OPTIMALITY OF FINANCIAL PLANNING CLIENTS' STRATEGIC ASSET ALLOCATIONS

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Abstract

In this paper, the optimality of Australian financial planning clients' asset allocations are analysed using the mean-variance formulation of the Modern Portfolio Theory. The asset allocations recommended by financial planning groups are examined. The mean-variance characteristics of the various asset classes are derived from historical indices, using last 21 years data and last 5 years data. The return-risk values of the recommended portfolios are determined and a simple method of iso-risk maximum return calculation using the Excel Solver command is utilised to determine the corresponding optimal portfolios. The recommended portfolios were found to have expected returns that are around 8% and 32% below optimal returns based on last 21 years data and last 5 years data, respectively.

Introduction

The objective of this study is to examine the optimality of Australian financial planning clients' strategic asset allocations. Financial planning clients are a good starting point in studying private investors as financial planners exercise considerable control over a substantial portion of the total private investment pool. The fifty largest financial planning groups have approximately $316 billion worth of funds under their advice (Wilkinson 2007) while the total private investment pool can be estimated at $1.9 trillion based on average financial assets of $157,900 per household (Headey, Warren & Harding 2006) and 7.6 million households (ABS 2005) in 2002 and assumed annual growth of 10%.

This study utilised as a proxy for financial planning clients' strategic asset allocations the asset allocations recommended by personal financial planning groups to clients. The accepted practice is to assess a client's risk profile based on factors such as risk aversion, investment time frame and life

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cycle stage and recommend an appropriate asset allocation (Taylor 2007). Small deviations are allowed when establishing the investment account and regular rebalancing is carried out to keep the asset allocations in line. It is similar in other countries where personal financial planning is an established practice such as in the US (Kapoor, Dlabay & Hughes 2004) and in the UK (Harrison 2005).

The importance of this practice of strategic asset allocation over tactical asset allocation and security selection has been established in research literature (Brinson, Singer & Beebower 1991; Ibbotson & Kaplan 2000), with some dissenting minority (Hlawitschka & Tucker 2006). For this study, we examined the benchmark strategic asset allocations of major financial planning groups in Australia. Given the crucial role that asset allocation plays in the overall financial planning process, the results of this study have implications for the practice of personal financial planning.

Literature Review and Research Theoretical Framework

There appears to have been only one previous investigation into the optimality of the private investors' asset allocation on the basis of financial planners' recommendations (Huber & Kaiser 2003). This study was undertaken in the US context. The authors analysed adviser recommendations on allocating investments among five asset classes namely equities, bonds, hedge funds, property and cash for investment time frames of 5, 20 and 40 years corresponding to investors' life cycle stages. Three investment styles were considered namely conservative, moderate and aggressive. The calculated risk levels for each investment time frame and investment style were used as a basis to generate the iso-risk optimised portfolios. This was done by generating artificial time series of returns for the various combinations of investment time frames and styles based on the historical mean-variance characteristics of the asset classes. The resulting returns were compared with the optimal returns. The adviser recommended asset allocations were found to achieve on average 80% to 98% of optimised portfolio returns[2]. The aim of the present paper is to contribute to the body of literature by studying the Australian context and suggesting a different methodology for assessing optimality of portfolio asset allocations that can be used even in other investment contexts.

Like the studies cited above, almost all the recent investigations of optimality of asset allocations utilise the mean-variance formulation of the Modern Portfolio Theory (Markowitz 1952) as the theoretical framework. A few examples of these are (Waggle & Gisung Moon 2005) examining the effect of bond-equity correlation on optimal asset allocation, (Grover & Lavin 2007) studying asset

[2] The same authors previously published a similar study from the perspective of a Euro based investor: Huber, C & Kaiser, H 2002, 'Asset allocation for the private investor', *Economic and Financial Computing*.

allocation for investors in one of the largest retirement plans for the US academic community, (Flavin & Wickens 2003) utilising time-varying covariance matrices to study macroeconomic influences on optimal asset allocation and (Maller & Turkington 2003) which presents a mathematical solution maximising Sharpe ratio to determine the optimal portfolio.

Likewise, the present study is set within the context of Modern Portfolio Theory or MPT. MPT will provide the theoretical framework and analytical tools necessary to analyse the optimality of the asset allocation weightings recommended by the financial planning groups. MPT reduces the asset allocation problem to a mathematical exercise that makes extensive use of asset return covariances and the mathematical-analytical tool known as quadratic programming. Markowitz specified two criteria relevant to the asset allocation decision namely expected or *ex ante* portfolio return and expected or *ex ante* portfolio risk (measured by computing the variance of returns). Markowitz showed how the combination of assets or asset classes in a portfolio could reduce total portfolio variance and, in so doing, provided the theoretical rationale for diversification.

If investors are solely concerned with the expected return and risk of their portfolios, risk averse investors will attempt to maximise the utility function:

$$U = f\left(E_R, \sigma_R\right) \quad \textbf{(Equation 1)}$$

Where U is the agents's total utility, E_R is the expected return of a portfolio or asset ($dU / dE_R > 0$) and σ_R is the standard deviation of the possible divergence of actual returns from expected returns ($dU / d\sigma_R < 0$) (Sharpe 1964, p. 428). In practice, expected return and *ex ante* risk are estimated on the basis of historical asset (mean) returns and variances and assumptions concerning the underlying probability distribution of returns. Whilst computationally intensive, Markowitz portfolio programming is an important analytical tool that permits the analysis of the set of portfolios of assets from which risk averse investors may make their investment choices.

