Key words: Retirement incomes; self-managed superannuation funds

A 'perfect storm' in retirement savings

This study reveals that investors may be incorrectly assessing their investment risk. With a significant percentage of SMSF funds likely to face high levels of implementation risk, this could help create a 'perfect storm' in the Australian retirement savings pool. These results have far-reaching implications for the SMSF sector, trustees and their advisers, as well as the ATO, as the regulator.

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SINCE 1993 the self-managed superannuation fund (SMSF) sector of the Australian superannuation industry has become both numerically and economically significant. SMSF entities account for 98.5% of all superannuation funds and, as at 30 September 2008, they held 30% of total superannuation assets, followed closely by retail superannuation funds that accounted for 29%. As at September 2008, the SMSF sector was worth $354.6 billion and held by 394,996 entities on behalf of an estimated 730,000 members. This implies an average balance per fund of approximately $897,700 or $485,000 per member account.[1]

Substantial survey evidence suggests that many of the ingredients for a 'perfect storm' in the SMSF savings pool may have been in place for at least 15 years:[2]

- relatively low-skilled investors in control of an economically significant pool of wealth;
- an unwillingness to diversify investment portfolios;
- portfolios with a large concentration of wealth in one or two asset classes (Australian shares and property);
- a support industry of accountants and auditors that ignores the lack of diversification in the sector; and
- regulators who have yet to robustly administer the key section 52 (2) (f) of the Superannuation Industry (Supervision) Act.

The final ingredient to be added to this potent mixture is the potential for SMSF trustees, their experts and regulators to fail to recognise that their portfolios are exposed to more risk than they realise. This paper uses simulation techniques to explore this potential.

Setting the investment strategy

Table 1 provides an example of a typical 'balanced' investment strategy expressed in terms of asset allocation ranges together with a defined benchmark portfolio against which short-term 'tactical' portfolio positions may be evaluated.

TABLE 1: An example of a 'balanced' investment strategy and a short-term implemented 'tactical' portfolio[a]

Asset Class	Minimum	Benchmark	Maximum	Tactical[b]
Cash	0	5	10	7
Australian fixed interest	10	20	30	13
International fixed interest	0	5	10	6
Property	0	5	10	8
Australian shares	20	40	60	33
International shares	10	25	40	23
Other[c]	0	0	15	10
Total		100		100

a The minimum, benchmark and maximum are typical for 'balanced funds' and are based upon the AXA Diversified Balanced Fund October 2004 which is closed to new investors.

b The tactical portfolio is based on the average default strategy for all superannuation funds with more than four members published in APRA Annual Statistics June 2005. It is interesting to note that this average default strategy falls within the structure of a widely accepted 'balanced' investment strategy.

c Other is a 'catch-all' that could include assets in alternative investments such as hedge funds, infrastructure, private equity and various collective investments. This category is reported here for completeness and is not modelled in this paper.

Table 1 contains a number of implications for implementation of the strategy and the expected return and risk consequences.

First, it should be noted that investment strategy is generally formulated in terms of broad asset classes. Hence, Table 1 is effectively a statement of investment strategy in terms of index funds because they are the *only* investment products specifically designed to mimic individual asset classes.

Second, even if index funds are used to implement the strategy, investors can still generate a vast range of risk and return outcomes within a well-defined balanced framework. At best, asset allocation ranges define an implicit 'zone of admissible risk' for SMSF trustees.

Finally, the complete distribution of feasible risk outcomes is defined by the estimated risks of *all* valid portfolios that lie within the strategic framework. Wider asset class ranges will permit more extreme risks and tighter ranges will narrow the distribution of admissible risks. Hence, it is possible for an investor to, *a priori*, limit the potential risk to be taken by the fund through controlling the asset class ranges and then, *ex post*, assess how extreme the actual risk-taking of the fund has been.

Implementing the investment strategy

Table 2 illustrates a common approach to implementing investment strategy followed by many financial planners in Australia.

Based on a $250,000 portfolio, Table 2 suggests that $82,500 (33% in Table 1 above) is to be allocated to Australian shares, of which $37,500 (15%) is indexed. Of the remaining amount, $30,000 (12%) is allocated to active managed funds that specialise in Australian shares and $15,000 (6%) is allocated to direct holdings of individual Australian shares.

