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Attribution of investment performance: An analysis of Australian pooled superannuation funds[*]

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Abstract

This paper evaluates the market timing and security selection capabilities of Australian pooled superannuation funds over the eight-year period from January 1991 to December 1998. Evaluation of both components of investment performance is surprisingly scarce in the Australian literature despite active investment managers engaging in both market timing and security selection. The paper also evaluates performance for the three largest asset classes within diversified superannuation funds and their contribution to overall portfolio return. The importance of an accurately specified market portfolio proxy in the measurement of investment performance is demonstrated. Consistent with prior U.S. literature, the empirical results indicate that funds in general do not exhibit security selection or market timing skill.

Keywords: Performance attribution; Market timing; Security selection; Benchmarks

JEL classification: G2; G23

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1. INTRODUCTION

The performance of investment managers has long been of interest to practitioners and investors, and in academia the performance evaluation literature spans at least four decades. Indeed the debate within industry between active and passive investment management continues, despite the overwhelming empirical evidence that active funds, on average, do not earn superior risk-adjusted returns. This can perhaps be considered as paradoxical when consideration is given to the relative magnitude of assets actively managed in Australia. Rainmaker Information reports the size of the investment industry at December 1999 was around $A632 billion, of which the overwhelming majority (approximately 88.9 percent) of funds were actively invested.[1] In light of the active versus passive debate, this paper evaluates the market timing and security selection components of abnormal returns earned by active Australian pooled superannuation funds in the period 1991-1998.

Most performance evaluation studies have employed the Jensen (1968) approach where risk-adjusted performance measures the ability of funds to outperform the market (Jensen, 1972; Lee and Rahman, 1990). However, the Jensen Measure ignores the potential market timing strategies employed by active portfolio managers as the model does not partition the quality of information a manager holds from the aggressiveness of the investment strategy. Indeed, active investment managers commonly distinguish between both market timing and stock selection performance in the context of their investment objectives. Therefore, performance evaluation models ignoring market timing strategies assume that risk levels for managed funds remain stationary through time, causing the estimate of abnormal return to be downward biased where market timing ability is present (Dybvig and Ross 1985 and Grinblatt and Titman 1989a). As a result, models that fail to measure market timing and security selection simultaneously could lead to inaccurate inferences being made concerning the source of portfolio performance. Accordingly, this paper evaluates both components of investment performance – timing and selectivity.

Empirical evidence in the U.S. widely documents that active funds do not outperform the market (for example Jensen, 1968; Grinblatt and Titman 1989b; Elton, Gruber, Das and Hlavka 1993; Malkiel 1995; and Gruber 1996). The literature also confirms that funds do

[1] Rainmaker Information *Roundup*, December Quarter 1999

not successfully 'time' the market (Treynor and Mazuy 1966; Kon 1983; Chang and Lewellen 1984; Henriksson 1984; Lee and Rahman 1990; Coggin, Fabozzi and Rahman 1993; Ferson and Schadt 1996; Daniel, Grinblatt, Titman and Wermers 1997; and Becker, Ferson, Myers and Schill 1999). Australian research supports the U.S. evidence that funds do not earn significantly positive risk-adjusted returns attributable to security selection (Bird, Chin and McCrae 1983; Robson 1986 and Gallagher 1999). Sinclair (1990) was the first Australian paper to evaluate both market timing and security selection performance, finding that adverse market timing by funds eroded the gains attributable to stock selection. More recently, Hallahan and Faff (1999) examined selectivity and timing ability of Australian equity trusts, documenting that little evidence existed to support the view that such funds were successful market timers. Sawicki and Ong (2000) also document the inability of funds to outperform market indices where a conditional performance evaluation methodology was adopted.

