

Are Larger Self-Managed Superannuation Funds Riskier?

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Abstract

In this paper, we examine the relationship between the portfolio size and allocation to risky assets that characterises self managed superannuation funds (SMSFs). In particular, we investigate whether the allocation to risky assets is higher for higher valued SMSFs. At this early stage of SMSF research the gathering of facts about these economic entities is necessary to guide policy makers and regulators. This study contributes to this small but growing body of factual knowledge regarding the microstructure of SMSFs in Australia. The results show that the percentage of the portfolios' investable funds allocated to risky assets has no clearly defined relationship with portfolio size. A high net worth SMSF will, on average, have a greater absolute dollar amount invested in risky assets but the portfolio weightings may be such that a high valued fund has a lower percentage of its portfolio invested in risky assets than a much smaller fund. There is not a strong tendency for higher net worth SMSFs to bear greater risk through increasing allocations to risky assets but there is, nevertheless, a tendency for higher net worth SMSFs to have higher allocations to risky assets.

Keywords: Self Managed Superannuation, Net Worth, Risk

JEL Classifications: G11, G23, G28

1. Introduction

Self Managed Superannuation Funds (SMSFs) are retirement or pension savings funds that are managed by the owners or trustees of the funds. These are generally non-professional investors. Since a SMSF is a retirement fund for five or fewer members, each SMSF represents the savings of a small group of family or friends. The self-managed nature of these entities raises many important economic questions. The question that is investigated in this paper is: Do higher valued SMSFs have higher allocations to risky assets? This is an important question that cannot be answered by referring to the Australian Taxation Office's aggregated SMSF data. Of course, it should be expected that SMSF trustees will allocate their investable funds between low risk assets such as cash and fixed interest securities and risky assets such as shares in a manner that reflects their level of risk aversion. In this case, the portfolio's size should not be a factor in determining the percentage of the portfolio's investable funds that will be allocated to risky assets. A high value fund may just as likely be allocated almost entirely to cash as a low value fund. The only way to empirically investigate the relationship between SMSF net worth and allocation to risky assets is by investigating the portfolio structures of individual SMSFs. We investigate this relationship using a unique and pure dataset consisting of two independent samples of a total of 141 SMSFs.

The implications of the research question are significant. The value of savings contained in self managed superannuation funds is approximately \$300 billion. Compulsory contributions to superannuation increase this by a considerable amount each year. Whilst there is no intention to draw conclusions for the general population of SMSFs on the basis of the funds contained in this sample, this investigation provides some of the first pieces of information regarding the relationship between fund size and allocation to risky assets. This is important for the policy makers and regulators who are charged with the responsibility of overseeing the management of SMSFs. In addition, preliminary studies of this sort provide the foundations for further economic analysis of the self managed superannuation phenomenon and its implications for Australia's retirement income stream.

In this paper, the relationship between SMSF net worth and allocation to risky assets is explored. Two independent samples of SMSFs are available for this study—one consisting of 100 portfolios and one consisting of 41 portfolios. In the context of SMSF research this sample size is quite significant and the independent nature of the two samples adds a degree of rigour to the investigation. In order to examine the relationship between net worth and allocations to risky assets, the funds in each sample are separated into various categories of net worth. The allocations to risky assets that characterise the funds in each category were determined. On the basis of the raw data alone, it is clear that there is no discernible relationship between SMSF portfolio size or net worth and the percentage of the portfolio allocated to risky assets. This is confirmed by a basic statistical (chi-square) test, which reveals that the variables are independent. On the basis of the results, the funds in the sample

do not show any tendency to become riskier as their net worth increases. Rather, the SMSFs in the highest net worth category are characterised by lower allocations to risky assets than other lower net worth fund categories.

Viewed from another aspect, this investigation also makes another contribution. Concerns have been raised about the large allocation to cash that characterises SMSFs (see Phillips, Cathcart and Teale (2007)). Cash in bank accounts and term deposits—and, to a lesser extent, fixed interest securities—generates a very low rate of return and may be vulnerable to erosion by inflation over long time periods. Again, the Australian Taxation Office publishes aggregated data that provides an indication of the percentage of the portfolio that the average SMSF trustee allocates to cash. On average, the SMSFs in our sample allocate a larger percentage of their portfolios to cash assets than the ATO's aggregate. Furthermore, a number of the funds have very large allocations to cash. Whilst the risk that characterises SMSFs may be of interest to policy makers and regulators, the cash allocations may be viewed with equal importance. In the long run, the terminal values of SMSFs may be just as adversely affected by excess volatility as the low real returns associated with holding a large percentage of the portfolios in cash.

This paper is organised as follows. In Section 2 some of the relevant economic theory is presented. This focuses on the theoretical importance of utility function configuration in economics. The literature survey highlights the absence from the literature of investigations into the relationship between SMSF net worth and allocations to risky assets. The research and the methodology deployed herein is linked to seminal work on investor utility of wealth functions produced during the 1970s, especially the empirical investigations undertaken by Blume and Friend (1975). In Section 3, the data are described. The data consist of two independent sub-samples comprising a total of 141 self managed superannuation funds. In Section 4, the analysis of the data is presented. This involves a cross-classification analysis (using a chi-square test statistic) to examine the relationship between SMSF net worth and allocations to risky assets exhibited by the self managed superannuation funds in the sample. In Section 5, the implications of the results are discussed. This is followed in Section 6 by conclusions and suggestions for future research.

2. Background and Existing Studies

There exists a body of economic theory that provides some insights into the relationship between net worth and allocation to risky assets. Depending on the type of risk aversion an individual exhibits, that individual will have different preferences for risky assets as his or her wealth changes. There are two ways in which the individual's preferences for risky assets may be described: (1) absolutely; or (2) relatively. Individuals may exhibit increasing, constant or decreasing absolute risk aversion. Just which will decide the amount of *dollars* they hold in risky assets as their wealth changes. With regard to relative risk aversion,

individuals may exhibit increasing, constant or decreasing relative risk aversion. Just which of these will decide the *percentage* of their wealth they invest in risky assets as their wealth changes. An individual who exhibits increasing, decreasing or constant relative risk aversion will hold a lesser, greater or unchanged percentage of his or her wealth in risky assets as his or her wealth increases¹.