The generation of the full set of portfolios from which investors may choose, involves the computation of the expected return and variance for each possible combination of risky assets in the economic system. The expected return for a portfolio of assets is the weighted average of the expected returns of each of the individual assets in the portfolio:

$$E\left(R_P\right) = \sum_{i=1}^{n} w_i E\left(R_i\right) \quad \textbf{(Equation 2)}$$

The risk or variance of the portfolio must take into consideration the covariances between each pair of assets in the portfolio. This is the distinguishing feature of Markowitz portfolio programming. The returns of the assets in the portfolio will, on most occasions, be less than perfectly correlated with each other. Hence, there will be a tendency for the less than perfectly correlated fluctuations in the returns of individual assets to dampen the impact of any one individual security on the total risk of the portfolio. The risk of a portfolio of assets is determined by taking into consideration both the variance of each portfolio component as well as the covariance for each pair of components:

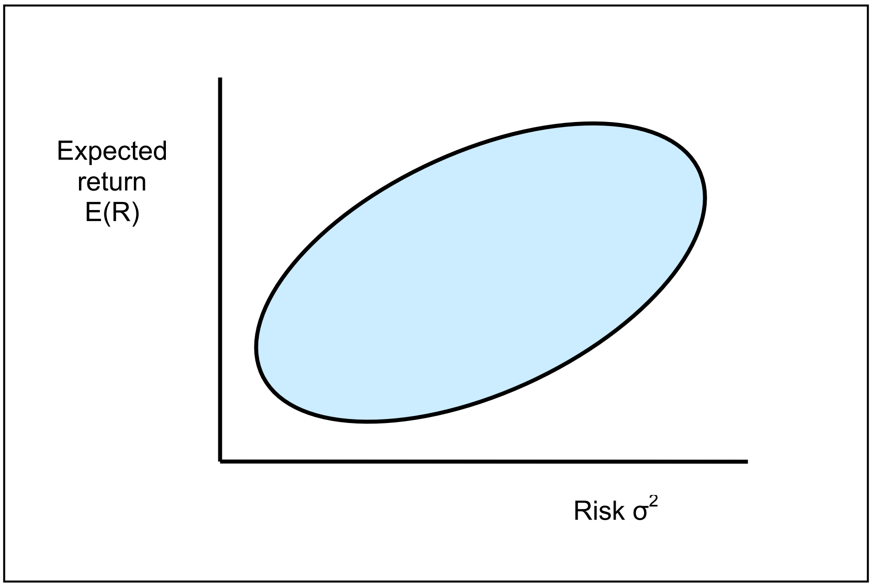
$$\sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j$$

(Equation 3)

$$= \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n}\sum_{\substack{j=1 \\ i \neq j}}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j$$

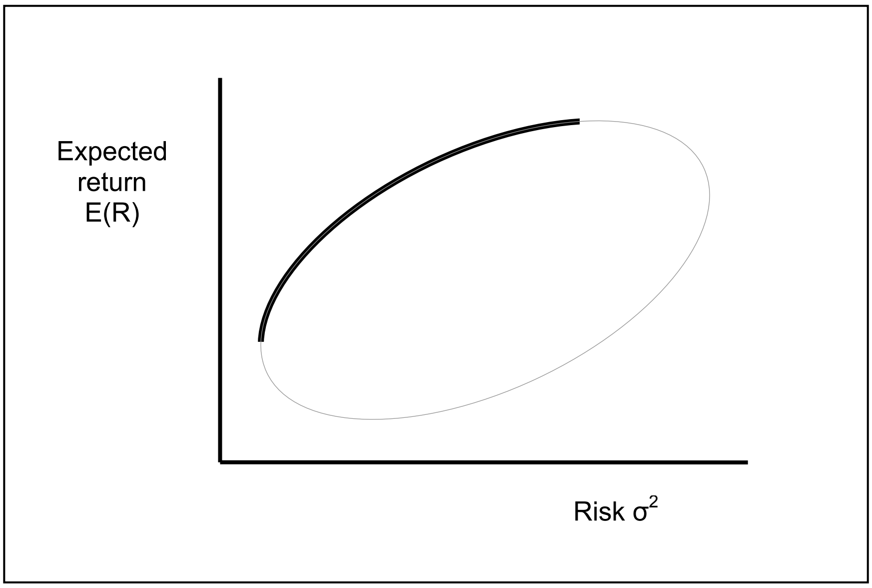
Where ρ_{ij} is the correlation coefficient that expresses the degree of correlation between asset *i* and asset *j*. It should also be noted that $\rho_{ij}\sigma_i\sigma_j$ is equal to the covariance between assets *i* and *j* (σ_{ij}). The double summation sign implies that all possible pairs of assets must be accounted for in the calculation. When the expected return and variance calculations are done for all possible combinations of assets in the economic system, the result is a choice set from which investors select a portfolio:

Figure 1: The set of all portfolios from which an investor may choose



Some of the portfolios contained in the choice set are dominated by others. Portfolios that are located on the upper rim of the choice set have a higher expected return for each level of risk than portfolios contained in the interior of the set. Investors seeking to maximise the utility function depicted in Equation 1 will be interested in portfolios that are located as far to the northwest in expected return-risk space as possible. The upper rim of the choice set is the farthest to the northwest that is possible given the available assets in the economic system. Risk averse investors seeking to maximise their utility will therefore be interested in the set of efficient portfolios that are located farther to the northwest than all other portfolios in the choice set:

Figure 2: The set of efficient portfolios or the efficient frontier



Stated in terms of MPT, the objective of this study is to determine whether the asset allocations recommended to Australian investors by financial planning groups result to portfolios that are located in the efficient frontier. Referring to the chart above, there is one remark about the measure of risk. The mean-variance formulation of MPT looks at all deviations from expected returns, but in reality, investors should be concerned only with returns below expectations which means only deviations below the mean value otherwise known as the semivariance. This formulation of MPT is known as mean – lower partial moment (M-LPM) as opposed to mean-variance (M-V). However, a recent study that employed the lower partial moment as a risk measure for downside loss aversion showed that when asset returns are nearly normally distributed, there is little difference between the M-V and M-LPM optimal portfolios (Jarrow & Zhao 2006). Therefore, this study will use the mean-variance formulation subject to a normality test of the asset class historical returns.