The paper makes the following contributions to the Australian performance evaluation literature. First, the market timing and security selection abilities of active pooled superannuation funds are evaluated at both the total portfolio level and across the three largest asset classes that comprise diversified superannuation portfolios; namely Australian equities, international equities and Australian fixed interest. Second, the paper demonstrates the importance of using correctly specified benchmarks in the measurement of performance where funds also hold non-Australian equity assets in their portfolios. Sinclair's (1990) finding that pooled superannuation funds exhibit both positive and significant selectivity skill coupled with significantly poor timing is shown to arise when the market portfolio proxy is misspecified. The potential bias in performance measurement where inefficient benchmark proxies are used is also evaluated. Finally, the study utilises a unique data set comprising pooled superannuation fund asset allocations relative to strategic benchmark weights and the performance of funds across individual asset classes. This detailed level of information provides insight into the tactical investment strategies that fund managers have used in their quest for active returns.

The remainder of this paper is structured as follows. Section 2 outlines the empirical tests for market timing and security selection. Section 3 describes the data and this is followed by the empirical results. The final section concludes and provides suggestions for future research.

2. EMPIRICAL FRAMEWORK

2.1 Risk-Adjusted Performance Evaluation Models

Security selection represents the ability of an investment manager to identify and exploit mispriced securities (micro forecasting). On the other hand, market timing represents the ability of portfolio managers to position their portfolios to take advantage of predicted market movements (macro forecasting). Successful market timing occurs when portfolio risk is increased in anticipation of market rises. Extending Jensen's (1968) model (based on the CAPM framework), Henriksson and Merton (1981) decompose performance into selectivity and timing as follows:

$$R_{pt} = \alpha_p + \beta_{p1} x_t + \beta_{p2} y_t + \varepsilon_{pt} \qquad (1)$$

Where:

R_{pt} = the portfolio return in period *t* in excess of the risk free return;

α_p = the abnormal return attributable to security selection;

β_{p2} = the coefficient estimating timing ability;

x_t = the market return in excess of the risk free rate in period *t*;

$y_t = \max[0, -x_t]$

ε_{pt} = the random error term with expected mean of zero.

The term (β_{p2}) is used by Henriksson and Merton (1981) to capture the market timing component of investment performance following Jensen (1972), Grant (1977), Dybvig and Ross (1985) and Grinblatt and Titman's (1989a) demonstration of potential bias in the estimates. These authors suggest that funds attempting to market time will bias (β_{p1}) upward and the abnormal return (α_p) will be biased downward if market timing (β_{p2}) is ignored. The Henriksson-Merton model assumes fund managers target two systematic risk levels; one where the manager forecasts the riskless asset to outperform the market portfolio (β_{p1}) and the other where the market return is expected to outperform the risk-free rate (β_{p2}).[2] Successful market timing exists where the estimate of β_{p2} in (1) is significantly positive. The model does not predict the magnitude of the return differential between risky assets and the riskless asset, but rather considers the direction of the forecast that a portfolio manager uses to re-weight the portfolio between risky assets and the riskless asset.[3]

An alternative test for market timing ability is the Treynor-Mazuy model. Treynor and Mazuy (1966) propose the use of a quadratic term to capture market timing ability (compared with Henriksson-Merton's β_{p2} measure), arguing that funds with market timing ability will hold a greater (smaller) proportion of their portfolios in the market portfolio of risky assets when they expect the market to rise (fall). The Treynor-Mazuy approach indicates successful market timing where the coefficient γ is significantly positive.

$$R_{pt} = \alpha_p + \beta_p x_t + \gamma_p x_t^2 + \varepsilon_{pt} \qquad (2)$$

Given the Henriksson-Merton and Treynor-Mazuy models both rely on the CAPM framework, empirical tests using these models assume the market portfolio proxy is mean-variance efficient. Roll's (1977, 1978) criticisms of the CAPM are well documented in the literature. Dybvig and Ross (1985) also warn of the potential dangers of an inefficient market portfolio proxy, where abnormal returns reflect these inefficiencies rather than being derived using superior investment skill. For example, Grinold (1992) found in tests of benchmark efficiency that the Australian All Ordinaries Index is ex-ante inefficient. Finn and Koivurinne (2000) also find evidence of benchmark inefficiency for Australian stock market indices. Measuring active performance relative to a passive benchmark index that is independent of private information and mean-variance inefficient can overstate performance. Admati and Pfleiderer (1997) suggest an alternative benchmark proxy that

[2] Henriksson and Merton's (1981) β_{p2} accounts for market timing on the basis of a fund manager engaging in a protective put option investment strategy. See Henriksson and Merton (1981) for a detailed description.

