THE DIVERSIFICATION AND PERFORMANCE OF SELF MANAGED SUPERANNUATION FUNDS

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ABSTRACT

In this paper we examine the diversification and performance of a small preliminary sample of Australian self managed superannuation (retirement) funds (SMSFs). Using the single index model and traditional (risk-adjusted) performance measures within the context set by modern portfolio theory we find that the SMSFs in our sample exhibit considerable under-diversification. In addition, we find that the SMSFs do not appear to be benefiting from even naïve diversification and, unsurprisingly, perform poorly on a risk-adjusted basis *vis-à-vis* the unmanaged S&P/ASX300 index. This empirical investigation contributes to economists' understanding of the microeconomic structure of this increasingly important component of Australia's retirement income stream.

Key Words: Self Managed Superannuation Funds (SMSF), diversification, performance.

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Self managed superannuation funds (SMSFs) now represent a significant component of Australia's retirement income stream. Indeed, SMSFs represent approximately one-quarter (to be precise, 23.10 per cent) of all superannuation assets and 97.69 per cent of all superannuation entities (APRA, September 2006). As this significance continues to grow, sound government policy concerning the regulation and prudent management of SMSFs becomes even more important. The regulation of SMSFs and, indeed, the superannuation fund industry as a whole, is still in its infancy relative to the prudential supervision of authorised deposit taking institutions and insurance companies. As such, research into the nature of this new and burgeoning industry is required to assist with the development of sound policies. It is the purpose of this paper to contribute to the body of empirical knowledge that guides the policies of those whose task it is to ensure the prudent management of SMSFs.

Whilst superannuation has generated a reasonable amount of research by economists and others, self managed superannuation is still very much frontier territory. It has only just begun to be explored and there remains much to discover, particularly at the micro level of individual SMSFs. This paper concentrates on contributing to our empirical knowledge of SMSFs by examining two particular aspects of SMSF microstructure: diversification and performance. Financial economic theory has long stressed the importance and benefits of portfolio diversification and much time has been spent investigating the attainment of appropriate levels of diversification. Using the single index model developed by Sharpe (1963) and the portfolio performance measures developed by Sharpe and Treynor, we examine the degree of diversification exhibited by the SMSFs in our sample and their risk-adjusted performance.

The results of the investigation revealed that, treated as individual portfolios, the SMSFs analysed herein exhibit a considerable degree of *under*-diversification and poor risk-adjusted performance relative to the unmanaged benchmark S&P/ASX300 index. The volatility of the returns generated by these SMSFs is attributable to a very large degree to the volatility of the returns of specific assets within the portfolios,

especially particular shares in Australian companies, and only to a very small degree to the overall share market (or the macroeconomy). These funds, taken as individual portfolios, are vulnerable to adverse fluctuations in the fortunes of a relatively small number of companies or industrial sectors. Not surprisingly, the risk-adjusted performance of the SMSFs is relatively poor and could be improved, in most cases, by simply allocating funds between the risk free security and the ASX300 index depending on the degree of risk the individual trustee is willing to bear.

An important limitation of this analysis is the applicability of the results in situations where the SMSF trustees hold assets outside of their SMSF or when the SMSF cannot be treated as a separate compartment of the trustees' wealth. A trustee might have an under-diversified SMSF but when his or her assets are considered *in aggregate* there may be no diversification problem. Hence, it is not possible for us to draw conclusions regarding the optimality of this particular component of Australia's retirement income stream. Rather, it is best to treat the results of this investigation as a description of the microstructure characteristics of SMSFs rather than a study of the optimality of investors' retirement funds. Whilst the performance of the SMSFs in our sample could be improved by more effective asset selection and diversification, it is not permissible for us to make specific prescriptions in this regard without assuming that the SMSFs are a separate, stand-alone, component of the trustee's wealth to which he or she applies a special set of rules[3].

This paper is organised as follows. In the second section, the background to this analysis is briefly sketched. If SMSFs were not an important component of Australia's retirement income stream there would be no need to study them. In Section II, this importance is established. In Section III, the data are discussed. The portfolio data gathered for this investigation consist of the actual portfolio structures of a number of self managed superannuation funds. This would appear to be the first time that such data have been used in an investigation such as this. In Section IV, the methodology and the results of the analysis are presented and discussed. The analysis

[3] This assumption is accorded some support by research into the related topic of non-fungibility (see, for example, Kahneman and Tversky (1982)). However, its tenuous nature leads us to favour a more descriptive approach rather than a prescriptive one.

revealed substantial under-diversification of the SMSF portfolios. In Section V, the policy implications of the results are discussed. Section VI concludes the analysis.

II Background to the Study

Superannuation represents a very significant component of Australia's retirement income stream and represents the hopes of successive Australian governments as a replacement or supplement to the publicly provided pensions that were once relied upon by the majority of Australia's retirees as their sole source of retirement income. The importance of superannuation in Australia has grown significantly since the introduction of compulsory employer superannuation contributions from 1 July 1992. As a result of this Federal Government initiative and a greater awareness of the benefits of superannuation within the wider community, superannuation assets have grown from $519.4 billion in 1992 to $945.6 billion as at the September quarter 2006, an increase of 82.05 per cent (APRA, 2006).