It is important to note that $45,000 could have been invested into any randomly selected active specialist managed fund and/or any randomly selected individual share listed on the Australian stock exchange in *any* proportions – and the 33% to be invested in Australian shares would still be *consistent* with the original statement of investment strategy. In fact, at the re-cast asset class level, all investors following the allocation in Table 2 will arrive at that same exposure to Australian shares irrespective of how recklessly they might have implemented their actual portfolio. Their risk exposure will, however, vary considerably!

TABLE 2: An example of an implementation for the 33% Australian shares exposure in a tactical investment strategy of a $250,000 fund

Australian shares	Allocation totals	Indexed	Managed specialist	Direct shares
Indexed	15%	15%	N/A	N/A
Active	18%	N/A	12%	6%
% allocated	33%	15%	12%	6%
Dollars allocated	$82,500	$37,500	$30,000	$15,000

Simulation method

A Monte Carlo simulation is used to create hypothetical portfolios with varying exposure to index funds, active specialist managed funds and direct shares. Systematic variation is controlled across % ACTIVE and % DIRECT (within each active allocation) using 10% allocation intervals for both. Within each of the 121 cells of the experimental grid, 200 random portfolios are created. The estimated risk of each portfolio is then compared to the estimated risk of the portfolio after it has been re-cast into the original strategic asset class framework.

This simulation experiment is analogous to 200 investors with an identical tactical portfolio in Table 1 and the same strategic asset class constraints but with each investor deciding to invest different amounts in different securities. The measured risks at the re-cast asset class level are identical for all investors sharing the same asset allocation.

Table 3 contains a summary of the number of securities available for random selection in each asset class.

All managed funds are larger than $10 million and direct investment in Australian shares is limited to the largest 300 issues – excluding all real estate and income securities that are reserved for direct investment into property and Australian fixed interest sectors respectively. The managed specialist universe is used when no direct investment is feasible for an asset class. Cash is modelled using both direct and specialist universes. This lack of direct securities may understate the significance of the results.

Statistical analysis

The experimental design lends itself to a one-way analysis of variance (ANOVA) with the number of securities in each portfolio introduced as a covariate because there will be a natural tendency for risk to decrease through the diversification effect of randomly increasing the number of investments in portfolios with higher allocations to DIRECT.[3]

The statistical model to be fitted to the simulated risk data is:

$$y_{ij} = \mu + \beta Z_{ij} + \alpha_i + \beta_i x_{ij} + \varepsilon_{ij} \qquad [1]$$

where:

$i = 1, 2, 3 \ldots 121$; $j = 1, 2, 3 \ldots n_i$; $n_i = 200$ and $\alpha_1 = 0; \beta_1 = 0$

Each y_{ij} is the ratio of the risk estimate for the implemented portfolio relative to the corresponding risk estimate obtained after all securities are re-cast into their asset classes. This risk ratio is defined as:

$$y_{ij} = \frac{\sigma_{ij}^{acutal}}{\sigma_{ij}^{class}} \qquad [2]$$

The first cell of the experimental grid (i.e. % ACTIVE = 0 and % DIRECT = 0) contains risk estimates for implemented portfolios using pure index funds for each asset class. Hence, the risk ratio in [2] is unity for these cells and is forced into the intercept, μ, when estimating equation [1]. For that reason, the estimates, β_i, become differences from the indexed base case and provide natural under- and over-estimates of actual risk relative to the corresponding pure index portfolio (i.e. the asset class itself). The Z_{ij} are the 24,200 observations of [2] on the number of securities held in each simulated portfolio and the x_{ij} are dummy variables that take a value of 1 for observations within a given cell and 0 otherwise. The dummy variable structure of the statistical model in [1] leads to a direct test of significance of the risk difference in each group relative to its base case.

Results

Prior to testing equation [1] it is useful to understand the distribution of risk outcomes that the strategic framework in Table 1 could have delivered in an 'all indexed' implementation. This can then be compared to the equivalent distribution of risk for implemented portfolios generated under Tables 2 and 3.