[3] The Henriksson-Merton model requires corrections for heteroskedasticity and this paper employs White's (1980) method of adjustment. The ordinary least squares estimates in the model are inefficient given systematic risk is not stationary. Henriksson and Merton (1981) show that the standard deviation of the error term is an increasing function of the absolute value of x_t. While Henriksson (1984) found that adjustments for heteroskedasticity did not affect the general conclusions made, other studies including Breen, Jagannathan and Ofer (1986) and Lee and Rahman (1990) suggest that the presence of non-homoskedastic residuals significantly affects the power of tests for market timing. Breen, Jagannathan and Ofer (1986) find that ignoring heteroskedasticity often leads to rejection of the null hypothesis for no market timing too often when in fact the null is true. The converse is also the case. The Treynor-Mazuy model also requires corrections for heteroskedasticity (Coggin, Fabozzi and Rahman, 1993).

employs the average return earned by managed funds as a group may alleviate some of the problems of benchmark inefficiency in performance evaluation studies, and this approach is considered in the empirical results section.

2.2 Performance Attribution Framework

Performance attribution measures the effect of the portfolio manager's active investment decisions across asset sectors and their respective contribution to portfolio performance (Burnie, Knowles and Teder, 1998). The monthly average asset allocations for each fund across each asset class within the portfolio are used, where the attribution framework decomposes the raw active return (fund return less return of the benchmark) into security selection and market timing components.[4] Attribution of investment performance can be performed using either an arithmetic approach (Karnosky and Singer (1995) and Singer, Gonzalo and Lederman (1998)) or geometric approach (Burnie, Knowles and Teder (1998)). In terms of the arithmetic approach, the methodology assumes the fund manager's portfolio management objective is to outperform using both 'top-down' and 'bottom-up' investment strategies. While this assumption has merit, given managers are likely to use elements of both styles, the attribution framework above leads to the necessity of a residual term which is potentially ambiguous (see Karnosky and Singer (1995) and Singer, Gonzalo and Lederman (1998)). In order to eliminate this residual or interaction term, Burnie, Knowles and Teder (1998) develop a geometric approach to decompose the active return into security selection and market timing components only.

2.2.1 Top-Down Portfolio Management

This geometric methodology assumes fund managers prioritise their portfolio management strategies between top-down and bottom-up styles, thereby rendering the residual term obsolete.[5] Top-down portfolio management assumes that investment managers' primary emphasis is asset allocation whereas the bottom-up strategy identifies security selection as taking precedence. The top-down asset allocation component (4) measures the portfolio

[4] This study evaluates the components of performance in single currency terms. Where the portfolio manager makes active decisions with respect to currencies, additional terms must be added to the attribution framework.

manager's ability to underweight or overweight the asset classes within the portfolio relative to each fund's unique strategic benchmark. The security selection component (5) for a top-down portfolio manager measures the stock selection effect using the portfolio's actual asset class weights. The total portfolio's active return (*Tot*), and the two components of total performance for a top-down investment strategy, asset allocation (R_a) and security selection (R_s), are represented geometrically:

$$Tot_t = [(1 + R_{at})(1 + R_{st})] - 1 \qquad (3)$$

$$R_{at} = \frac{(1 + \sum_i \omega_i \bar{r}_i)}{(1 + \bar{r}_b)} - 1 \qquad (4)$$

$$R_{st} = \frac{(1 + r_p)}{(1 + \sum_i \omega_i \bar{r}_i)} - 1 \qquad (5)$$

Where:

ω_i = average actual weight in asset class *i*;

$\bar{\omega}_i$ = benchmark weight in asset class *i*;

r_i = return earned by the fund in asset class *i*;

r_p = fund return for the total portfolio;

$\bar{r}_i$ = benchmark return representing a passive investment strategy in asset class *i*;

$\bar{r}_b$ = benchmark return for the total portfolio.