A significant part of this increase in superannuation assets has derived from the growth in the number of self managed superannuation funds and the assets held in them. A SMSF is a superannuation fund with between two and five members, where all members are trustees who actively participate in the fund's management and investment functions. The fundamental purpose for establishing these funds is governed by the *Superannuation Industry (Supervision) Act 1993* (SISA), which states that the fund's sole purpose is to provide superannuation benefits to members or to members' dependants when they die. SMSFs are also commonly referred to as DIY funds, 'mum and dad' funds or 'family' funds.

The concept of the self managed superannuation fund has its origins in the accounting industry. The accountants who established these funds for clients still control approximately 80 percent of the self managed superannuation fund market (Barret, 2006). Traditionally, self-employed people and retirees were the main two groups of individuals who established SMSFs, but in more recent times many employees, especially high income earners and high net worth individuals have emerged as the most prominent groups of individuals establishing their own self managed superannuation funds. The attractions of SMSFs are that they offer members greater

control, flexibility and choice in the operation of the fund and costs can be minimised (Leo and Murphy, 2005).

The Quarterly Superannuation Performance report as at the end of the September quarter 2006 issued by the Australian Prudential Regulation Authority (APRA) shows that the assets held by SMSFs total $218.4 billion, or 23.10 per cent of all superannuation assets totalling $945.6 billion. Only retail superannuation funds hold more superannuation assets with a total of $306.10 billion (APRA, 2006). A further indication of the importance of SMSFs within the Australian superannuation industry is emphasised by the size of this sector in terms of the number of funds in relation to the total superannuation industry. There are 325,730 SMSFs (up from 200,000 in June 2000), which comprise 97.69 per cent of an industry total of 333,429 funds. Additionally, the SMSFs contain a total of approximately 600,000 members and have a growth rate of approximately 1,800 new funds per month. SMSFs represent a significant component of Australia's retirement savings.

Superannuation in Australia has attracted a reasonable amount of research. This research has concentrated on the performance of superannuation funds (Drew and Stanford (2003) and Gallagher (2001)) and the problems of fund selection (Drew, Stanford and Taranenko (2001), asset allocation and asset selection (Drew and Stanford (2001). As we have highlighted above, SMSFs are an increasingly important component of Australia's superannuation system and despite the research generated on superannuation in general, SMSFs are still under-researched due to the difficulty of obtaining micro level data. This study complements these existing, broader investigations by utilising micro level data from individual SMSFs. The methods used in this investigation are similar (to the extent that they are derived from modern portfolio theory) to the methods deployed in the extant literature but we take the further step of applying these methods to an analysis of the microstructure of SMSFs.

III Self Managed Superannuation Fund Data

The data used in this study were obtained from a large accounting firm in South East Queensland. This firm administers approximately 130 self managed superannuation funds. Of these, approximately one third are characterised by the direct management of equity securities by the trustees of the SMSF. The other two thirds of the 'global'

population of SMSFs are characterised by funds that consist almost solely of commercial and residential property. We were permitted access to the one third of the total population of SMSFs administered by this organisation that involve the direct management of equities by the trustees. Our sample consists of approximately 40 SMSFs where the trustees directly manage the equity securities, cash, real estate and managed funds contained in their portfolios.

The accounting firm from which the data were sourced does provide financial advice and employs several individuals qualified to provide financial planning services to clients. However, upon careful consideration of firm's operations (including a personal conversation between the author and the firm's financial advisor) it is right to conclude that the SMSF portfolios in this sample are the product of the decisions of the SMSF trustees and not the financial advisor. It is likely that some general advice has been sought by the SMSF trustees and, perhaps, some investment advice as well. Some of this advice may have influenced the choices of particular shares included in the portfolios and might account for some of the naïve diversification that appears to have been attempted but this would amount to little more than the advice an individual normally receives from his or her (full service) stockbroker. Overall, the portfolios are the product of the trustees' decisions and the trustees remain responsible for the management of the portfolios over time.

The SMSF portfolio data are extremely detailed. The data include information on the asset structure of each SMSF at the end of the financial year 2003/2004 (*i.e.* June 30, 2004). This information contains: (1) asset holdings; (2) purchase prices; (3) purchase dates; and (4) returns attributable to each investment. A summary of the composition of the portfolios is presented in Table 1 below. The asset categories are short and long term cash, listed and unlisted Australian ordinary shares, listed overseas shares, corporate bonds, unit trusts and managed funds, real estate and derivatives. Short term cash is cash that is deposited in savings accounts with banks or other deposit taking institutions. Long term cash is cash invested in term deposit accounts. Real estate is direct property investment (either commercial or residential). Property trusts are included in the unit trusts and managed investments category.

TABLE 1

The Composition of the Self Managed Superannuation Fund Portfolios

Asset	Mean ($)	Mean (%)	Percentage of Funds with Zero Holdings
Short Term Cash	80,822	18	0
Long Term Cash	26,625	4	92.68
Listed Australian Shares	159,847	46.9	2.4
Unlisted Australian Shares	999	0.28	95.12
Fixed Interest	8,879	1.7	78
Unit Trusts	56,655	13.5	39
Managed Funds	9,592	4.9	92.68
Real Estate	50,165	9.5	82.9
Overseas Shares	3,388	0.78	87.8
Derivatives	18	0.012	92.68
TOTAL	396,995		

Notes: All of the items in the asset column listed above are self-explanatory. However, the 'derivatives' category may cause some curiosity. A very small number of funds contained options. These were company options listed on the ASX and not calls and puts traded through ASX Derivatives (ASXD).