Formally, the Arrow-Pratt measures of absolute and relative risk aversion are measures of how the investor's absolute and relative risk aversion behaves with respect to changes in the investor's wealth. These measures, which were derived by Pratt (1964) independently of Kenneth Arrow's similar efforts, hold a place of some prominence in the literature:

$$R_A(W) = -\frac{U''(W)}{U'(W)} \quad (1)$$

$$R_R(W) = -W \frac{U''(W)}{U'(W)} \quad (2)$$

Where $R_A(W)$ is the Arrow-Pratt measure of absolute risk aversion and $R_R(W)$ is the Arrow-Pratt measure of relative risk aversion. These measures have a very desirable property. The numerical estimates of equation (1) and equation (2) do not depend upon the units in which the utility is measured. This is a significant advance over the naïve measure of risk aversion computed simply by taking the second derivative of the utility of wealth function, $U''(W)$.

The first derivative of $R_A(W)$ with respect to wealth, $R'_A(W)$, will be positive, zero or negative depending on whether the investor exhibits increasing, constant or decreasing absolute risk aversion or, equivalently, if the investor holds fewer, the same or more dollars in risky assets as wealth increases. The first derivative of $R_R(W)$, $R'_R(W)$, will be positive, zero or negative depending on whether the investor exhibits increasing, constant or decreasing relative risk aversion or, equivalently, if the investor holds a lower, unchanged or higher percentage of wealth in risky assets as wealth increases. Importantly, the Arrow-Pratt

¹ Further discussion can be found in texts on portfolio theory and is therefore omitted from the present article. See Elton *et al.* (2003).

measures of absolute and relative risk aversion show that risk aversion may vary as wealth changes. Hence, as additional savings are added to self managed superannuation funds and the fund advances (or declines) due to the returns generated by the constituent assets, the trustee's risk aversion may vary.

There are both theoretical and empirical investigations extant in the literature that are relevant to the present investigation. Theoretical investigations derive mathematically the various relationships that exist between risk aversion, wealth and the demand for risky assets (see Tobin (1958), Pratt (1964) and Cass and Stiglitz (1972)). These have played a fundamental role in the development of various branches of financial economics, including asset pricing and the determination of the market price of risk (see Landskroner (1977)). Empirical investigations, which are relatively few and far between, into the type of relative risk aversion that characterises individuals, have generally been conducted using data on households' assets. A large number of investigations into the risk aversion of individuals have also been undertaken through economics experiments and psychological questionnaires (see, for example, Donkers, Melenberg and Van Soest (2001)). However, these studies are often discounted because it is impossible to design experiments or questionnaires involving significant monetary stakes (Campbell, 2003, p.53).

The first major empirical investigation into the nature of household's utility of wealth functions was undertaken by Friend and Blume (1975). Using data from the 1962 and 1963 *Federal Reserve Board Surveys*, these researchers concluded that the assumption of *constant* relative risk aversion is a "... fairly accurate description of the market place." In order to arrive at this conclusion, the authors derived a number of equilibrium expressions that were compatible with the Federal Reserve Board's cross-sectional data. Of particular interest is the following relationship:

$$\alpha_k = \frac{E(r_m - r_f)}{\sigma_m^2} \cdot \frac{1}{(1 - t_k)C_k} \quad (3)$$

Where r_m is the return on the market portfolio of all risky assets, r_f is the return on the risk-free asset, σ_m^2 is the variance on the market portfolio, t_k is the average rate of tax for investor k and C_k is the Arrow-Pratt measure of relative risk aversion. If this relationship holds and if investors agree on the market price of risk then, by simple algebraic manipulation of the equation (3) an estimate of $[E(r_m - r_f)/\sigma_m^2]C_k^{-1}$ is given by

$\alpha_k(1-t_k)$. According to Friend and Blume (1975, p.908), this means that “ $\alpha_k(1-t_k)$ provides an estimate of C_k^{-1} up to a multiplicative constant, so that $\alpha_k(1-t_k)$ can be used to assess how C_k^{-1} and, thereby, how C_k varies with net worth.” The empirical results generated by Friend and Blume (1975) indicated that $\alpha_k(1-t_k)$ was invariant to net wealth, leading them to conclude that relative risk aversion was constant.

In a study produced a short time later, the same authors (Marshall Blume and Irwin Friend) again concluded that households exhibit constant relative risk aversion. Blume and Friend (1975)², using data from income tax returns filed during 1971 as well as the Federal Reserve Board’s 1962 survey, again examined the utility of wealth functions of American households. This time, however, the authors deployed slightly different assumptions in their work. The authors’ first study was based upon the assumption that investors have homogenous expectations. Suspecting the possibility that heterogeneous expectations may have interfered with the conclusions of their previous investigation, Blume and Friend (1975) used a sample more plausibly characterised by homogenous expectations (Blume and Friend, 1975, p.602). As mentioned above, the conclusion of constant relative risk aversion generated in the earlier paper was supported.

The other empirical study into the nature of individuals’ relative risk aversion that is of particular note is Cohn, Lewellen, Lease and Schlarbaum (1975). These authors used data obtained from a survey of customers of a large nation-wide brokerage house (in the United States). Their methodology differs markedly from that of Friend and Blume. Specifically, where the Friend and Blume studies are based upon the derivation of various theoretical relationships between household wealth and utility functions, Cohn *et al.* (1975) explored only the empirical relationship between household wealth and investment in risky assets. Cohn *et al.* (1975) found that, as wealth increases, the proportion of wealth invested in risky assets also increased. That is, higher net worth households invested a larger percentage of their wealth in risky assets than lower net worth households. Cohn *et al.* (1975), therefore, generated evidence in favour of a *decreasing* relative risk aversion assumption (in contrast to Blume and Friend’s constant relative risk aversion conclusion).

The empirical studies discussed above are the seminal investigations into the nature of household risk aversion and retain a place of prominence in the literature. In some ways, the work presented in this paper resembles these studies. In particular, the methodology deployed herein is essentially the same as that deployed by Cohn *et al.* (1975). However, whereas these studies focussed on the risk aversion of investors in the American economy, we are interested

² The study just discussed was Friend and Blume (1975).

in investigating the relationship between SMSF net worth and allocations to risky assets. In this paper, we take some small steps towards a more complete understanding of microeconomic characteristics of SMSFs by examining the relationship between SMSF net worth and allocations to risky assets exhibited by a sample of Australian SMSF trustees. Our objective is not to examine risk aversion but determine whether there is a tendency for larger SMSFs to hold a greater percentage of risky assets than smaller SMSFs. The data used in this paper are discussed in the next section.