The individual asset class contributions for a top-down portfolio manager can be expressed geometrically as:

$$R_{at} = (\omega_i - \bar{\omega}_i)[\frac{(1 + \bar{r}_i)}{(1 + \bar{r}_b)} - 1] \qquad (6)$$

[5] The goal of partitioning managers on the basis of predominant style used is aimed at eliminating the interaction effect or residual term. However, the dichotomy may appear overly simplistic, as some managers may not see themselves as clearly belonging to a single group, but a mixture of the two.

$$R_{st} = \frac{\omega_i (r_i - \overline{r}_i)}{(1 + \sum_i \omega_i \overline{r}_i)} \quad (7)$$

2.2.2 Bottom-Up Portfolio Management

Portfolio management decisions that are predominantly bottom-up assume stock picking is of higher priority than asset allocation. Given that managers select securities across asset classes on the basis of fundamental value, bottom-up strategies are not limited by asset allocation weights in the portfolio. Accordingly, the security selection component for a bottom-up portfolio manager relies on a fund's benchmark weight in each of the asset classes. The bottom-up asset allocation component measures the impact of the portfolio's actual asset allocation divergence from the strategic benchmark based on the fund's portfolio returns rather than the performance of the benchmark. The bottom-up attribution framework at the total portfolio level, geometrically, can be represented as:

$$Tot_t = [(1 + R_{at})(1 + R_{st})] - 1 \quad (8)$$

$$R_{at} = \frac{(1 + r_p)}{(1 + \sum_i \overline{\omega}_i r_i)} - 1 \quad (9)$$

$$R_{st} = \frac{(1 + \sum_i \overline{\omega}_i r_i)}{(1 + \overline{r}_b)} - 1 \quad (10)$$

The individual asset class contributions for a bottom-up portfolio manager can be expressed geometrically as:

$$R_{at} = (\omega_i - \overline{\omega}_i)[\frac{(1 + \overline{r}_i)}{(1 + \sum_i \overline{\omega}_i r_i)} - 1] \quad (11)$$

$$R_{st} = \frac{\omega_i (r_i - \overline{r_i})}{(1 + \overline{r_b})} \qquad (12)$$

The performance methodology outlined above is used to evaluate the extent to which fund managers exhibit superior market timing and security selection skills with reference to their predominant portfolio management strategy (top-down versus bottom-up), individual asset allocation decisions, strategic benchmarks and portfolio returns.

3. DATA

This study uses monthly Australian pooled superannuation fund returns for 16 average and above average volatility funds using a unique data set provided by Towers Perrin Australia. The *Towers Perrin Pooled Superannuation Funds* database monitors fund performance across the entire Australian market and therefore a representation of fund manager performance.[6] Funds comprising the sample were included where Towers Perrin had complete historical information concerning performance, asset allocations and strategic benchmark weights provided by the investment managers over the entire 96-month period. Towers Perrin classifies pooled superannuation funds on the basis of historic volatility in fund returns as well as fund investment style. Two of the funds in the sample (denoted fund A and B) are managed by the same investment organisation. Fund B has therefore been removed from Table 4 in the results section reporting the sector performances.[7] The period of evaluation is the 8-year period January 1991-December 1998. The total assets under management for these 16 funds at December 1998 was around $A29.9 billion and investment performance is reported before management fees and tax. The market indices,

[6] While the sample size is relatively small compared with U.S. studies, the Australian market is considerably smaller coupled with these types of funds (superannuation) being relatively unique. Given the criteria for including funds, a number of funds were not included as they were either (1) not in existence at January 1991 and/or (2) did not have sufficient data (returns and asset allocations) to perform the analysis over the entire 8-year period. Therefore 10 funds (accounting for $A5.7 billion at December 1998 or 16 percent of the total eligible market size) could not be included, primarily on the basis of not having existed for the entire 8-year period being evaluated (i.e. they were younger funds). Another valid point concerning the sample size is due to Australian fund managers (generally) not offering multiple pooled superannuation vehicles to investors (which may be contrary to sector specialist funds). Overall, these factors contribute to the relatively small number of funds included in the study.

[7] While funds A and B have identical sector performances in Australian equities, international equities and Australian fixed interest, these funds have different investment objectives. These include different weights across investment sectors and different total fund returns.

outlined in Table 1, represent passive investment strategies across each asset sector.[8] The risk free rate used in the study is the 13-week Treasury note converted to a monthly rate.