The most popular risky investment undertaken by the SMSF trustees is investment in Australian ordinary shares listed on the Australian Stock Exchange. Almost all of the SMSFs contained some shares in listed Australian companies. Of note is the large weighting of cash in the portfolios. On average, the trustees of the SMSFs kept approximately one-fifth of investable funds in short term cash accounts. All of the funds contained at least some short term cash. This would tend to indicate, at the very least, a reasonable amount of disinterest in 'squeezing' the maximum return from each investable dollar. It could also be indicative of a lack of confidence or a higher level of risk aversion amongst some trustees. Unit trusts and managed funds and real estate are also reasonably popular asset classes. However, a large number of the SMSFs in the sample did not contain any of these assets.

The SMSF portfolio data have some advantages that are not usually present in data gathered from primary data sources. Most importantly, the data are accurate, complete and correct. The portfolio structures containing all of the information discussed above were provided to us directly from the administering accounting firm's databases. As such we did not have to rely upon surveys, questionnaires or other similar methods to

gather the data. This avoided or diminished the impact of some of the biases and inaccuracies that may influence other sets of primary data. The only things that we do not know about the SMSFs concern the trading names of the funds, the names of the trustees and the demographics of the trustees. This information, of course, was withheld from us in compliance with privacy legislation.

In order to determine the level of diversification of the SMSFs in our sample, we supplemented the SMSF portfolio data discussed above with some additional secondary (market) data gathered from Thomson DataStream as well as some additional data that were the results of calculations that were undertaken as part of the investigation and analysis. These data included: (1) market prices of marketable assets sourced from DataStream; (2) the weights of each security or asset in each portfolio; (3) the daily returns (including dividends and other cash distributions) for each security; (4) the betas for each security; (5) the covariances of the returns between each pair of securities in each portfolio; and (6) the variance of each portfolio. The portfolio data provided by the accounting firm and supplemented by these additional data permit the computation or determination of the level of diversification of the SMSF portfolios.

IV Methodology and Results

The methodology deployed in this investigation is straightforward. The tool that may be utilised to determine the level of diversification of a portfolio of assets is readily available from the existing body of mathematical and statistical tools in the field of financial economics. Quite simply, the level of diversification of a portfolio may be measured by determining the proportion of the variance of the portfolio's returns that is attributable to the variance of the returns of a broad stock market index (which is usually considered to be a proxy for the macroeconomy) *vis-à-vis* the proportion that is attributable to the returns of specific assets in the portfolio. Computing these proportions is a data and time intensive exercise but an exercise that is, nonetheless, relatively straightforward. The procedure involves computing the parameters for Sharpe's (1963) single index model.

According to modern finance theory, investors face two types of risk: (1) systematic risk; and (2) non-systematic risk. Systematic risk, which derives from the ups and

downs of a broad market index, is risk that cannot be diversified away. Non-systematic or firm-specific risk is risk that derives from particular securities or business sectors that can be diversified away by combining securities in a portfolio. Since non-systematic risk can be diversified away, the investor is only rewarded for bearing systematic risk. To the extent that the investor bears systematic risk rather than non-systematic risk his or her portfolio is diversified or, conversely, to the extent that the investor bears non-systematic risk rather than systematic risk his or her portfolio is under-diversified. One of the most readily applicable contributions to modern finance theory that provides important insights into portfolio diversification is Sharpe's (1963) single index model. This model permits the calculation of the proportion of total portfolio risk that is attributable to systematic and non-systematic factors.

Whilst Markowitz mean-variance analysis has been widely used in the financial services industry for over forty years, there are certain features of the analytical method that are undesirable from an operational standpoint. It was these features that prompted the development of index models. The single index model developed by Sharpe (1963) compares securities to a single benchmark or index and can result in significant computational economies *vis-à-vis* the standard portfolio analysis developed earlier by Markowitz (1952). Formally and according to Sharpe (1963), the excess return on a portfolio is given by[4]:

$$R_P = \alpha_P + \beta_P R_M + e_P \qquad (1)$$

In practice, Equation (1) is utilised as a regression equation where α_P and β_P are parameters, R_M is the excess return on a broad market index during a particular time period and e_P is a random variable with a mean of zero. Since excess returns (returns in excess of the risk-free rate of return) are not significantly different from zero at daily time horizons, we deploy total returns measured at daily intervals throughout the analysis. From Equation (1) it is possible to derive Equation (2) (below), which is an equation for the variance exhibited by a portfolio.

[4] See Bodie, Kane and Marcus (2005, p.324). Sharpe (1963, p.281) uses slightly different, but equivalent, notation.

According to Sharpe (1963), the total variance of the returns generated by the portfolio is given by:

$$\sigma_P^2 = \beta_P^2 \sigma_M^2 + \sigma^2(e_P) \qquad (2)$$

In this equation, σ_P^2 is the portfolio variance, β_P^2 is the square of the Beta for the portfolio (where Beta is a measure of the sensitivity of the portfolio's returns to the returns on a market index[5]) and σ_M^2 is the variance of the returns on a market index. The two terms $\beta_P^2 \sigma_M^2$ and $\sigma^2(e_P)$ represent the two components of portfolio variance: (1) the systematic component; and (2) the non-systematic or firm-specific component. For a well-diversified portfolio, the first term dominates. That is, $\beta_P^2 \sigma_M^2$ is a large percentage of σ_P^2 when the portfolio is well-diversified.