Data and Research Methodology

As mentioned earlier, this study will utilise financial planners' recommendations as a proxy for the clients' asset allocations. For this study, we examined the benchmark asset allocations of ten of the thirty largest financial planning groups representing approximately $143 billion worth of funds under advice (Wilkinson 2007). The names of the financial planning groups will not be disclosed in this study and they will instead be designated by letters A to J. Australian financial planning groups have determined the following investor styles and associated asset allocations. Accompanying explanations indicate that these weightings are based on *ex ante* beliefs and expectations about the various asset classes.

Table 1: Benchmark asset allocations of financial planning groups

Financial planning group	Investor risk profile	Recommended strategic asset allocation (%)					
		Cash	Australian Fixed Interest	Intl Fixed Interest	Property	Australian Shares	Intl Shares
A	Conservative	25	23	22	9	11	10
	Moderately conservative	10	20	20	9	21	20
	Balanced	5	13	12	9	31	30
	Moderately aggressive	0	8	7	9	38	38
	Aggressive	0	0	0	9	45	46
B	Capital secure	50	40	10	0	0	0
	Conservative	25	35	10	5	15	10
	Moderate	10	25	10	10	25	20
	Balanced	5	15	10	10	35	25
	Growth	5	10	5	10	40	30
	High growth	0	0	0	10	50	40
C	Cautious	21	43	21	2	7	6
	Conservative	21	26	23	8	12	10
	Moderately conservative	10	24	14	9	24	19
	Balanced	5	17	8	10	35	25
	Growth	2	9	3	10	45	31
	High growth	0	0	0	10	50	40
D	Defensive	20	30	20	8	14	8
	Moderately defensive	10	23	17	10	22	18
	Balanced	4	15	11	10	34	26
	Growth	2	8	5	10	43	32
	High growth	1	0	0	5	45	49

Financial planning group	Investor risk profile	Recommended strategic asset allocation (%)					
		Cash	Australian Fixed Interest	Intl Fixed Interest	Property	Australian Shares	Intl Shares
E, F, G[3]	Preservation	90	5	5	0	0	0
	Conservative	20	25	25	5	15	10
	Moderately conservative	10	23	22	5	20	20
	Balanced	5	15	15	10	30	25
	Assertive	5	8	7	10	40	30
	Aggressive	0	0	0	10	45	45
H, I, J	Conservative	21	26	23	8	12	10
	Moderately conservative	10	24	14	9	24	19
	Balanced	5	17	8	10	35	25
	Growth	2	9	3	10	45	31
	High growth	0	0	0	10	50	40

Monthly total return or accumulation indices data were obtained for each of the asset classes listed in Table 1, to be used in calculating historical returns. The indices (all denominated in Australian $) that are used as proxy measures for the asset classes as well as the dates of available data are summarised below.

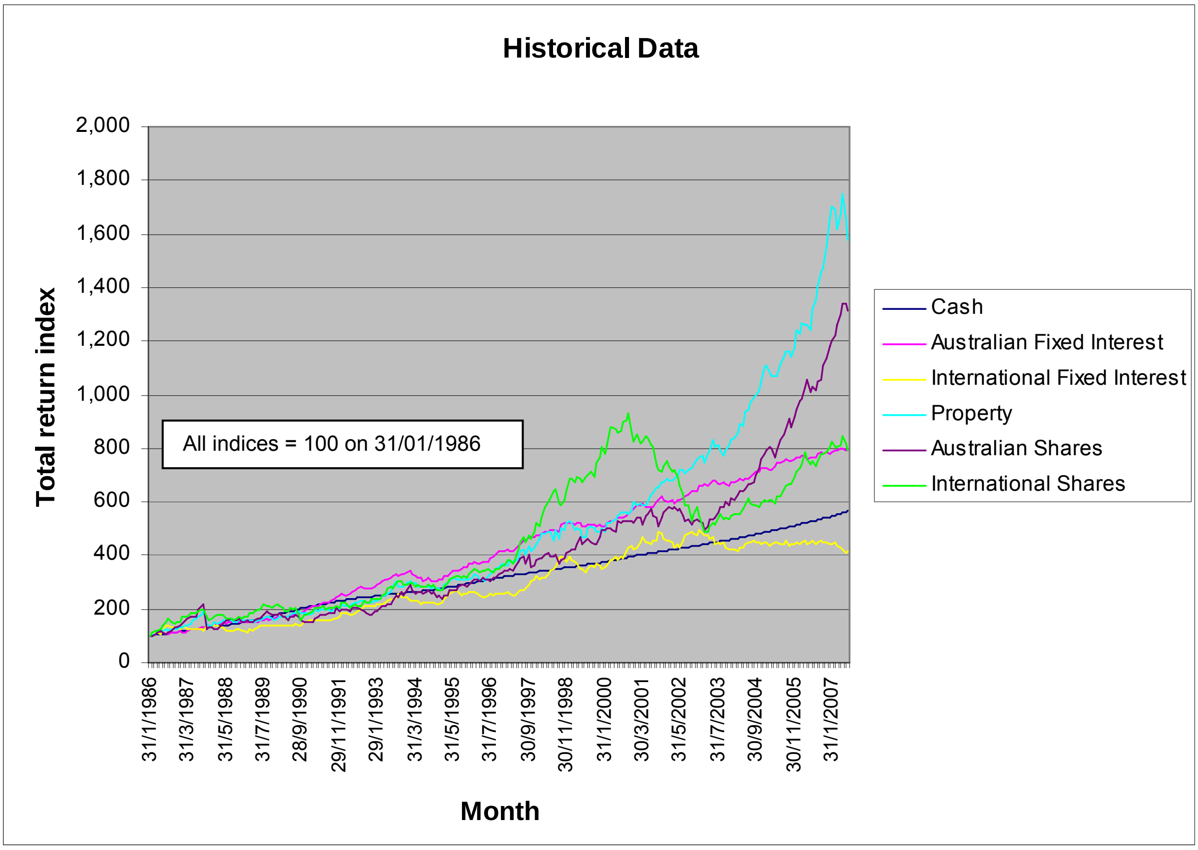
Table 2: Historical indices data utilised in the study