<<INSERT TABLE 1>>

The *Towers Perrin Pooled Superannuation Funds* database includes monthly fund performance across individual sectors and the total portfolio.[9] Average asset allocations of each fund and across each month are also recorded, which allows inferences to be made concerning the asset allocation positions of investment managers relative to each fund's unique strategic benchmark. The investment managers provide these strategic benchmark weights for each of their pooled funds to asset consulting firms such as Towers Perrin in order to better understand the investment strategy.[10] Strategic benchmarks are generally fixed across time and represent a fund's long term investment objective. Over the short-term, managers may adopt strategies of under or overweighting fund asset allocations relative to their own strategic benchmark in an attempt to enhance portfolio performance. The funds included in the sample are also classified, where possible, according to the two distinct investment management styles – top-down and bottom-up. The partitioning of funds was performed based on information provided to Towers Perrin by the fund managers. Half of the funds in the sample predominantly used top-down strategies, 6 funds managed their portfolios using a bottom-up approach.

4. EMPIRICAL RESULTS

4.1 Overall Portfolio Performance

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[8] These market proxies are the most commonly used/cited indexes in the Australian investment industry.

[9] The sample group of superannuation funds in the study contains the standard survivorship bias problems faced by most performance evaluation studies in the literature, where funds included in the sample remain in existence at the end-date of the performance evaluation period. Studies including Brown, Goetzmann, Ibbotson and Ross (1992) and Elton, Gruber and Blake (1996) highlight the problems performance evaluation studies face where survivorship bias exists. The extent to which the results in the paper are biased is not known, however, analysis of Towers Perrin's historical performance surveys indicate that it is likely to be small. Given the major source of bias generally arises due to poor performing funds having higher attrition probabilities, survivor biased studies are likely to positively overstate performance than may otherwise be the case.

[10] These independent strategic benchmark weights provided by the investment managers have been used in the attribution analysis performed below.

The empirical results derived from both the Henriksson-Merton and Treynor-Mazuy models and presented in Table 2 do not support the hypothesis that funds collectively have security selection or market timing skill at the total fund level. Panel A of Table 2 (employing the Henriksson-Merton approach) reveals that a majority of funds exhibit security selection and market timing coefficients insignificant from zero. Three funds have selectivity estimates significantly different from zero, where two funds are significantly positive. Approximately half of the funds record negative stock selection estimates. The market timing performance of funds provides even greater evidence of an inability by fund managers to outperform. The results show that while a significant majority of funds (15 out of 16) have insignificant timing coefficients, the majority of funds (11 out of 16) have negative β_{p2} estimates. Further, the solitary fund exhibiting significantly positive market timing underperforms in security selection. Panel B of Table 2, reports the security selection and market timing estimates using the Treynor-Mazuy approach, and the findings are largely consistent with those in Panel A.

<<INSERT TABLE 2>>

An interesting finding documented in Table 2 is existence of strong negative correlation (cross-sectional) between selectivity and timing estimates.[11] Around two thirds of funds exhibit either positive selectivity coupled with negative timing or positive timing and negative security selection coefficients. Both the Pearson (-0.635) and Spearman (-0.435) correlation coefficients are significant at the 0.01 and 0.10 levels respectively. Other studies, including Henriksson (1984) and Coggin, Fabozzi and Rahman (1993) find evidence of a strong negative relationship between timing and selectivity, indicating that perceived skill in one component of portfolio management activity does not necessarily imply skill in the other. Henriksson (1984) hypothesises the existence of a negative relationship due to the market proxy being misspecified or the model omitting relevant factors explaining the derivation of fund returns. While the former argument may appear to have little merit in this study, due to the tests for timing and selectivity relying on the use of a more appropriate benchmark, the issue remains an empirical question. An alternative possibility driving the phenomena may be due to omitted risk factors. Jagannathan and Korajczyk (1986) suggest the negative correlation between timing and selectivity may occur as a result of portfolio managers holding options or option-like securities such as listed securities with high leverage. Coggin, Fabozzi and Rahman (1993) indicate that the phenomenon of a negative relationship between timing and security selection is derived due to sampling errors of the two estimates being negatively correlated. However, while not reported directly in this paper, evidence of negative correlation (time series) between timing and selectivity is statistically weak when consideration is given to the geometric performance attribution approach. One problem of testing this phenomenon in this paper with significant rigor is the limitation of only having a small number of funds (where the sample size is restricted due to such funds being unique). Indeed, future research is warranted concerning the contradiction is results concerning negative correlation between timing and selectivity that encompasses a much larger sample of funds and across multiple asset classes.