In both Equation (1) and Equation (2), '*M*' denotes a broad market index like the S&P/ASX 300 or All Ordinaries Index. It could also be GNP, a price index or any other 'macro' factor that represents the current state of the macroeconomy (Sharpe, 1963, p.281). One can see immediately that both of these single index equations, one for the return on the portfolio and one for the risk of the portfolio, relate the portfolio return and total variance to a single broad market index. In short, the model suggests that the return and total variance of a portfolio is a function of the return and variance of a broad market index. The sensitivity of the portfolio's return and variance to those exhibited by the market index is measured by the beta of the portfolio.

For the purposes of this analysis, Equation (2) is most important. In Equation (2), the term $\beta_P^2 \sigma_M^2$ denotes that part of the total variance of the returns of the portfolio that is attributable to systematic factors (the variance in the returns of the broad market index as a proxy for the state of the macroeconomy) and $\sigma^2(e_P)$ denotes the variance attributable to non-systematic factors (the variance in the returns of the portfolio attributable to the specific idiosyncrasies of the assets in the portfolio or, in general

[5] The market index has a Beta of 1. If a portfolio has a Beta greater than 1 then it will move more than proportionately following movements in the index's returns and *vice versa* for a portfolio Beta less than 1.

terms, firm specific factors). Hence, the single index model provides a means of analysing total portfolio variance in terms of these two components. Indeed, one can utilise the single index model to determine the percentage of the total portfolio variance that is attributable to the movements in the market index and the percentage that is attributable to movements in individual securities (Elton, Gruber, Brown and Goetzmann, 2003, p.137).

To facilitate the analysis, some adjustments were made to the data. In some portfolios, the investors held securities that were delisted during the time frame. The delisted securities were excluded from the analysis. Also, a number of portfolios held property assets without including a rate of return on the property. In these cases a proxy rate of return was included, whose fluctuations were based on fluctuations in the cash rate. This was chosen because the capital growth in different properties fluctuates at different rates, and in the last ten years there has been little evidence of significant negative returns in property. Hence, the conservative estimate based on the cash rate was used. Overall, most portfolios remained complete and unaltered. In cases where a proxy value could be reasonably used to simulate returns, it was. And in cases where no reasonable simulation was available to substitute returns, the asset was excluded. In most cases, the excluded asset/s represented a small fraction of the total portfolio value, typically less than five percent (not enough to affect the conclusions of the analysis).

In all cases, it was assumed that all SMSF investors adopted a passive investment strategy after the last asset in the portfolio was purchased. In most cases, investors gradually added securities to their portfolios, and the portfolios were analysed from the date the last security was added until the 24th of April 2006. The dates the last security was added varied from 1999 to mid 2004. The variations in portfolio dates does not limit the analysis however, as all portfolios were analysed individually, and all portfolios were stationary for at least two years. To determine the level of diversification of the SMSFs in our sample, we compute the parameters of the single index model (Equation (2)). This involves the following steps, presented in Table 2 (below), for each of the SMSF portfolios.

TABLE 2

Steps to be Followed in Undertaking the Analysis of the SMSF Portfolios

STEP	FORMULA OR ANALYTICAL TOOL
Compute the daily (total) holding period returns of each security	$TR_i = \frac{CF_t + (P_E - P_B)}{P_B}$ Where TR_i is the total return on security *i*, CF_t is the cash flow generated by the security during the period, P_E is the price of the security at the end of the period and P_B is the price of the security at the end of the period.
Compute the weight w_i of each security in a portfolio	
Compute the variance of the returns $\left(\sigma_i^2\right)$ of each security in the portfolio	
Compute the covariance $\left(\sigma_{ij}\right)$ between each pair of securities *i, j* in the portfolio	
Compute each portfolio's total variance	$\sigma_P^2 = \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} w_i w_j \sigma_{ij}$
Compute the beta for each portfolio	$\beta_P = \sum_{i=1}^{n} w_i \beta_i$ Where $\beta_i = \frac{\sigma_{i,M}}{\sigma_M^2}$ is the beta of security *i* and $\sigma_{i,M}$ is the covariance between the returns of security *i* and the market index.
Compute the variance of the total daily returns generated by the S&P/ASX300 stock market index	$\sigma_M^2 = \frac{\sum_{t=1}^{n} \left(Market\,TR_t - Mean\,Market\,TR\right)^2}{n-1}$

Notes: All of the steps of the analysis outlined in the table were undertaken using Microsoft Excel. As mentioned previously, all data were gathered either (1) primarily from the South East Queensland accounting firm that cooperated with this research project or (2) from Thomson DataStream.

Once all the steps in Table 2 (above) had been carried out for all of the portfolios in our sample, the results could be input into the single index model Equation (2) to facilitate the analysis of the level of diversification exhibited by each of the self managed superannuation funds in our sample. The results obtained from steps one through seven (above) can be input in Equation (2) to facilitate the analysis. The proportion of each portfolio's variance of returns that is attributable to systematic or market index factors can be computed as the ratio of $\beta_P^2 \sigma_M^2$ to σ_P^2. After solving for

$\sigma^2(e_P)$, the proportion of each portfolio's variance of total returns that is attributable to non-systematic or firm specific factors can be similarly computed. The results of these calculations are presented below.