3. The Data

In order to complement the existing studies and take some steps towards a more complete understanding of self managed superannuation funds, some unique and pure SMSF data was gathered. The data gathered for this investigation consists of two independent samples of SMSF portfolio microstructures. 100 of the SMSF microstructures were obtained from a large financial planning and superannuation administration firm based in one of Australia's capital cities. The other 41 SMSF microstructures were obtained from an accounting and financial services firm based in one of Australia's regional centres. The 100 SMSFs whose portfolio structures constitute the first part of the sample were drawn more or less at random from the total number of SMSFs administered by the financial planning and superannuation administration firm. The other 41 SMSFs represent a complete sub-population of just over 100 SMSFs overseen by the accounting and financial services firm. These 41 SMSFs are those funds overseen by the accounting and financial service firm that contain a mixture of assets directly managed by the trustees and are *not* 'shells' established merely to hold particular assets such as commercial property.

The data contained in this sample has several desirable properties: (1) a self managed superannuation fund cannot have liabilities (except under some very limited conditions). Hence, the net worth of the SMSF is unambiguous and we do not need to consider the effects of leverage on the portfolio returns. Essentially, the net worth of the fund is equal to the size of the fund's portfolio; (2) because the SMSFs in this sample have been subjected to annual audits, the data should exhibit a high degree of accuracy; (3) the data is self-contained and there is no need to rely on surveys or questionnaires of investors; and (4) unlike household balance sheet studies or investigations into the demand for risky assets, the SMSF data is isolated from and uncomplicated by insurance issues. Simply, the limitations of survey-based data such as that analysed by Friend and Blume (1975)³ in their analysis of the demand for risky assets and the risk aversion of American households are mitigated quite substantially.

There is nothing unique or special about the SMSFs in the sample that would lead to a conclusion that the SMSFs are not representative of the broader population of self managed

³ Also see Blume and Friend (1975).

superannuation funds in Australia. Given the difficulty in obtaining SMSF data, the sample is quite significant and exceeds by three-to-one the sample of SMSFs gathered by Phillips, Cathcart and Teale (2007). Furthermore, the fact that the overall sample consists of two independent samples of portfolios from independent sources and geographical locations adds a large degree of substance to the investigation. Essentially, concerns that may be held about the idiosyncrasies of any particular individual sample of SMSFs are eased. It should also be noted that the 100 SMSFs that constitute the first part of the sample have benefited from professional administration whilst the 41 SMSFs that constitute the second part of the sample have not. Although both samples' trustees may have benefited from advice in choosing investments (as clients do for example upon calling a stock broker), the trustees remain responsible for their self managed superannuation fund.

All of the SMSF portfolios contained in the sample are reasonably large portfolios containing an asset mix of cash, fixed interest securities, managed funds and domestic and overseas shares. Some of the funds contain real assets such as real estate. Bearing in mind that each SMSF represents the retirement savings of a small group of people up to a maximum of five members, the portfolios are quite large. The average size of each of the 100 portfolios in the first part of the sample was \$796611 at June 30 2007. The largest portfolios have a value of just over \$4 million whilst the smallest portfolios have a value of just under \$200 000. Most of the SMSFs were formed sometime over the last five to fifteen years but a few of the funds were initiated more than twenty years ago. The average size of the 41 portfolios in the second part of the sample was approximately \$400 000 at June 30 2004. Most of the SMSFs were formed sometime over the last ten years. Taken together, the data available for this investigation consists of 141 SMSFs with an average size of approximately a half-million dollars. This is a substantial sample in the context of SMSF research. The samples are summarised in Table 1 below.

Table 1. Self Managed Superannuation Funds: Summary of Portfolio Structure

Asset Class	Mean % (100 Portfolios)	Mean % (41 Portfolios)
Cash	11	22
Fixed Interest	13	2
Listed Shares	40	47
Unlisted Shares	5	< 1
Overseas Listed Shares	1	< 1

Overseas Unlisted Shares	2	0
Managed Investments	10	5
Listed Unit Trusts	4	14
Unlisted Unit Trusts	12	0
Real Estate	2	10
Total	100	100

Notes: The asset categories are self-explanatory. For the '41 Portfolios' there was no distinction made between listed and unlisted unit trusts in the portfolio structure summaries obtained for this research. All unit trusts were simply classified as 'listed unit trusts'. Hence, it could very well be the case that the allocation between listed and unlisted unit trusts diverges less between the two parts of the sample than the figures in the table appear to show.

A simple comparison of the two samples reveals some interesting results. Apart from one or two of the asset categories, the average allocations appear to be quite similar. This is quite reassuring. Because the samples are independent, the similarity of the asset allocations provides us with a greater degree of confidence in the results of the analysis. Upon close inspection it is apparent that the sample of 41 SMSFs tend to allocate a far larger amount to cash than most financial advisors would recommend (except for the most conservative of investment strategies which, of course, would also contain a far lower allocation to shares than the SMSFs exhibit). The trustees of the 41 SMSFs appear to lack awareness regarding the importance of fixed interest investments. Whilst such investments are very low risk, the yield is usually much more than that which could be obtained from holding cash in bank accounts. Developing such awareness in clients is one benefit likely to accrue to SMSF trustees who seek financial advice. Of course, many of the other benefits of financial advice are not apparent from the summary data presented in Table 1. For example, the diversification of the shares component is of vital importance (see Phillips, Cathcart and Teale (2007)).