Asset class:	Cash	Australian Fixed Interest	International Fixed Interest	Property	Australian Shares	International Shares
Proxy index and dates data available:	JP Morgan Australia Cash Total Returns Index (31/12/1985 to 31/07/2007)	JP Morgan Australia Government Bond Total Return Index (31/01/1986 to 31/07/2007)	JP Morgan Global (ex-Australia) Govt Bond Total Return Index (31/01/1986 to 31/07/2007)	ASX Listed Property Trust Index (31/12/1979 to 30/04/1992) S&P/ASX 200 Property Trust Accumulation Index (31/05/1992 to 31/07/2007)	S&P/ASX All Ordinaries Accumulation Index (31/12/1979 to 31/07/2007)	MSCI World (ex-Australia) Total Return Index (31/12/1979 to 31/07/2007)
Database source:	Datastream	Datastream	Datastream	IRESS	IRESS	MSCI Australia

[3] These financial planning groups only have a single weighting for Fixed Interest. For the purpose of this study, it was assumed that this is equally divided into Australian and International Fixed Interest.

Most of these indices are established industry investment performance benchmarks (Gallagher 2002) and are also used by fund managers. The use of indices to derive the asset class returns for the analysis is justified by the fact that financial planners generally recommend managed funds to clients and are the main distributors of managed funds and investment platforms (AXISS 2004). The use of listed property trust indices to represent the property asset class is justified by the general practice of excluding direct properties from the investment portfolio which is focussed on managed funds. The unavailability of some index data for certain periods constrained the analysis to the period from 31/01/1986 to the present or around a 21-year period. The index data are summarised in the chart below.

Figure 3: Historical total return or accumulation index data for the various asset classes



The monthly returns are derived from the index data and are used as the basis for the mean-variance analysis. To provide a way of validating the result of the analysis, two sets of analysis are carried out: based on last 21 years data and based on last 5 years data. The descriptive statistics for each asset class are presented in the following tables.

Table 3: Descriptive statistics for last 21 years data

	Cash	Australian Fixed Interest	Intl Fixed Interest	Property	Australian Shares	Intl Shares
Mean	0.0067	0.0082	0.0060	0.0113	0.0113	0.0090
Standard deviation	0.00354	0.01586	0.03191	0.03328	0.04725	0.04326
Kolmogorov – Smirnov normality test (95% confidence)	0.000	0.200	0.023	0.063	0.000	0.200

Table 4: Descriptive statistics for last 5-years data

	Cash	Australian Fixed Interest	Intl Fixed Interest	Property	Australian Shares	Intl Shares
Mean	0.0046	0.0043	-0.0020	0.0139	0.0157	0.0054
Standard deviation	0.00047	0.00907	0.02032	0.02777	0.02504	0.03201
Kolmogorov – Smirnov normality test (95% confidence)	0.200	0.200	0.200	0.200	0.010	0.200

Almost all the normality test statistics have significance levels greater than 0.05. Therefore, it is acceptable to use the M-V instead of the M-LPM formulation as discussed previously (Jarrow & Zhao 2006). It is noted that the mean-variance characteristics for the various asset classes as shown above are not consistent with common belief and expectations. For instance, Cash and Australian Fixed Interest both dominate International Fixed Interest and the same is true for Property and Australian Shares over International Shares.

In addition to asset class returns and variances, the other inputs to the MPT model are the covariances between the asset class returns. These are summarised in the following tables.

Table 5: Covariance matrix for last 21 years data

	Cash	Australian Fixed Interest	Intl Fixed Interest	Property	Australian Shares	Intl Shares
Cash	0.0000125	0.0000153	0.0000048	0.0000089	0.0000182	0.0000118
AFI	0.0000153	0.0002506	0.0000304	0.0002029	0.0002489	0.0000454
IFI	0.0000048	0.0000304	0.0010149	-0.0000882	-0.0005458	0.0005444
Property	0.0000089	0.0002029	-0.0000882	0.0011033	0.0009378	0.0004222
AS	0.0000182	0.0002489	-0.0005458	0.0009378	0.0022240	0.0007307
IS	0.0000118	0.0000454	0.0005444	0.0004222	0.0007307	0.0018645

Table 6: Covariance matrix for last 5 years data

	Cash	Australian Fixed Interest	Intl Fixed Interest	Property	Australian Shares	Intl Shares
Cash	0.0000002	0.0000004	0.0000017	0.0000010	0.0000016	0.0000015
AFI	0.0000004	0.0000807	0.0001007	0.0000404	-0.0000577	-0.0000861
IFI	0.0000017	0.0001007	0.0004323	0.0000705	-0.0001604	-0.0000078
Property	0.0000010	0.0000404	0.0000705	0.0007617	0.0002599	0.0003101
AS	0.0000016	-0.0000577	-0.0001604	0.0002599	0.0006585	0.0005617
IS	0.0000015	-0.0000861	-0.0000078	0.0003101	0.0005617	0.0010506