TABLE 3

The Results of the Analysis of Diversification: Portfolios 1 to 20

Portfolio Number	Variance	Average Annual Return	Beta	Systematic Risk	Non-Systematic Risk	No. Of Assets	Standard Deviation
1	0.00000072	5.97%	0.07	0.167	0.833	7	0.00085
2	0.00062	5.54%	0.24	0.003	0.997	7	0.02488
3	0.0000094	4.38%	0.20	0.121	0.879	20	0.00307
4	0.0000071	11.17%	0.40	0.700	0.300	10	0.00266
5	0.000032	21.19%	0.75	0.539	0.461	18	0.00569
6	0.000001	7.16%	0.15	0.647	0.353	12	0.00100
7	0.00032	6.08%	0.50	0.022	0.978	15	0.01779
8	0.00000037	4.50%	0.04	0.155	0.845	4	0.00061
9	0.000012	7.53%	0.29	0.215	0.785	20	0.00342
10	0.0000073	11.62%	0.43	0.765	0.235	20	0.00270
11	0.000042	18.86%	0.83	0.508	0.492	16	0.00645
12	0.000013	10.40%	0.53	0.639	0.361	21	0.00365
13	0.0000011	6.43%	0.12	0.344	0.656	10	0.00106
14	0.000022	14.58%	0.77	0.823	0.177	9	0.00472
15	0.000028	21.30%	0.71	0.557	0.443	19	0.00529
16	0.000047	10.71%	0.84	0.514	0.486	9	0.00688
17	0.000033	9.57%	0.90	0.692	0.308	17	0.00571
18	0.000031	28.43%	0.89	0.824	0.176	13	0.00557
19	0.00002	17.67%	0.56	0.468	0.532	19	0.00451
20	0.00031	84.76%	0.72	0.051	0.949	9	0.01759
Average for all 40 Portfolios		13.48%	0.46	0.418	0.582	12.9	0.00523
ASX300 - From 1/1/03	0.000032	23.12%	1.00	1.000	0		0.00569

Notes: All of the calculations have been derived from daily data. Unless otherwise stated, all values presented in the Table refer to daily return horizons. Most importantly, the variances and standard deviations reported in the Table above are daily variances and standard deviations. This accounts for the low values presented in the Table.

TABLE 4

The Results of the Analysis of Diversification: Portfolios 21 to 40

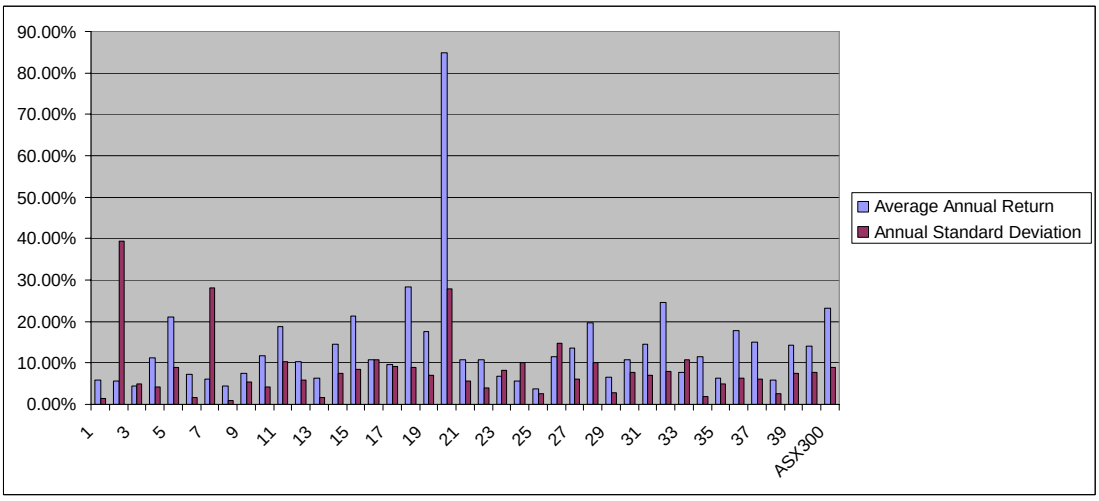
Portfolio Number	Variance	Average Annual Return	Beta	Systematic Risk	Non-Systematic Risk	No. Of Assets	Standard Deviation
21	0.000012	10.81%	0.44	0.504	0.496	14	0.00349
22	0.0000062	10.68%	0.37	0.714	0.286	9	0.00249
23	0.000027	6.90%	0.61	0.393	0.607	9	0.00518
24	0.000041	5.57%	0.61	0.273	0.727	9	0.00644
25	0.0000029	3.71%	0.11	0.168	0.832	5	0.00170
26	0.000087	11.40%	0.33	0.039	0.961	20	0.00931
27	0.000015	13.60%	0.53	0.576	0.424	15	0.00385
28	0.000041	19.66%	0.64	0.298	0.702	8	0.00640
29	0.0000034	6.46%	0.27	0.595	0.405	8	0.00185
30	0.000024	10.79%	0.65	0.563	0.437	12	0.00485
31	0.000019	14.63%	0.57	0.495	0.505	18	0.00441
32	0.000025	24.54%	0.67	0.571	0.429	33	0.00504
33	0.000046	7.83%	0.83	0.424	0.576	8	0.00679
34	0.0000013	11.60%	0.10	0.289	0.711	8	0.00113
35	0.0000098	6.40%	0.08	0.018	0.982	7	0.00313
36	0.000016	17.74%	0.27	0.126	0.874	8	0.00395
37	0.000015	14.99%	0.58	0.710	0.290	14	0.00385
38	0.0000028	5.88%	0.20	0.450	0.550	7	0.00169
39	0.000023	14.18%	0.75	0.760	0.240	22	0.00481
40	0.000024	14.04%	0.01	0.000	1.000	7	0.00492
Average for all 40 Portfolios		13.48%	0.46	0.418	0.582	12.9	0.00523
ASX300 - From 1/1/03	0.000032	23.12%	1.00	1.000	0		0.00569

Notes: All of the calculations have been derived from daily data. Unless otherwise stated, all values presented in the Table refer to daily return horizons. Most importantly, the variances and standard deviations reported in the Table above are daily variances and standard deviations. This accounts for the low values presented in the Table.

