performance using a one-factor risk adjustment, 1984-86 inclusive. Compared with the All Ordinaries Accumulation Index.

Fund	Fund-specific risk premia % per month	t-statistic	b_1
1	-.024	-.102	.209
2	.568	2.309	.239
3	.501	1.320	.031
4	.558	1.514	.210
5	.246	.811	.113
6	.595	1.527	.260
7	.019	.078	.310
8	.088	.254	.235
9	.157	.365	.336
10	.260	.977	.209
11	.728	1.493	.379
12	.451	1.127	.152
13	.086	.292	.297
14	-.148	-.381	.348
15	.224	.603	.445
16	.131	.400	.404
17	.237	.683	.251
18	.241	.774	.186
19	.272	.816	.329
20	.524	1.714	.077

Table 4 contains the answers to the trustees' second question. The results in Table 4 are the optimal set of investment proportions in the 20 funds over the 1984-86 period, computed such that the return performance of any fund is replicated for the lowest possible risk[14]. For example, if the trustees had set a risk premium target of .867 of one per cent per month (effectively 10.9 per cent per annum above the risk-free rate) then fund 6 achieved that target with a standard deviation of 2.523 per cent. However, the same target could have been achieved by investing 66.7 per cent in fund 2, 23.1 per cent in fund 11 and 10.2 per cent in fund 20. The standard deviation of returns on that portfolio was only 1.851 per cent. It should also be noted that fund 6 itself was *not* required in the optimal portfolio and does not appear in any other optimal portfolio. Similarly in Table 4, it is clear that 13 of the remaining 19 funds are also redundant since they do not appear in any of the optimal portfolios.

Figure 2 shows the average monthly risk premia and minimum standard deviation of monthly risk premia for these optimal portfolios. Only funds or combinations of funds such as those in Table 4 which lie on the upper boundary in Figure 2 are considered to be efficiently diversified.

The answer to the split-funding question is clear. First, there are clear risk-reduction advantages to be gained from split-funding[15]. In Table 4, except for the extreme funds 1 and 11, it was possible to replicate any other funds' performance with lower risk. Second, out of the 20 funds in the sample only six funds were necessary for this task; the remaining 14 funds were redundant. Fund 2 and fund 20 were clearly the major contributors to overall performance of the split-fund because to replicate their performance it was necessary to invest 65.6 per cent and 39.6 per cent respectively in those funds[16].

Conclusions

In this paper two questions of interest to superannuation fund trustees and their advisers were addressed. They concerned the risk-adjusted performance of superannuation investment funds and the extent to which a policy of split-funding offered a financial advantage.

The evidence on the first issue indicates that only one out of 20 funds statistically outperformed one and two-factor risk-adjustment models over the period 1984-1986. Despite a very high level of commonality in fund returns

during this period, very little appears to be due to market factors.

The reason for significant commonalities in fund returns must lie elsewhere. The evidence also suggests that smaller funds did not outperform larger funds on a risk-adjusted basis although if risk was ignored then it may appear that smaller funds earned hgher returns.

Finally, the evidence suggests that split funding can lead to significant risk reductions without sacrificing returns.

However, due to the high level of commonality in fund returns, it was found that approximately six funds out of the 20 in the sample were sufficient to achieve any return target with minimum risk. To what extent these results will extrapolate to future time periods and other funds remains an interesting but unanswered question for fund trustees. □

Table 3: Fund-specific performance using a two-factor risk adjustment, 1984-86 inclusive. Compared with the All Ordinaries Accumulation Index.

Fund	Fund-specific risk premia % per month	t-statistic	b_1	b_2
1	-.033	-.134	.221	.184
2	.528	2.155	.297	.142
3	.443	1.168	.115	-.100
4	.514	1.383	.273	.105
5	.239	.772	.123	.095
6	.536	1.377	.344	.120
7	.015	.059	.316	.291
8	.057	.163	.279	.159
9	.131	.299	.373	.268
10	.218	.821	.269	.109
11	.637	1.324	.508	.166
12	.475	1.165	.118	.200
13	.082	.274	.302	.280
14	-.201	-.515	.424	.219
15	.146	.401	.557	.257
16	.102	.309	.444	.328
17	.194	.555	.313	.147
18	.259	.817	.160	.220
19	.241	.714	.373	.250
20	.540	1.732	.054	.110

Table 4: Using split-funding to replicate the performance of individual funds with minimal risk, 1984-1986.

Fund	Type	Size	Average risk premia % per month	Standard deviation % per month	Minimum standard deviation % per month	% Optimal amounts invested in each fund to achieve minimum risk. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	A	2929	.194	1.657	1.657	1.0																			
2	A	280	.818	1.772	1.684		65.6									14.1									20.3
3	M	667	.534	2.189	1.421	28.6	24.9	7.1		.7															38.7
4	G	263	.777	2.317	1.573		64.7									6.7									28.6
5	A	454	.364	1.815	1.451	55.5	1.8			6.8															35.9
6	A	85	.867	2.523	1.851		66.7									23.1									10.2
7	A	537	.344	1.970	1.459	60.5				5.2															34.3
8	A	42	.335	2.260	1.464	63.7				3.6															32.7
9	N	6	.509	2.899	1.422	32.2	21.7	5.4		2.2															38.5
10	A	555	.478	1.790	1.425	37.0	17.5	3.3		4.1															38.1
11	M	60	1.124	3.274	3.274											1.0									
12	U	164	.610	2.398	1.425	14.7	34.5	11.1																	39.7
13	N	44	.397	2.150	1.440	50.0	6.4			6.9															36.7
14	M	57	.216	2.721	1.612	94.6																			5.4
15	N	62	.690	2.918	1.441		45.0	14.6																	40.4
16	G	78	.553	2.601	1.421	25.3	27.4	8.3																	39.0
17	M	184	.500	2.287	1.422	33.7	20.4	4.8		2.8															38.3
18	M	219	.435	1.971	1.431	43.5	11.9	.3		6.7															37.6
19	M	152	.616	2.413	1.425	13.6	35.3	11.4																	39.7
20	A	n/a	.605	1.791	1.424	15.8	33.8	10.8																	39.6
ALL FUNDS			.548		1.421	26.2	26.8	8.1																	38.9
ALL FUNDS MINIMUM STANDARD DEVIATION			.550		1.421	26.0	27.0	8.1																	38.9