Using these returns and covariances, we compute the expected (mean) return and variance for each of the portfolios defined by the weighting schedules presented in Table 1. The variance can be taken to represent the risk standard for each investor style and the optimal return corresponding to this same risk can then be calculated. This is done by solving the following quadratic programming problem for each portfolio in order to assess the efficiency or optimality of these portfolios:

Figure 4: The quadratic programming problem

$$\max E(R_P) = \sum_{i=1}^{n} w_i E(R_i)$$

Subject to a target level of variance:

$$\sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j = \sigma_p^{2^{**}}$$

And the constraints:

$$\sum_{i=1}^{n} w_i = 1$$

$$w_i \geq 0$$

This is a variation of the iso-return minimum variance method of deriving the efficient frontier discussed in most textbooks (Elton et al. 2003; Strong 2006). The methodology deployed in this study is summarised step-by-step in the following table. For each portfolio formed using the financial planning groups' weighting schedules, the following steps were undertaken:

Table 7: Methodology deployed

Step	Formula or procedure
1. Compute the expected monthly return and risk for each of the portfolios formed using the financial planning groups' weightings.	$E(R_P) = \sum_{i=1}^{n} w_i E(R_i)$ $\sigma_p^2 = \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j$
2. Solve the quadratic programming problem for each of the portfolios derived in the first step using Excel Solver. Solver is a command that utilises what-if analysis to find an optimal value for a variable subject to constraints (see Appendix). In this case, the output variable that will be optimised is E(Rp) subject to a certain risk value and the input variables that will be varied are the portfolio weightings.	$\max E(R_P) = \sum_{i=1}^{n} w_i E(R_i)$ subject to the risk computed in the first step
3. Record the expected returns generated by the optimal portfolios determined in the second step.	
4. Using the expected returns and variances of the optimal portfolios, plot the efficient set in expected return-risk space.	
5. Plot the expected returns and variances of the financial planning groups' portfolios relative to the efficient set to show (in)efficiency and calculate the percentage shortfall from the optimal return.	

These steps were carried out for both sets of historical data: last 21-year period and last 5-year period. A similar application of the Excel Solver command was utilised in another asset allocation optimisation study (Grover & Lavin 2007) where they used instead a single index model.

The solution to the quadratic programming problem determines the existence and definition of a weighting schedule that produces a higher portfolio expected return with the same level of risk as the portfolio formed utilising a financial planning group's weighting schedule. Such portfolios, if they exist, represent a combination of the asset classes listed in Table 1 that dominates the portfolios formed utilising the weightings suggested by the various financial planning groups. The portfolios derived from the solution of the quadratic programming problem will be located in the efficient set of portfolios. If such portfolios are shown to exist, the associated financial planning groups' portfolios will be shown to be located in the interior of the efficient set in inefficient positions. The results of the investigation are presented in the following section.

Results and Discussions

The investigation revealed a number of important characteristics of Australian financial planning clients' strategic asset allocations. Using the last 21 years data, it was discovered that the recommended weighting schedules generated portfolios that lie in the interior of the mean-variance opportunity set. The solution of the quadratic programming problem for each of the recommended portfolios generates a set of portfolios that lie in the efficient set (the upper rim of the opportunity set). The existence of these efficient portfolios suggests that Australian financial planning clients' strategic asset allocations could have been improved by the selection of alternative weighting schedules. The alternative mean-variance efficient weighting schedules generate portfolios with the same level of risk as the recommended portfolios but produce higher expected returns. The results based on the last 21 years data are summarised in the following chart and table.