4. The Analysis

A risk free asset is one for which the standard deviation of the possible divergence of actual returns from expected returns is zero. For the purposes of this investigation, cash is the risk free asset (leaving aside considerations of inflation risk (see Cohn *et al.* 1975)). All other assets, which have positive standard deviation of returns, are risky⁴. Before proceeding to the formal statistical analysis of the relationship between SMSF portfolio size and allocation to

⁴ The risk varies, of course. Some securities are more risky than others but this is not a salient point for the purposes of this investigation.

risky assets, much can be learned about this relationship through the informal method of analysing data-plots or charts. Of course, the value of this particular activity lies in the light that it can shed on the characteristics of the SMSFs in the samples. Not only does an analysis of a small number of data-plots provide contextual completeness for the investigation, it also provides some important insights into the operation of individual SMSFs that cannot be obtained through an analysis of the aggregated data such as that which is available from the Australian Taxation Office.

For the 100-portfolio sample, Figure One below presents a chart of the total fund size for each portfolio. This may be compared with the data presented in Figure Two, which shows the percentage invested in cash for each portfolio in the 100-portfolio sample. An inspection of Figures One and Two does not reveal any obvious relationship between fund size and allocations to cash. The larger portfolios appear, from what must be a very cursory inspection at this stage, to be just as likely to exhibit low allocations to cash as they are to exhibit high allocations to cash. Indeed, the largest fund in the sample exhibits among the highest allocations to the risk free security (30 percent) whilst one of the smallest funds in the sample exhibits the lowest allocation to the risk free security (0 percent). The percentage allocations to the risk free securities appear to reveal no structure or pattern across the funds in the 100-portfolio sample. This tends to indicate that we should expect to find that the riskiness of the SMSFs is independent of the size of the SMSF. However, it is necessary to undertake formal statistical analysis in order to determine in a rigorous manner whether any such relationship exists.

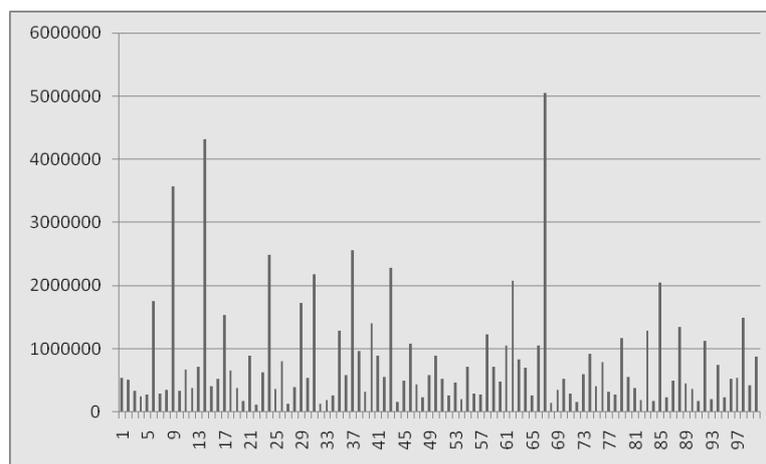


Figure 1. Fund Size: 100-Portfolio Sample

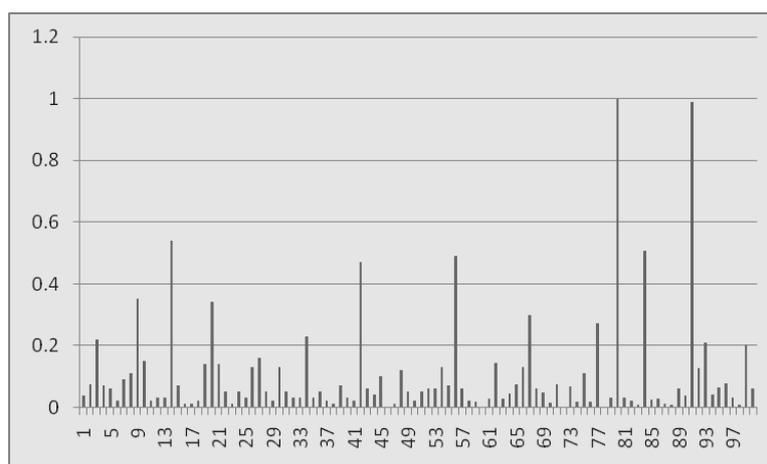


Figure 2. Percentage Allocations to Cash: 100 Portfolio Sample

To analyse the relationship between SMSF portfolio size and allocation to risky assets, we must determine the percentage of the SMSF portfolios' investable funds are allocated to cash in various categories of fund sizes. This provides the basis for the formal, cross-classification analysis. Because the portfolios contained in the two sub-samples diverge quite significantly in average size, each sub-sample is analysed separately. To extract the appropriate information required for statistical testing, the portfolios in the 100-portfolio sub-sample were divided according to net worth into five groups: \$0 to \$500,000; \$500,000 to \$1,000,000; \$1,000,000 to \$1,500,000; \$1,500,000 to \$2,000,000; and \$2,000,000 +. The portfolios in the 41-portfolio sub-sample were also divided according to net worth into five groups: \$0 to \$100,000; \$100,000 to \$200,000; \$200,000 to \$300,000; \$300,000 to \$400,000; and \$400,000 +. The percentage of each portfolio devoted to risky assets and the number of dollars devoted to risky assets was then computed. The computations, which form the basis for the statistical tests, are presented in the tables below.

Table 2. Ratios of Risky Assets to Total Portfolio Net Worth

Net Worth (100 Portfolios)	% Invested in Risky Assets	Net Worth (41 Portfolios)	% Invested in Risky Assets
\$0 to \$500,000	87.88%	\$0 to \$100,000	92.3%
\$500,000 to \$1,000,000	90.58%	\$100,000 to \$200,000	80.6%
\$1,000,000 to \$1,500,000	96.09%	\$200,000 to \$300,000	91.2%
\$1,500,000 to	98.33%	\$300,000 to	73.6%

\$2,000,000		\$400,000	
\$2,000,000 +	88.22%	\$400,000 +	69.7%

Table 3. Average Dollars Invested in Risky Assets

Net Worth (100 Portfolios)	\$ Invested in Risky Assets	Net Worth (41 Portfolios)	\$ Invested in Risky Assets
\$0 to \$500,000	\$260,289	\$0 to \$100,000	\$55,574
\$500,000 to \$1,000,000	\$623,325	\$100,00 to \$200,000	\$154,873
\$1,000,000 to \$1,500,000	\$1,185,128	\$200,000 to \$300,000	\$221,337
\$1,500,000 to \$2,000,000	\$1,645,347	\$300,000 to \$400,000	\$241,491
\$2,000,000 +	\$2,205,564	\$400,000 +	\$443,540