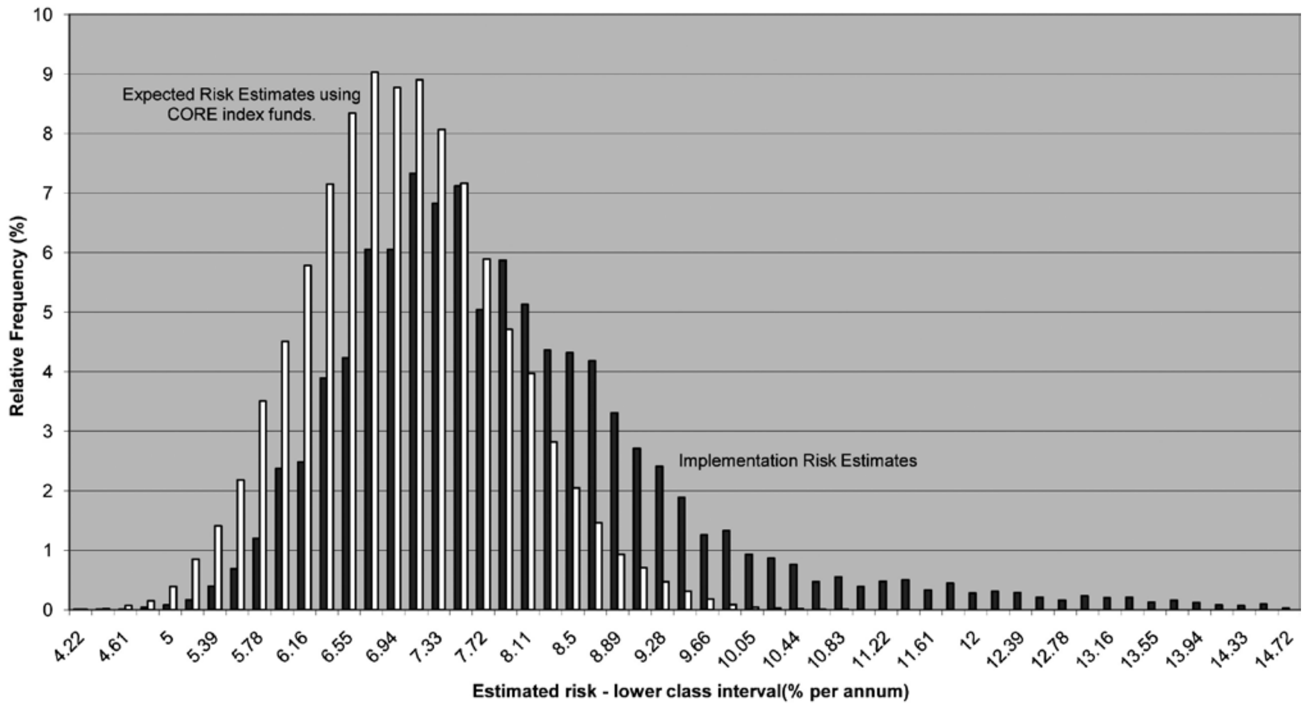
Figure 1 presents the relative frequency distribution of 50,000 simulated risk estimates, obtained from a previous simulation study,[4] together with the frequency distribution of risk outcomes obtained from the 24,200 randomised portfolios described above. The difference between the two distributions is both visually and statistically highly significant (Kolmogorov-Smirnov Z statistic > 28).

From Table 4, those investors who implement a 'balanced' investment strategy using only indexed securities can construct portfolios with expected risk outcomes between 4.22% and 11.08% with 95% of those most likely to lie within the range 5.66% to 9.27% per annum. The summary statistics in Table 4 show that this distribution is

TABLE 3: Number of retail actively managed specialist funds and direct shares available for random selection in each asset class

Asset class	Managed specialist	Direct shares
Cash	42	Use managed specialist (=43)
Australian fixed interest	59	139
International fixed interest	29	Use managed specialist (=29)
Property	24	103
Australian shares	391	222
International shares	212	Use managed specialist (=212)

FIGURE 1: **A comparison of simulated risk distributions for portfolios of indexed asset classes versus porfolios of index funds, active specialist funds and direct shares**



close to symmetric (average ≈ median) although it is not statistically 'normal' (bell shaped) since it has slight positive skewness (too much mass to the right) and slight kurtosis (more peaked), both of which are statistically significant.