Figure 5: Results based on last 21 years data

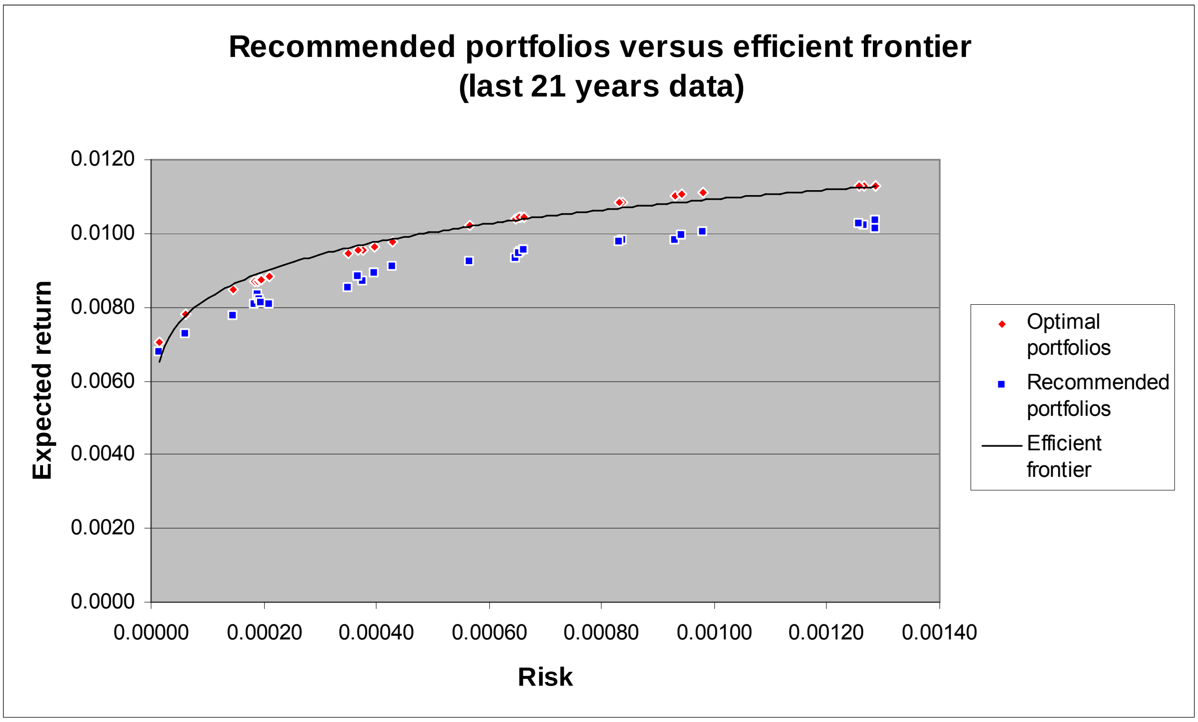


Table 8: Results based on last 21 years data

Financial planning group	Investor risk profile	Risk	Expected return		
			Recommended portfolio	Optimal portfolio	Shortfall
A	Conservative	0.00018	0.0081	0.0087	7.2%
	Moderately conservative	0.00038	0.0087	0.0096	8.8%
	Balanced	0.00065	0.0093	0.0104	10.3%
	Moderately aggressive	0.00093	0.0098	0.0110	11.2%
	Aggressive	0.00127	0.0102	0.0113	9.6%
B	Capital secure	0.00006	0.0073	0.0078	6.8%
	Conservative	0.00019	0.0083	0.0087	4.5%
	Moderate	0.00043	0.0091	0.0098	6.9%
	Balanced	0.00066	0.0095	0.0104	8.9%
	Growth	0.00084	0.0098	0.0108	9.6%
	High growth	0.00129	0.0104	0.0113	8.3%
C	Cautious	0.00015	0.0078	0.0085	8.1%
	Conservative	0.00020	0.0081	0.0088	7.5%
	Moderately conservative	0.00040	0.0089	0.0096	7.4%
	Balanced	0.00066	0.0095	0.0104	8.6%
	Growth	0.00098	0.0100	0.0111	9.7%
	High growth	0.00129	0.0104	0.0113	8.3%
D	Defensive	0.00019	0.0082	0.0087	5.8%
	Moderately defensive	0.00037	0.0088	0.0095	7.4%
	Balanced	0.00065	0.0095	0.0104	9.1%
	Growth	0.00094	0.0100	0.0111	10.0%
	High growth	0.00129	0.0101	0.0113	10.6%
E, F, G	Preservation	0.00002	0.0068	0.0070	3.6%
	Conservative	0.00021	0.0081	0.0088	8.5%
	Moderately conservative	0.00035	0.0085	0.0095	10.0%
	Balanced	0.00057	0.0092	0.0102	9.4%
	Assertive	0.00083	0.0098	0.0108	9.9%
	Aggressive	0.00126	0.0102	0.0113	9.4%
H, I, J	Conservative	0.00020	0.0081	0.0088	7.5%
	Moderately conservative	0.00040	0.0089	0.0096	7.4%
	Balanced	0.00066	0.0095	0.0104	8.6%
	Growth	0.00098	0.0100	0.0111	9.7%
	High growth	0.00129	0.0104	0.0113	8.3%
				Average shortfall	8.4%

When the same analysis is applied using the last 5 years data, the results are even more striking. The recommended portfolios were found to lie a considerable distance from the efficient frontier. Figure 6 below indicates that a significantly higher expected monthly return could be generated by finding the efficient combination associated with each of the recommended portfolios and selecting alternative portfolio weighting schemes. The mean-variance inefficiency of the recommended portfolios based on the last 5 years data results in expected monthly returns that are on average about one-third below the expected monthly returns generated by the efficient portfolios. Australian financial planning clients following recommended asset allocation strategies for both the five year and twenty-one year periods would have found, *ex post*, that their shortfall in expected returns has been substantial.