Casual investigation of the data presented in Tables 2 and 3 suggests two things. First, the proportion of total portfolio net worth invested in risky assets does not appear to exhibit a stable relationship with total portfolio net worth. Those SMSF trustees with a portfolio net worth in the third bracket of our cut-offs, \$1,000,000 to \$1,500,000 and \$200,000 to \$300,000, invested a higher percentage of total portfolio net worth in risky assets than those SMSF trustees whose portfolio net worth was located in the second bracket of our cut-offs, \$500,000 to \$1,000,000 and \$100,000 to \$200,000. However, the SMSFs in the highest net worth category invested a lower amount in risky assets than funds in some of the lower net worth categories. Second, in both sub-samples the dollars invested in risky assets increases as portfolio net worth increases. This is a consistent pattern across the entire range of portfolio net worth categories and both sub-samples but is not particularly surprising. It is, after all, to be expected that a very large portfolio may have a larger dollar amount invested in all asset classes than a very small portfolio.

In order to investigate the relatedness of the proportion of total portfolio net worth invested in risky assets and total portfolio net worth, a *cross-classification* analysis is undertaken. A cross-classification, cross-tabulation or contingency analysis is a non-parametric

methodology that permits the investigation of the relationship between variables when one or both of the variables is categorical in nature with a nominal or ordinal scale (see, for example, Sheskin (2000)). A cross-classification analysis is a simple statistical technique with few underlying assumptions⁵ that permits the detection a relationship or association between two variables. It is particularly well suited to this investigation because there is a strong likelihood that the variables are non-normally distributed (see Smith (1975)). Indeed, when regression analysis is attempted, it quickly becomes clear that the variables (portfolio size and percentage allocations to particular asset classes) are not normally distributed. A non-parametric methodology is therefore desirable. The cross-classification analysis undertaken here is essentially the same as the test deployed by Cohn *et al.* (1975) and therefore has a history of being utilised in this sort of investigation.

To undertake a cross-classification analysis, the data must be tabulated in contingency tables. In the table below, the table's variables are (1) categories of portfolio net worth; and (2) percentage invested in risky assets. Each cell of a contingency table represents a unique combination of the variables. For example, the first cell in Table 4 (below) represents portfolios with a net worth of between \$0 and \$100,000 and 0% to 40% invested in risky assets. The contingency tables are frequency tables in the sense that each cell of the table represents the frequency of observations associated with that combination of variables. The analysis of these frequencies permits the identification of the presence or absence of a relationship between the two variables. The relevant test statistic is Pearson's chi-square statistic.

Table 4. Percentage of Portfolio in Risky Assets Vs Portfolio Net Worth (Cross-Classification Analysis)

Portfolio Net Worth (41 Portfolios)	0% to 40% invested in risky assets	40% to 60% invested in risky assets	60% to 75% invested in risky assets	75% to 100% invested in risky assets	Total
<i>\$0 to \$100,000</i>	0.00	0.00	0.00	1.00	1.00
<i>\$100,000 to \$200,000</i>	0.1428	0.00	0.00	0.8571	1.00
<i>\$200,000 to \$300,000</i>	0.00	0.00	0.00	1.00	1.00
<i>\$300,000 to \$400,000</i>	0.1428	0.00	0.2857	0.5715	1.00

⁵ These are simply the assumptions underlying the chi-square test because, in essence, that is what a cross-classification is.

\$400,000 +	0.1764	0.1764	0.1764	0.4708	1.00
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Table 5. Percentage of Portfolio in Risky Assets Vs Portfolio Net Worth (Cross-Classification Analysis)

Portfolio Net Worth (100 Portfolios)	0% to 40% invested in risky assets	40% to 60% invested in risky assets	60% to 75% invested in risky assets	75% to 100% invested in risky assets	Total
<i>\$0 to \$500,000</i>	0.00	0.04166	0.04166	0.9166	1.00
<i>\$500,000 to \$1,000,000</i>	0.0344	0.0344	0.00	0.9310	1.00
<i>\$1,000,000 to \$1,500,000</i>	0.00	0.00	0.00	1.00	1.00
<i>\$1,500,000 to \$2,000,000</i>	0.00	0.00	0.00	1.00	1.00
<i>\$2,000,000 +</i>	0.00	0.00	0.2222	0.7777	1.00

In Tables 4 and 5, the data are tabulated according to portfolio net worth (rows) and proportions of total portfolio net worth invested in risky assets (columns). Tables 4 and 5 show the percentage of SMSFs at different portfolio net worth levels that have certain proportions invested in risky assets. For example, the figure 0.1428 in row 3, column 2 of Table 4 means that 14.28% of the self managed superannuation funds in the 41-portfolio sub-sample with a net worth of \$100,000 to \$200,000 had between 0% and 40% of total portfolio net worth invested in risky assets. Whilst the data are presented here as percentages of the self managed superannuation funds that held particular percentages of their net worth in risky assets, the data were also arranged in contingency tables displaying the absolute number of funds with particular percentages of their net worth invested in risky assets. The analysis of the absolute values yielded the same statistical results as the analysis of the contingency tables above.

In order to assess the statistical significance of the relationship between the variables, a chi-square (χ^2) test of the cross-classifications was undertaken. As mentioned previously, this type of statistical analysis is particularly well suited to this investigation because there is a

strong likelihood that the variables are non-normally distributed. Furthermore, this methodology has been deployed in well-known studies that have a similar theme to the present investigation. Formally, the chi-square statistic is used to test whether the allocations (dollars and percentages) to risky assets and total portfolio net worth are statistically independent. Chi-square permits testing of the following type of hypothesis: the percentage of total portfolio net worth invested in risky assets is associated with the total net worth of the portfolio. As a distribution-free test, chi-square is appropriate for the type of data contained in the cross-classification tables. The results are presented in Table 6 below:

Table 6. Results of the Analysis: Chi-Square Test Statistics

Sub-Sample	χ^2	Asymptotic Significance (2 Sided)
100-Portfolios (Percentage of Risky Assets)	0.3785	0.464
40-Portfolios (Percentage of Risky Assets)	0.3705	0.451

In Table 6, the Pearson chi-square (χ^2) tests the hypothesis for each sub-sample: that total portfolio net worth and the percentage of net worth invested in risky assets are independent. The lower the significance level, the less likely it is that the two variables are *unrelated*. For both sub-samples, the chi-square statistics relevant to the first hypothesis, 0.3785 and 0.3705 for each sub-sample respectively, are *not* significant. This leads to the conclusion that total portfolio net worth and the percentage of net worth invested in risky assets are *not* dependent. The fact that these results are the same for both of the independent sub-samples means that we can have a reasonable degree of confidence in the soundness of the analysis and rigour of the outcomes. The conclusions that may be drawn from this analysis can be stated as follows. The statistical analysis revealed the independence of total portfolio net worth and the percentage of net worth invested in risky assets. There is no tendency for either larger (smaller) portfolios to be riskier than smaller (larger) portfolios.