4.2 Sensitivity of Performance to Choice of Benchmark

Previous performance evaluation studies in both Australia and the U.S. have relied on the use of an equity market proxy as the benchmark, even where funds have non-equity assets as some proportion of the total portfolio. Henriksson (1984) states the use of such a benchmark is a sufficient market proxy where fund performance is highly correlated with the true market proxy. However, in response to Ippolito's (1989) conclusion that U.S. mutual funds earned sufficient risk-adjusted returns to recover expenses, Elton, Gruber, Das and Hlavka (1993) demonstrate that performance can be sensitive to the choice of benchmark used. These authors show that Ippolito's (1989) results were due to the benchmark proxy excluding the performance of non-S&P 500 securities.

In view of Elton et al.'s finding (1993), performance in this study is also analysed using the All Ordinaries Accumulation Index as the market proxy (following Sinclair's (1990) method) to evaluate the extent of possible bias generated for pooled superannuation funds.[12] As outlined in Table 1, pooled superannuation funds, on average, have less than 40 percent of their strategic benchmark allocations to the Australian equities asset class.

[11] Similar to the results in Table 2, Table 4 also shows a strong negative relationship (cross-sectional) between timing and selectivity estimates across Australian equities, international equities and Australian fixed interest.
[12] Fund returns in the sample, on average, had a correlation coefficient of 0.92 with the All Ordinaries Accumulation Index. This compares with a correlation coefficient of investment performance relative to each fund's specific strategic benchmark asset allocation of approximately 0.97.

Sinclair (1990) reports that 15 of the 16 funds examined in the period 1981-1987 exhibited significantly positive security selection estimates at 0.05 level under the Henriksson-Merton model. In contrast to the results presented in Table 2, Table 3 clearly demonstrates the problems that arise where a benchmark is used for diversified funds that ignores other asset class exposures beyond Australian equities provides. Funds in the sample exhibit significantly higher security selection estimates while simultaneously recording significantly worse market timing. While the results in both Table 2 (Panel A) and Table 3 provide consistent evidence that funds do not exhibit superior timing ability under the Henriksson-Merton approach, the use of an equity market proxy overstates both pooled superannuation funds' poor timing ability and successful security selection. These findings support Elton, Gruber, Das and Hlavka's (1993) correction of Ippolito's (1989) finding that mutual funds outperform.

<<INSERT TABLE 3>>

4.3 Performance of Individual Sectors

Analysis of the performance of funds in Australian equities, international equities and Australian fixed interest sectors was evaluated over the 8-year period to December 1998 using both the Henriksson-Merton and Treynor-Mazuy models.[13] Table 4 presents the results using the Henriksson-Merton model, again documenting the inability of funds to outperform the relevant market indices.[14] The overwhelming majority of funds exhibit positive security selection estimates in Australian equities (6 funds significant) and Australian fixed interest sectors. However around three-quarters of funds in Australian equities (2 funds significant) have negative timing coefficients. In Australian fixed interest 14 of 15 funds (1 fund significant) record negative timing estimates. International equities performance on the basis of security selection is the worst across all sectors, however only

[13] The results derived using the Treynor-Mazuy model were consistent with the Henriksson-Merton and consequently are not directly reported.

[14] Tests for market timing and selectivity were also performed to assess the potential bias in results arising from benchmark inefficiency following the approach outlined by Admati and Pfleiderer (1997). These alternative market proxies are more difficult yardsticks for funds to outperform as they represent the average performance of potentially informed investment managers. The security selection estimates were generally lower across all sectors for all funds and independent of the model used. Overall, the results indicated that funds do not exhibit superior selectivity or timing skill.

one manager recorded significantly negative selectivity. Market timing ability in the international shares sector is shown to be non-existent.