Figure 6: Results based on last 5 years data

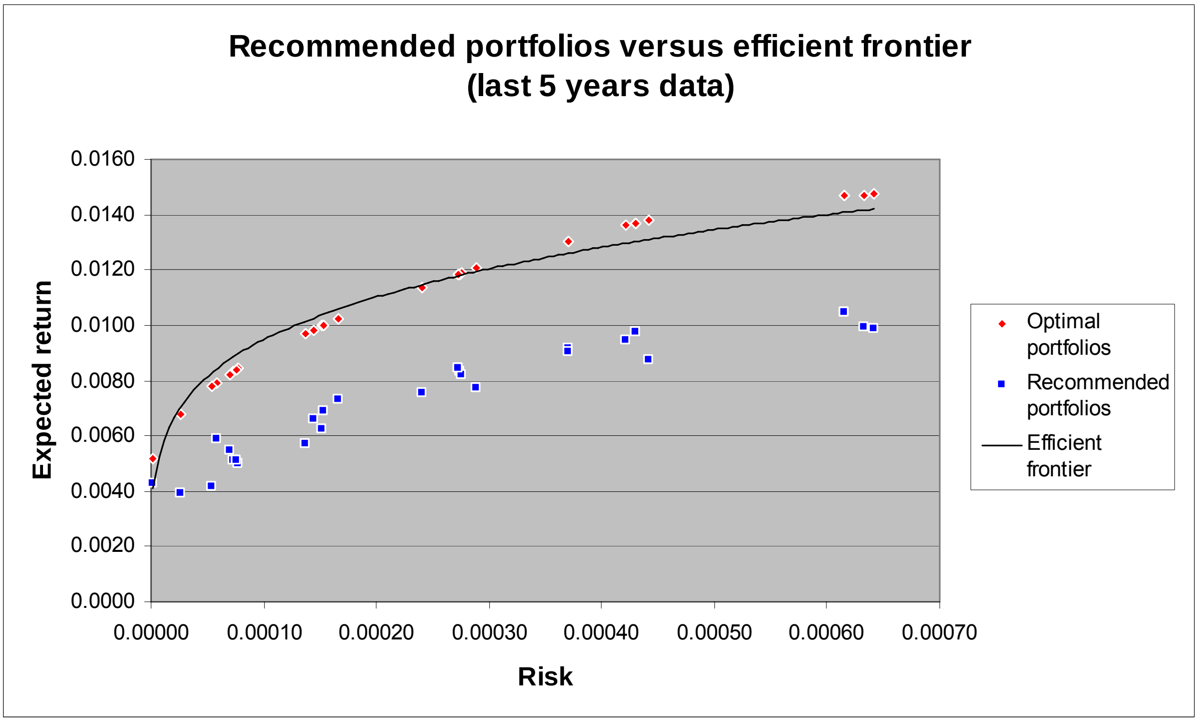


Table 9: Results based on last 5 years data

Financial planning group	Investor risk profile	Risk	Expected return		
			Recommended portfolio	Optimal portfolio	Shortfall
A	Conservative	0.00007	0.0051	0.0083	38.2%
	Moderately conservative	0.00015	0.0063	0.0100	37.4%
	Balanced	0.00029	0.0077	0.0120	35.8%
	Moderately aggressive	0.00044	0.0087	0.0138	36.7%
	Aggressive	0.00064	0.0099	0.0147	33.1%
B	Capital secure	0.00003	0.0039	0.0068	42.1%
	Conservative	0.00006	0.0059	0.0079	25.5%
	Moderate	0.00017	0.0073	0.0102	28.3%
	Balanced	0.00027	0.0084	0.0118	29.4%
	Growth	0.00037	0.0092	0.0130	29.7%
	High growth	0.00062	0.0105	0.0147	28.7%
C	Cautious	0.00005	0.0042	0.0078	46.8%
	Conservative	0.00008	0.0051	0.0084	39.3%
	Moderately conservative	0.00015	0.0069	0.0100	30.9%
	Balanced	0.00027	0.0085	0.0118	28.4%
	Growth	0.00043	0.0098	0.0137	28.5%
	High growth	0.00062	0.0105	0.0147	28.7%
D	Defensive	0.00007	0.0055	0.0082	33.6%
	Moderately defensive	0.00014	0.0066	0.0098	32.7%
	Balanced	0.00028	0.0082	0.0119	31.0%
	Growth	0.00042	0.0095	0.0136	30.4%
	High growth	0.00066	0.0095	0.0111	14.7%
E, F, G	Preservation	0.00000	0.0043	0.0052	17.3%
	Conservative	0.00008	0.0050	0.0084	40.6%
	Moderately conservative	0.00014	0.0057	0.0097	41.4%
	Balanced	0.00024	0.0076	0.0114	33.7%
	Assertive	0.00037	0.0090	0.0130	30.6%
	Aggressive	0.00063	0.0099	0.0147	32.4%
H, I, J	Conservative	0.00008	0.0051	0.0084	39.3%
	Moderately conservative	0.00015	0.0069	0.0100	30.9%
	Balanced	0.00027	0.0085	0.0118	28.4%
	Growth	0.00043	0.0098	0.0137	28.5%
	High growth	0.00062	0.0105	0.0147	28.7%
				Average shortfall	32.2%

The substantial shortfall in expected returns is of considerable interest to Australian financial planning clients. These shortfalls are even more significant when one considers that the recommended asset allocations are supposed to be strategic and are maintained for a long investment horizon. To highlight the magnitude of the shortfalls we have identified, a $100,000 optimal portfolio earning 10% pa will compound to $1.74 million in 30 years but will only be $1.40 million if the return is 9.2% pa or 8% less as was the result for the last 21 years analysis. It would be a lot less with the 32% suboptimality result for the last 5 years analysis.

These results are expected given the uncharacteristic mean-variance combinations obtained for the various asset classes, as noted in an earlier section. It is likely that the benchmark asset allocations of financial planning groups are based on the supposed inherent return-risk characteristics of the various asset classes, which are not supported by historical data. For instance, it is not generally held to be the case that both Property and Australian Shares will dominate International Shares. However, this is what is being revealed by the historical data and even more so by the last 5 years data.

An important finding generated during the analysis is that the mean-variance efficient portfolios that lie directly above the inefficient recommended portfolios contain no allocations to International Shares. Whilst the diversification benefits (higher expected returns and lower risk) that may be obtained from International Shares have come to be generally accepted, the increasing correlation between the world's financial markets may have eroded the benefits somewhat. Whilst the correlation between Australian Shares and International Shares for the last 21 year period is a relatively low 0.3588, the correlation between these two asset classes for the last 5 year period has been 0.6915. Positively (and increasingly) correlated asset classes reduce diversification benefits. Formally, the total variance of a portfolio will only be reduced through the inclusion of International Shares (or any 'new' asset) if the following inequality holds (Strong 2006, p. 158):

$$\rho_{\text{portfolio, international shares}} < \frac{\text{smaller } \sigma}{\text{larger } \sigma}$$ **(Inequality 1)**

For example, consider the mean-variance efficient combination of Financial Planning Group A's moderately aggressive portfolio. The mean-variance efficient moderately aggressive combination contains 4.69% Australian Fixed Interest, 34.16% Property and 61.14% Australian Shares. The correlation of this portfolio's returns with International Share returns for the last 5 year period is 0.6536. The ratio of the standard deviation of the portfolio's returns during this period (0.0211) to International Share returns (0.03268) is 0.6484. In this case, the addition of International Shares to the portfolio will *not* improve the total variance of the portfolio.