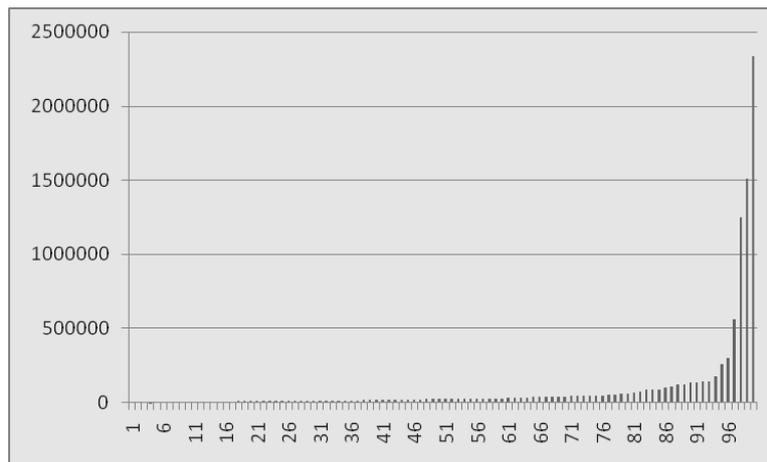
5. Discussion of Results

The SMSF portfolio data obtained for this study presented a unique opportunity to contribute to the fledgling research programme that investigates the economic characteristics of SMSFs. In the analysis presented above, the relationship between portfolio size and allocations to risky assets exhibited by two independent sub-samples of Australian SMSFs was examined. Using a non-parametric cross-classification analysis with a chi-square test statistic, it was concluded that the portfolios being considered in this study exhibited no discernible relationship between portfolio size and allocations to risky assets. That is, the percentage of

total portfolio net worth allocated to risky investments did not change in any consistent way—positively or negatively—as total portfolio net worth changed. Interestingly, some of the highest valued SMSF portfolios in the sample exhibited lower allocations to risky assets (or, to put it differently, higher allocations to cash) than funds with a much lower net worth. This is to be expected if SMSF trustees form their portfolio strategies on the basis of their risk aversion (and their other economic vital statistics) and is comforting to the extent that there does not appear to be a tendency for the SMSFs to become more speculative either when they are in their early stages of development (and have a low net worth) or when they are in a more advanced state (and have a high net worth).

This result implies that, at least within the SMSFs in the sample, there is no tendency for the trustees to take on more risks as the value of their portfolios increases. Whilst the absolute dollar value of funds invested in risky assets increases as the funds increase in size, the relative (percentage) allocations exhibit no particular relationship with net worth. For the funds in the 100-portfolio sample, there is a tendency for the weighting of risky assets to increase as the portfolios increase in size. However, the trend is interrupted by the much lower allocation to risky assets exhibited by funds in the largest size category. These funds exhibit only slightly higher allocations to risky assets than the funds in the lowest size category. Similarly, for funds in the 41-portfolio sample, there is actually a trend towards decreasing allocations to risky assets as the fund size increases. However, this ‘trend’ is also interrupted by the higher allocations to risky assets exhibited by funds in the middle size category. The results certainly suggest that there is no consistent relationship between fund size and allocations to risky assets.

As mentioned earlier, when viewed from another aspect, this investigation provides important insights into another characteristic of SMSF portfolio structure: cash allocations. The high proportion of their portfolios that SMSF trustees allocate to cash has been noted (Phillips, Cathcart and Teale 2007). The data presented in Table 1 (above) indicate that SMSF trustees in the sample allocated between 11 and 22 percent of their portfolios to cash. This is consistent with the most conservative investment strategies. Once more, however, close inspection of individual SMSF portfolio microstructures is the only way to shed more light on the behaviour of individual SMSF trustees. The actual cash allocations—not averages—of the funds in the 100-portfolio sample are presented in Figures 3 and below, which display the dollar allocations and percentage allocations respectively. These have been ordered (lowest to highest) to permit easier inspection of the data.



3. SMSF Dollar Allocations to Cash: 100-Portfolio Sample

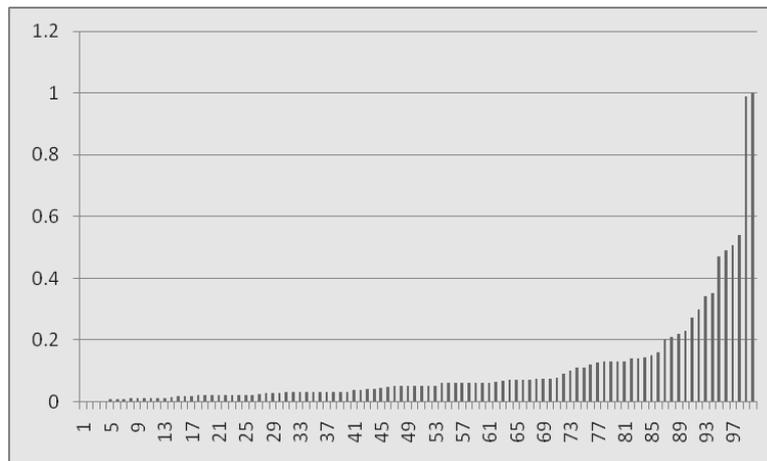


Figure 4. SMSF Percentage Allocations to Cash: 100-Portfolio Sample

It is clear from the data presented in Figures 3 and 4 that, whilst the average cash allocation for these funds is 11 percent, a number of funds exhibit much higher allocations. Some of these allocations may be explained as temporary cash allocations of newly established SMSFs. This is the case for fund 80 (see Figure 3). However, funds 84 and 91 (Figure 3) have been long established, as have all of the other funds with 20+ percent allocations to cash. When the funds are examined individually, marked deviations from the averages presented in aggregated data emerge. At least 10 to 15 percent of the funds in the 100-portfolio sample have extremely high cash allocations. Investments in fixed income securities are far from risk-free and were considered to be risky assets for the purposes of the analysis presented previously. The allocations to both cash and fixed income securities within SMSFs are important pieces of information for economists and policy-makers to be aware of. The allocations to fixed income securities for each of the funds in the 100-portfolio sample are presented in Figure 5.