Other investors who implement their investment strategies using active specialist managed funds and direct shares encounter highly non-normal distributions of risk. The summary statistics in Table 4 show that this distribution of risk outcomes is asymmetric and distinctly non-normal with significant positive skewness (too much mass to the right) and kurtosis (peaked). In this case, 95% of risk outcomes lie in the range 5.97% to 12.93% per annum.

Formal estimation of model [1] results in an adjusted R^2 of 49% and an overall F test statistic of 97.3 with 241 degrees of freedom. The result is highly significant (p=0.00). The main effects for covariate, differences across groups and the interaction between them are also highly significant. This result confirms that the differences between risk distributions observed in Figure 1 and Table 4 are spread across the 121 individual treatment groups.

Table 5 explores the risk drift inherent to the balanced strategy in Table 1 as well as how risk drift is amplified by the way the strategy is implemented.[5]

TABLE 4: **Statistical summary of simulated risk distributions**

A: Previous study (N=50,000)
Risk outcomes for SMSF trustees using only index funds to implement their strategy

B: This study (N=24,200)
Risk outcomes for SMSF trustees using combinations of index funds, specialist managed funds and direct shares to implement their strategy

Summary statistics	A	B
Average risk (% per annum)	7.13%	8.39%
Median risk (% per annum)	7.09%	7.99%
Minimum risk estimate (% per annum)	4.22%	2.81%
Maximum risk estimate (% per annum)	11.08%	34.11%
95% confidence limits (% per annum)	5.66% to 9.27%	5.97% to 12.93%
Pearson central moment – skew	0.08 (p = 0 .00)	6.64 (p =0.00)
Pearson central moment – kurtosis	3.10 (p= 0.00)	15.62 (p = 0.00)

When implementation of the strategy is not confined to index funds, approximately twice as many risk outcomes (27.61%) can be misclassified as when it is confined to index funds (14%).

In Table 5, the entries in the cells are 'misclassification percentages' between desired and actual risk outcomes for the 24,200 simulated portfolios. For the 'all index' base case, only 86% of the 24,200 portfolios had risk estimates lying between 6% and 9% per annum (i.e. medium risk zone). Indeed, 13.5% of those random indexed portfolios would be classified as high risk zone with risk estimates between 9% and 12% per annum. This result is due to the width of the policy ranges permitted in Table 1 and serves to emphasise their critical role in risk control for investors and their advisers. In short, investors can generate high risk outcomes even within a medium risk ('balanced') strategic framework based on index funds.

The re-estimation of portfolio risk based on the implemented portfolio reveals that 72.39% remain in the original medium risk zone and more portfolios are assigned to the 'high' and 'very high' risk zones (21.5% and 4.6%, respectively). This result comes about because implementation is not confined to index funds and, instead, is based on combinations of index funds, active specialist managed funds and direct shares.

The results in Table 5 suggest that only 68.93% of implemented portfolios were originally conceived as medium risk strategies and implemented in such a way that they remained within that risk zone. Further, although 15.83% were considered 'medium', they had drifted to 'high' (12.43%) or 'very high' (3.4%) risk zones on implementation.

Overall, the results in Table 5 suggest that when implementation of the strategy is not confined to index funds, approximately twice as many risk outcomes (27.61%) can be misclassified as when it is confined to index funds (14%).

Closer scrutiny of the β_i estimates from model [1] show patterns suggesting that, on average, an investor with 70% of the fund invested in non-indexed products, of which 70% is invested in direct shares, may have a fund that is 20% more risky than their investment strategy intended. Further, at the extreme, an investor 100% active in all asset classes with 100% invested in direct shares within the asset class (where possible), could hold an implemented portfolio with risk 115% greater than the risk of the re-cast asset classes.

Conclusions and implications

The results of the study are summarised below.

1. Investors who focus only on aggregate asset allocation ranges without explicitly examining the actual risk structure of their implemented portfolios may incorrectly assess their investment risk.
2. The extent and significance of the error in risk assessment depends predominantly on the percentage allocated to non-indexed specialist managed funds and the percentage allocated to direct share investment. Direct share investment is more likely to cause implementation risk to drift significantly higher than its intended level.
3. Published statistics and commissioned surveys suggest that a significant percentage of funds in the SMSF sector is likely to face high levels of implementation risk.