The SMSF returns and standard deviation data displayed in Tables 3 and 4 are summarised in the chart presented below. This permits a visual inspection of the return and risk characteristics of the SMSFs and permits the comparison of the returns (unadjusted for risk) with the S&P/ASX300 index for the same period. The daily standard deviations have been adjusted to annual standard deviations to facilitate the risk-return comparison:

FIGURE 1

The Average Annual Returns and Standard Deviation of the SMSF Portfolios



It can be said that, as a whole, the SMSF portfolios (examined as individual portfolios without reference to trustees' 'outside' assets) are not well diversified. Even though most SMSFs contain over ten assets, firm specific (non-systematic) risk still represents nearly 60 percent of all risk in the portfolios. In 11 of the 40 portfolios the non-systematic risk accounted for 80 percent of all risk and in only two portfolios did it account for less than 20 percent of all risk. Evidence indicates that investors need between 30 and 40 assets in their portfolios to benefit significantly from diversification (Evans and Archer (1968) and Campbell *et al*. (2001)). Only one portfolio had over 30 securities and non-systematic risk still accounted for 42.9 percent of its risk. A fully diversified portfolio would contain no non-systematic risk. Theoretically, investors are not rewarded for bearing non-systematic risk and, as such, it is desirable to diversify non-systematic risk away.

Our results, by and large, also highlight the risk-return trade-off. Whilst significant returns were earned by some portfolios (especially portfolio 20), these returns were generated by investing in very few assets (portfolio 20 contains just 9 securities) and bearing a large amount of risk (variance). Portfolio 20 exhibits very high returns but also exhibits an annual standard deviation that is approximately three times larger than that exhibited by the unmanaged S&P/ASX300 index. This portfolio is, as are many of the portfolios in our sample, very vulnerable to fluctuations in the fortunes of a small number of companies and sectors. A down-turn in a relatively small part of

the economic system may result in significant adverse results for such a thinly diversified portfolio. Diversification insulates the portfolio from these vulnerabilities and usually provides a simple way of improving expected returns whilst reducing the variance of the portfolio.

In short, theoretical financial economics tells us that investors are not rewarded for bearing non-systematic risk. Also, effective diversification can enhance (expected) returns and reduce the risk of a portfolio of assets. The SMSFs in our sample all bear some degree of non-systematic risk. In most cases the percentage of total portfolio risk that is attributable to non-systematic factors reaches high levels. Theoretically, it would be best for such portfolios (treating them as individual portfolios) to exhibit no non-systematic risk. This would be achieved by investing in a broader range of securities (approximately 30). However, even the addition of a handful of carefully selected securities could potentially increase the expected returns of the portfolios and diminish the variance they exhibit. Some of the SMSF trustees appear to have attempted this careful selection by selecting shares from different industry classifications.

Interestingly, the attempted diversification that is exhibited by the portfolios appears to have been far from effective. Even the portfolios with a larger number of assets do not appear to be benefiting from even naïve diversification (the reduction in risk that occurs simply by randomly adding more assets to the portfolio). This feature of the SMSF portfolios is highlighted by the charts below:

FIGURE 2

Non-Systematic Risk and the Number of Assets in the Portfolio

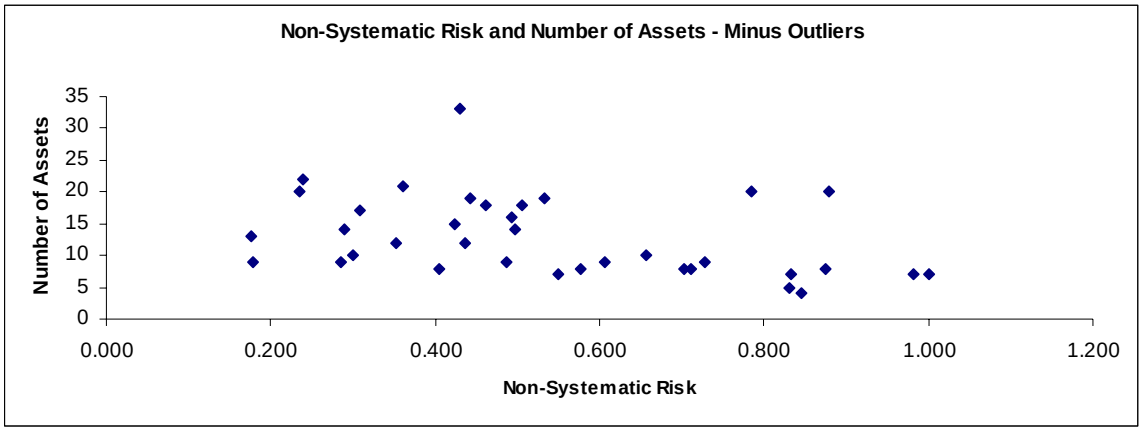
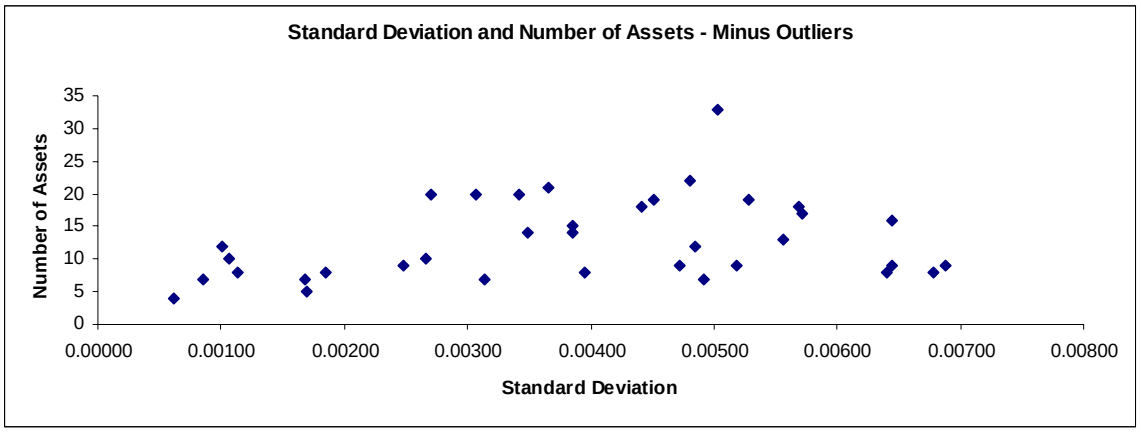