The increasing correlation of the world's financial markets poses significant challenges for those responsible for strategic asset allocation. Predominantly, this challenge may consist of the difficulties inherent in 'breaking with the past'. Whilst the benefits of international diversification that were first identified during the 1960s and 1970s provided a rationale for international diversification, these benefits cannot be taken for granted. It seems likely that allocations to International Shares may have to become more strategic and focussed into markets where the correlation with Australian-focussed portfolios is lower. Indeed, had the international components of the recommended portfolios been directed not to International Shares but to a more strategically constructed international share portfolio, it might well have been the case that overseas investments would retain their place in the mean-variance efficient portfolios.

The previous discussions raise the question whether analysts formulating asset allocation policies should continue holding on to the general beliefs and expectations for each asset class and thereby realise suboptimal returns or go by actual historical performance. The fact that the suboptimality appears to be uniform across the financial planning groups seem to indicate a consensus among analysts as far as these perceptions are concerned. The *ex-post* approach is seen as a criticism of the Markowitz model, but compared to *ex-ante*, could it be the more practical approach?

The fact that the suboptimality was found to be less for the longer period of analysis indicates that the benchmark asset allocations may still turn out to be optimal given an appropriate time frame of analysis. This could be the subject of further study. However, it should be noted that the maximum number of years that can be added to the present analysis is six years given that data for Listed Property Trusts only extend to 1980. This highlights the need for a stronger data basis in applying MPT to asset allocation optimisation. Of course, the mean-variance approach utilised in this study is just one of the methodologies available, another one being the state/preference or stochastic approach that has been gaining in its use (Sharpe 2007).

Summary and Conclusions

The objective of this study was to undertake an examination of the optimality of Australian financial planning clients' strategic asset allocations. Using last 21 years data, we computed the expected return and risk for each portfolio constructed utilising the financial planning groups' recommended weighting schedules. In each case, the solution of the relevant quadratic programming problem produced weighting schedules that generated higher expected returns for the same levels of risk. Using the last 5 years data, the results were even more pronounced. Each of the portfolios constructed utilising the recommended weighting schedules was found to be located in the interior of the opportunity set. *Ex post*, financial planning clients would have been able to extract much higher expected returns from strategic asset allocations based on mean-variance efficient portfolio weighting schedules.

Whilst Markowitz mean-variance portfolio optimisation relies upon historical asset returns data, this does not diminish the implications of this investigation for strategic asset allocation among private investors in Australia. A careful analysis based upon historical returns observed over various periods and sub-periods generates essential information of how various returns have behaved absolutely and relative to each other in various types of market conditions. Of most import, the general belief in the viability of even naïve international investing as a method for improving total portfolio variance cannot be taken for granted in a world where financial market returns are becoming increasingly correlated. Indeed, it seems that whilst international investing remains strategically viable, a tactical approach based upon more careful allocation to markets that exhibit lower correlation with Australian-focussed portfolios may be desirable.

The findings of this study raise the question whether asset allocation should continue to be based on the general beliefs and expectations for the various asset classes or whether it would be more optimal to take an *ex post* approach based on actual historical performance. The investigation of strategic asset allocation holds many tantalising prospects for future research.

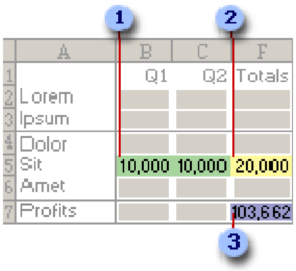
Appendix: Microsoft Excel Solver Command (extract from Excel Help)

Solver is part of a suite of commands sometimes called what-if analysis (what-if analysis: A process of changing the values in cells to see how those changes affect the outcome of formulas on the worksheet. For example, varying the interest rate that is used in an amortization table to determine the amount of the payments.) tools. With Solver, you can find an optimal value for a formula (formula: A sequence of values, cell references, names, functions, or operators in a cell that together produce a new value. A formula always begins with an equal sign (=).) in one cell— called the target cell— on a worksheet. Solver works with a group of cells that are related, either directly or indirectly, to the formula in the target cell. Solver adjusts the values in the changing cells you specify— called the adjustable cells— to produce the result you specify from the target cell formula. You can apply constraints (constraints: The limitations placed on a Solver problem. You can apply constraints to adjustable cells, the target cell, or other cells that are directly or indirectly related to the target cell.) to restrict the values Solver can use in the model, and the constraints can refer to other cells that affect the target cell formula.

Use Solver to determine the maximum or minimum value of one cell by changing other cells— for example, you can change the amount of your projected advertising budget and see the affect on your projected profit amount.

Example of a Solver evaluation

In the following example, the level of advertising in each quarter affects the number of units sold, indirectly determining the amount of sales revenue, the associated expenses, and the profit. Solver can change the quarterly budgets for advertising (cells B5:C5), up to a total budget constraint of $20,000 (cell F5), until the value for total profit reaches the maximum possible amount. The values in the adjustable cells are used to calculate the profit for each quarter, so they are related to the formula in target cell F7, =SUM(Q1 Profit:Q2 Profit).

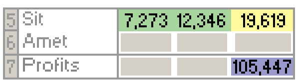


1 Adjustable cells

2 Constrained cell

3 Target cell

After Solver runs, the new values are as follows:



Algorithm and methods used by Solver

The Microsoft Excel Solver tool uses the Generalized Reduced Gradient (GRG2) nonlinear optimization code developed by Leon Lasdon, University of Texas at Austin, and Allan Waren, Cleveland State University.

Linear and integer problems use the simplex method with bounds on the variables, and the branch-and-bound method, implemented by John Watson and Dan Fylstra, Frontline Systems, Inc. For more information on the internal solution process used by Solver, contact:

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