The final ingredient for a 'perfect storm' in the Australian retirement savings pool is empirically feasible. These results have far-reaching implications for the SMSF sector of the superannuation industry:

1. SMSF trustees and their advisers need to explicitly estimate and monitor risk to demonstrate their fund's compliance with the law *rather than an exposure-based aggregation into asset classes*.
2. As the regulator of the SMSF sector, the Australian Taxation Office (ATO) may unwittingly be the

TABLE 5: Risk zone misclassification due to 'active' implementation of a 'balanced' investment strategy.

DESIRED Risk Zone at Asset Class Level	Actual risk zone at implementation level					
	Very low σ < 3% p.a.	Low 3% < σ ≤ 6%	Medium 6% < σ ≤ 9%	High 9% < σ ≤ 12%	Very high 12% < σ	Totals
Very Low	0	0	0	0	0	0
Low	0	0.26	0.22	0.02	0	0.50
Medium	0	1.24	68.93	12.43	3.4	86.00
High	0	0	3.24	9.06	1.2	13.50
Very High	0	0	0	0	0	0
Totals	0	1.50	72.39	21.51	4.60	100

Note: σ is an estimate of the standard deviation of returns (% per annum) for the investment strategy measured at both asset class level and implementation level.

custodians of a significant public policy risk. If the SMSF sector is exposed to considerably higher investment risks (of which both the regulator and SMSF trustees are unaware) then a fall in the market value of those risky securities could lead to a significantly amplified loss of wealth for the sector. This creates risks for the Australian Government's retirement income policy.

3. The ATO could consider a risk-based compliance screen as an adjunct to its SMSF compliance audit. Such a screen could identify SMSF trustees holding excessive risk in their funds and could be correlated with other audit criteria. This may require changes to the *Financial Sector (Collection of Data) Act 2001*, under which the Australian Prudential Regulation Authority (APRA) is empowered to determine reporting standards and specify which data are to be provided to it for prudential regulation.

4. The ATO and APRA could consider licensing and/ or competency tests for intending SMS trustees.

5. Financial advisors who use asset class allocation to suggest an appropriate investment strategy for a SMSF trustee and then implement it using high allocations to active managed funds and direct shares may have misrepresented the underlying risk of the fund. If so, it is quite possible that there are grounds for a successful complaint and/or litigation against the adviser for misrepresentation and/or negligence.[6]

Notes

1 See APRA, *Quarterly Superannuation Performance*, September 2008 and *Annual Superannuation Bulletin*, June 2008. The September 2008 estimate for SMSF members is based on the relatively constant proportion of 1.8 to 1.9 members per entity since 2001.

2 See an early paper by M. Roberts 2002, 'Self managed superannuation – overview', paper presented at the Tenth Annual Colloquium of Superannuation Researchers, July. This paper is the most detailed analysis of the SMSF sector to date and based on the returns of approximately 222,000 funds. Unfortunately this analysis appears to have been discontinued by the Australian Taxation Office. This has placed more reliance on privately sponsored surveys such as 'Investment trends/IFSA Self managed super funds (SMSF) Report', February 2006 based on only 570 responses.

3 See H. Markowtiz 1959, *Portfolio Selection*, Yale University Press, ch. 5, pp. 102–115. The risk of equal-weighted portfolios of randomly selected securities converges quickly to the average covariance across all securities. In some circumstances, this can be with as few as 15 securities.

4 An earlier report entitled 'SMSF investment strategy – a risk perspective', unpublished manuscript, November (2005) contained simulation results that cast light on this question. Those results presented were based on 500 portfolios randomly generated within the policy ranges specified in Exhibit 1 and modelled over 100 randomly generated time series of 120 months with assumptions about rebalancing (semi-annual); income flows (quarterly); capital gains realisation; and taxation (15%) incorporated into the time series simulation.

5 For the purpose of the exercise, arbitrary risk zones have been constructed around the medium risk zone defined to be between 6% and 9% per annum in standard deviation terms (expressed as 'sigma'). These risk zones are constructed in 3% bands.

6 Many complaints to the Financial Industry Complaints Service (FICS) have this common thread where the client experiences a significant change in portfolio value beyond what they expected or were led to believe possible from their adviser. Failure to explain the risk consequences of the implemented investment strategy is a commonly contested problem.