FIGURE 3

Portfolio Standard Deviation and Number of Assets in the Portfolio



The absence of a negative relationship between non-systematic risk, portfolio standard deviation and the number of assets held in the portfolios indicates that the portfolios fail, as mentioned above, to benefit from even naïve diversification.

Not surprisingly, the performance of the portfolios is quite poor on a risk adjusted basis, compared to the performance of the unmanaged S&P/ASX300 index. In this research, two measures of risk adjusted return were used. These are the Sharpe (RVAR) measure and the Treynor (RVOL) measure. Whilst neither of these measures is perfect, each has maintained an almost permanent presence in portfolio management practice for the past forty years. Since the Sharpe measure relates return to total risk it is most appropriately used in situations where non-systematic risk has been diversified away. Since our SMSFs exhibit a large amount of non-systematic risk, the Sharpe measure will tend to rank these under-diversified portfolios lower than the Treynor measure. Theoretically, as mentioned above, investors should only be rewarded for bearing systematic risk. Therefore, the Treynor measure is likely to be the most appropriate evaluation tool for our portfolios. The Sharpe measure of risk adjusted return is calculated as follows:

$$r = \frac{\bar{r}_p - \bar{r}_f}{\sigma_p} \qquad (3)$$

While the Treynor measure is calculated by:

$$r = \frac{\bar{r}_p - \bar{r}_f}{\beta_p} \quad (4)$$

Where $\bar{r}_p$ is the average return of the portfolio and $\bar{r}_f$ is the average return of a risk free asset. The risk adjusted return of the S&P/ASX300 index is calculated using the same equations. It is necessary to perform these calculations due to the presence of the risk/return trade-off. Certain portfolios may earn higher returns than others, but are subject to a greater degree of risk, and therefore cannot be compared. The results of the calculations are presented in Tables 5 and 6 below. A higher RVAR or RVOL ratio indicates superior risk-adjusted performance:

TABLE 5

The Risk Adjusted Performance of the SMSFs: Portfolios 1 to 20

Portfolio Number	**RVAR- Sharpe**	**RVOL- Treynor**
1	26.57%	11.26%
2	0.05%	1.27%
3	-1.06%	-4.29%
4	8.53%	14.81%
5	10.70%	21.33%
6	7.34%	12.86%
7	0.18%	1.69%
8	-4.59%	-17.32%
9	2.56%	8.02%
10	9.03%	14.88%
11	8.07%	16.44%
12	5.40%	9.81%
13	4.33%	10.42%
14	7.57%	12.15%
15	11.60%	22.60%
16	3.04%	6.52%
17	2.90%	4.84%
18	15.90%	26.02%
19	10.53%	22.34%
20	17.26%	110.08%
Average for all 40 Portfolios	6.72%	29.69%
ASX300 - From 1/1/03	**12%**	**17.9%**

TABLE 6

The Risk Adjusted Performance of the SMSFs: Portfolios 21 to 40

Portfolio Number	**RVAR- Sharpe**	**RVOL- Treynor**
21	6.10%	12.57%
22	8.37%	14.63%
23	1.23%	2.76%
24	0.20%	0.55%
25	-3.44%	-14.11%
26	2.53%	18.46%
27	8.29%	15.83%
28	8.60%	22.46%
29	2.52%	4.56%
30	4.37%	8.53%
31	8.13%	16.50%
32	14.64%	28.77%
33	1.46%	3.14%
34	21.42%	62.56%
35	1.43%	14.75%
36	12.10%	46.85%
37	9.68%	16.88%
38	1.46%	3.23%
39	7.10%	11.90%
40	6.82%	591.03%
Average for all 40 Portfolios	6.72%	29.69%
ASX300 - From 1/1/03	**12%**	**17.9%**

Our calculations show that only 13 of the SMSFs (a little less than 1/3) performed better than the unmanaged S&P/ASX300 market index on a risk-adjusted basis. The other 27 (over two-thirds) SMSFs in our sample under-performed the unmanaged S&P/ASX300 index on a risk-adjusted return basis. It would be possible to improve the performance of the average SMSF in our sample by simply allocating the investment capital to combinations (determined by the desired level of risk) of the ASX300 and the risk-free asset. As individual portfolios (treated separately from trustees' outside assets) the SMSFs in our sample exhibited under-diversification and poor risk-adjusted performance relative to the ASX300. These microstructure characteristics of SMSFs contribute to our understanding of the nature of SMSFs as a component of Australia's retirement income stream.