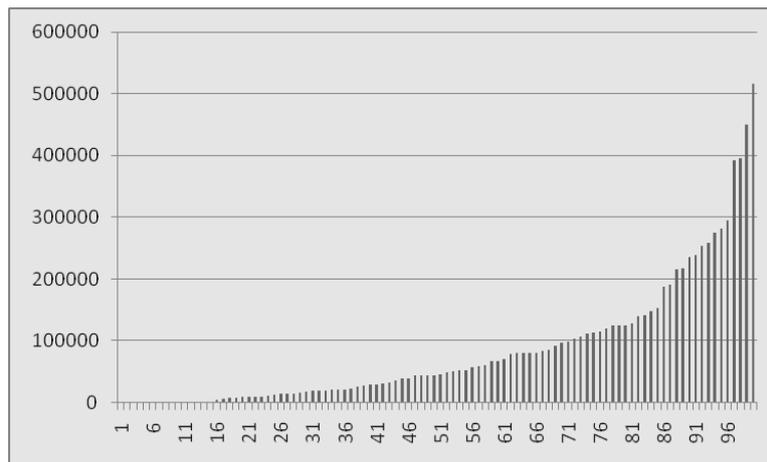


Figure 5 . SMSF Dollar Allocations to Fixed Income: 100-Portfolio Sample

The average investment in fixed income securities is 13 percent but the percentage investments can be quite considerable when the SMSFs are examined individually rather than in aggregate. For many of the SMSFs in this part of the sample, an allocation of more than 20 percent of investable funds to fixed income securities is clearly evident from the data presented in Figure 6.

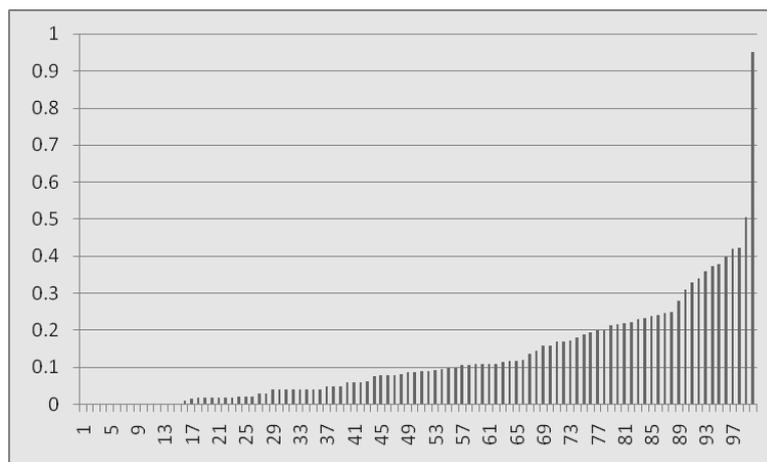


Figure 6. SMSF Percentage Allocations to Fixed Income: 100-Portfolio Sample

In order to complete the analysis of the relationship between fund size and allocations to risky assets, it is certainly worthwhile considering the relationship between fund size and allocations to cash, risky assets and fixed income securities with the additional power that may attend the deployment of regression analysis. To this end, three log-linear regressions were undertaken. Formally, in each of three cases, the log-linear regression equation that is analysed herein (with the data transformed by natural logarithms) is presented below. Ordinary least squares is used to estimate the regression equation:

$$\ln Y_i = \beta_1 + \beta_2 \ln X_{li} + u_i \tag{4}$$

Where the dependent variable Y_i is the percentage allocation to (1) fixed income securities of SMSF i ; (2) cash of SMSF i ; and (3) risky assets of SMSF i , respectively, and the independent variable X_{1i} is the size of fund of the i^{th} SMSF. The results of the regression estimations are presented below:

Regression Analysis: Fixed Income Securities and Fund Size

$$\begin{aligned} \ln \hat{Y}_i &= 3.10 - 0.3834 \ln X_{1i} \\ &\quad (1.91) \quad (0.144) \\ t &= 1.62 \quad -2.65 \\ \bar{R}^2 &= 0.057 \quad R^2 = 0.067 \end{aligned} \tag{5}$$

Regression Analysis: Cash and Fund Size

$$\begin{aligned} \ln \hat{Y}_i &= 0.5850 - 0.2593 \ln X_{1i} \\ &\quad (2.04) \quad (0.1541) \\ t &= 0.286 \quad -1.682 \\ \bar{R}^2 &= 0.01814 \quad R^2 = 0.028 \end{aligned} \tag{6}$$

Regression Analysis: Risky Assets and Fund Size

$$\begin{aligned} \ln \hat{Y}_i &= -1.55 + 0.09533 \ln X_{1i} \\ &\quad (0.8042) \quad (0.0607) \\ t &= -1.93 \quad 1.5697 \\ \bar{R}^2 &= 0.0145 \quad R^2 = 0.0245 \end{aligned} \tag{7}$$

The numbers in the parentheses are the OLS standard errors. The ratio of the explained sum of squares to the total sum of squares is very low for each of three regressions. The ANOVA statistics reveal that, in each regression, the regression only explains a very insignificant amount of the variation in the dependent variable (the natural logarithm of the SMSF size). Despite the low explanatory power, the coefficients for the independent variables are

significant at the 0.05 or 0.10 levels. With approximately normally distributed residuals and no distinct patterns in the plot of the residuals, the regressions are fundamentally sound and the results should be reasonably robust. The results imply that there is a tendency for SMSF trustees to decrease the allocation to fixed income securities and cash as their SMSF increases in size. And there is a tendency for SMSF trustees to increase the allocation to risky securities as their SMSF increases in size. This very elementary piece of regression analysis complements the robust results produced earlier using the non-parametric cross-classification analysis and provides additional statistical insights into the asset allocation of SMSFs.