V Policy Implications

At the time of writing, the Australian Taxation Office is responsible for the supervision of SMSFs in Australia. The Australian Taxation Office has prepared a number of documents to assist trustees, tax advisors, financial planners and auditors to meet their obligations. Unfortunately, it would appear that the focus of these

documents is not the prudent management of the portfolios. Rather, the focus appears to be the compliance of the SMSF with the relevant regulations with particular reference to the *SIS (Superannuation Industry Supervision) Act 1993*. Whilst compliance with this legislation is certainly of critical importance, the prudent management of the SMSF portfolio itself does not figure prominently in the ATO literature. It would seem entirely possible to manage a SMSF portfolio very poorly yet still maintain compliance with the *SIS Act*, as long as the fund's financial position remains sound and there are no breaches of requirements such as the sole purpose rule[6].

The potential problems revealed in our sample might be a consequence of the fact that the actual management of the portfolios (leaving aside the issue of compliance) figures less prominently than perhaps it should in the relevant documents and legislation governing the behaviour of SMSFs. For example, in the Australian Taxation Office's 'It's Your Money…But Not Yet!' document, prudent portfolio management is accorded much less attention than the compliance issues mentioned above. Responsible investment, including having a strategy and diversifying the fund's assets, receives only brief attention and there would appear to be little practical information available in these documents that would provide investor education with regards to these issues.

The nature of specific educational information will depend on the percentage of trustees' total wealth that is represented by the SMSF. If the SMSF represents a significant proportion of the trustees' wealth, the under-diversification of the SMSF is a particularly important portfolio management problem. If a decision has been made to invest in risky securities, the SMSF can achieve a higher expected return and lower risk through diversification. Through the selection of approximately 30 securities, the percentage of total portfolio variance attributable to firm specific factors is made negligible. If, on the other hand, the SMSF trustees hold assets outside of their SMSF, the diversification of the SMSF itself may be of less concern if the trustees' overall portfolios are diversified. Trustees who hold cash balances and property outside of the SMSF will experience less volatility in their overall wealth portfolio than their

[6] Whilst our sample size is small, the SMSFs in our sample have been fully audited and meet all the requirements of the ATO.

individual (under-diversified) SMSF. It is possible for a trustee to have a volatile, under-diversified SMSF and yet maintain a diversified total wealth portfolio of which the SMSF is a part.

Whilst portfolio management is important, the Australian Taxation Office's investment strategy fact sheet for SMSF trustees is heavily focussed on compliance issues. Trustees are instructed that the fund must have particular regard to the *SIS Act*, Section 52 (2) (f) by: "(1) investing in such a way as to maximise member returns taking into account the risk associated in holding the investment; (2) appropriate diversification and the benefits of investing across a number of asset classes (for example, shares, property, fixed deposit) in a long term investment strategy; and (3) the ability of the superannuation fund to pay benefits as well as other costs of the superannuation fund as they become due and payable" (ATO, 2006). However, the remainder of the document deals with compliance issues and we could not find any more detailed investor education information that would provide guidance to SMSF trustees on the practical attainment of these objectives.

In light of our analysis and our review of the information that is available to trustees, auditors, financial planners and tax agents from the regulatory body charged with the supervision of SMSFs, we have developed several simple and straightforward policy recommendations. First and foremost, it would seem highly desirable to devote more supervisory or regulatory attention to the practical management of the SMSF portfolios. Whilst it would not be feasible to undertake in-depth portfolio analysis of every fund, it is relatively easy to determine whether or not a SMSF is dangerously under-diversified and therefore vulnerable to specific industries and sectors. Financial economic theory informs us that 20 to 30 shares are necessary to approach full diversification (Evans and Archer, 1968)[7]. Most of the SMSFs that we investigated had 12 or less shares in their portfolios. Second and of equal importance, the potential problems that we have detected could be rectified by the provision of investment education material or by even more actively encouraging SMSF trustees to seek financial advice specifically regarding the management of their portfolios, not just on compliance issues.

[7] Also see Campbell *et al*. (2001).

VI Conclusion

Self managed superannuation funds are a significant component of Australia's retirement income stream. With the growth of the SMSF industry showing no signs of abatement their regulation becomes an ever more important issue. Prudent regulation requires information and we have set out to uncover some of the micro-level characteristics of SMSFs. Our results revealed (or perhaps confirmed existing suspicions) that the SMSFs in our sample were considerably under-diversified and contained a very small number of securities. Second, we discovered that most of the SMSFs in our sample performed poorly relative to the S&P/ASX300. Whilst we cannot draw conclusions concerning the optimality of the SMSFs, it is possible that under-diversification and poor relative performance are indicative of portfolio management issues that should be addressed. We suggest a more active programme of investor education as well as an auditing process that takes account of such important factors as possible policy options to rectify this rather unsatisfactory situation.

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