Both small and large SMSFs are likely to exhibit high allocations to cash (and fixed income securities). As mentioned previously, high cash allocations of 10 to 20 percent are associated with a conservative or moderately conservative investment strategy. However, within the portfolios themselves, a conservative investment strategy is not consistently applied. A conservative investment strategy, whilst calling for cash allocations of 10 to 20 percent, would only be consistent with an equity portfolio amounting to approximately 10 to 20 percent of the overall portfolio. Almost half of the investable funds of the average SMSF portfolio are allocated to Australian shares. For example, fund 14 has an over 50 percent cash allocation. It also has 37 percent allocated to Australian shares. Likewise, fund 42 has a 47 percent allocation to cash and a 40 percent allocation to Australian shares. This is a pattern that characterises many of the funds in the sample and indicates a potential problem with the formulation of the investment strategy.

All funds are required by law to have an investment strategy outlining the objectives of the fund and the asset classes in which it may invest. High cash allocations combined with high allocations to Australian shares may be the result of poor investment strategy construction. All investment strategy documents contain some flexibility regarding the asset class weightings. It would seem that the SMSFs have very flexible or broadly defined weightings schedules. This does allow SMSF trustees a certain freedom in designing a portfolio that they feel is consistent with their expectations and risk aversion but may result in a lack of structure within the portfolio. This can be compounded if inexperienced trustees, far from taking advantage of the flexibility associated with broadly defined weightings schedules to design portfolios well-suited to personal and market conditions, design portfolios with random structures. The investment strategies of SMSFs and the consistency with which they are applied is an important area for further research.

Following more extensive investigations of the economic properties of SMSFs, economists may be in a position to provide more guidance on the optimal management of SMSF portfolio. For example, balanced superannuation funds follow a 'constant proportional' investment policy whereby the proportions invested in various assets in the fund are maintained by frequent trading, especially after significant market movements. For SMSF trustees with particular types of risk aversion, the emulation of such a strategy may be

encouraged, providing there were no mitigating circumstances uncovered in the course of the investigation of SMSFs. It is easy to foresee, however, that a constant proportional strategy may be too cumbersome for many SMSF trustees to perform well and since many self managed superannuation funds may be too small to justify the higher transactions costs that may be involved, it may be more desirable for advisers to recommend the allocation of the capital of the SMSF to managed investments that do follow a constant proportional or balanced investment policy.

7. Conclusion

In this paper, the relationship between SMSF portfolio size (or net worth) and allocations to risky assets was examined. Based on the analysis of two independent samples of SMSFs, it was determined that there is no discernible relationship between the two variables of interest. Rather, funds with the largest net worth in both samples exhibit lower allocations to risky assets than funds with lower net worth. The allocations to non-risky cash assets in both samples are quite high on average and within the samples some trustees have allocated very large portions of their portfolios to cash. This suggests a conservative investment strategy which is of course entirely acceptable if that is what the risk aversion of the trustees calls for. Interestingly, however, the high cash allocations are often combined with high allocations to risky assets, especially Australian shares. The portfolios exhibit a dichotomy: high allocations to a risk free asset and high allocations to risky assets. It would appear as though the flexibility afforded by loosely constructed investment strategies is a likely source of this SMSF characteristic. The investigation of SMSF investment strategy documents *vis-à-vis* the portfolios actually constructed by their trustees would be a very interesting task for future research.

References

- Blume, M. and Friend, I. (1975), "The Asset Structure of Individual Portfolios and some Implications for Utility Functions," *Journal of Finance*, Vol. XXX, No. 2, May, pp.585-603.
- Campbell, J. (2003), "Two Puzzles of Asset Pricing and Their Implications for Investors," *The American Economist*, Vol. 47, No. 1, Spring, pp.48-74.
- Cass, D. and Stiglitz, J. (1972), "Risk Aversion and Wealth Effects on Portfolios with Many Assets," *Review of Economic Studies*, July, pp.331-354.
- Cohn, R., Lewellen, W., Lease, R. and Schlarbaum, G. (1975), "Individual Risk Aversion and Investment Portfolio Composition," *Journal of Finance*, Vol. XXX, No. 2, May, pp.605-620.
- Donkers, B., Melenberg, B. and Van Soest, A. (2001), "Estimating Risk Attitudes using

- Lotteries: A Large Sample Approach,” *Journal of Risk and Uncertainty*, 22:2, pp.165-195.
- Elton, E., Gruber, M., Brown, S. and Goetzmann, W. (2003), *Modern portfolio Theory and Investment Analysis*, 6th Edition, John Wiley and Sons, New Jersey.
- Friend, I. and Blume, M. (1975), “The Demand for Risky Assets,” *American Economic Review*, Vol. 65, No. 5, December, pp.900-922.
- Landskroner, Y. (1977), “Intertemporal Determination of the Market Price of Risk,” *Journal of Finance*, Vol. XXXII, No. 5, December, pp.1671-1681.
- Phillips, P.J., Cathcart, A. and Teale, J. (2007), “The Diversification and Performance of Self Managed Superannuation Funds,” *Australian Economic Review*, Vol. 4, Issue 4, pp.339-352.
- Pratt, J.W. (1964), “Risk Aversion in the Small and in the Large,” *Econometrica*, Vol. 32, No.1-2, January-April, pp.122-136.
- Sharpe, W. (1964), “Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk,” *Journal of Finance*, Vol. XIX, No. 3, pp.425-442.
- Sheskin, D. (2000), *Handbook of Parametric and Nonparametric Statistical Procedures*, 2nd Edition, Chapman and Hall, Florida.
- Smith, K. (1975), “Discussion,” *Journal of Finance*, Vol. XXX, No. 2, May, pp.621-623.
- Tobin, J. (1958), “Liquidity Preference as Behaviour Towards Risk,” *Review of Economic Studies*, No. 67, February, pp.65-86.