<<INSERT TABLE 4>>

4.4 Geometric Performance Attribution

An alternative test for security selection and market timing ability used in this paper relies on a performance attribution methodology decomposing the active raw return (not adjusted for risk) in the period across asset sectors given the active decisions employed by investment managers. The results in Table 5 indicate 2 funds have positive and significant active returns at the total fund level, and only one fund is successful in both timing and stock selection. The empirical results across the individual asset classes also indicate the majority of funds did not exhibit superior performance.[15] Stock selection in Australian equities was generally the most successful asset class for the funds in the sample, however no evidence exists of superior market timing ability. Four of the five funds with significantly positive selection record positive timing however none are statistically significant. Fund performance in international equities and Australian fixed interest also supports the general finding that funds overall do not outperform and therefore timing or selection skill being absent. In international equities, 12 funds have negative mean security selection values (4 significant) and 8 of the 14 funds exhibit negative timing. Little evidence supports collective timing and selection skill by managers in the Australian fixed interest sector. Analysis of the performance of funds predominantly top-down or bottom-up does not indicate that funds exhibit superior skill in asset allocation or stock selection respectively.

<<INSERT TABLE 5>>

Further tests of performance are contained in Table 6 evaluating the consistency of timing and selection skill for pooled superannuation funds. Analysis of the number of periods

[15] Performance attribution was also performed using an arithmetic approach which assumes investment managers emphasise both security selection and market timing. The results were consistent with the evidence presented using the geometric performance attribution approach. Further, only 14 funds are evaluated as a result of 2 fund managers (C and M) not being easily partitioned into top-down or bottom-up styles.

(months) where investment managers make correct forecasts, rather than the magnitude of the forecasts, provides information regarding the relative success of the portfolio management process over time. Hypothesis tests are conducted over the 96-month period to identify the ability of investment managers to make correct forecasts. The null hypothesis assumes the proportion of successful forecasts made by portfolio managers equates to 50 percent (H_0: p=0.5). Rejection of the null hypothesis concludes the portfolio manager exhibits evidence of positive skill where the proportion exceeds 0.5 for both market timing and stock selection (H_1: $p \neq 0.5$). In Australian equities, 5 funds record positive security selection significantly greater than 50 percent of months and 5 funds show significant consistency in market timing forecasts in the Australian fixed interest sector. However, the results provide further evidence that funds collectively did not exhibit successful security selection or timing skills.

<<INSERT TABLE 6>>

5. SUMMARY AND SUGGESTIONS FOR FUTURE RESEARCH

This paper evaluates the market timing and security selection capabilities of Australian pooled superannuation funds. The empirical evidence indicates that funds did not exhibit superior selectivity or timing skill at the total portfolio level, Australian equities, international equities and Australian fixed interest and confirms the findings of previous studies that funds do not outperform appropriate market indices. While funds are generally more successful in their security selection strategies than market timing, both components of performance do not provide investors with both positive and statistically significant risk-adjusted performance. An interesting finding is the strong negative cross-sectional correlation between selectivity and timing using both the Henriksson-Merton and Treynor-Mazuy models, supporting prior U.S. studies, however the phenomena is not supported using the geometric performance attribution methodology. The negative correlation phenomena requires further research, using an expanded data set and alternative evaluation models.

The paper also demonstrates the importance of using appropriate benchmarks that are consistent with the investment strategies and assets held in diversified portfolios such as pooled superannuation funds. Sinclair's (1990) finding that funds exhibit superior security selection skill and significantly perverse timing is shown to arise through the use of a misspecified market proxy that excludes assets other than Australian equities. Alternative benchmarks reflecting each fund's unique investment strategy leads to more accurate inferences concerning portfolio performance. An extension of this research should include an investigation of the market timing and stock selection capabilities of funds using a conditional performance evaluation framework that accounts for public information and time variation in risk.

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Table 1
Market indices by asset class. The mean strategic benchmark weights are at 31 December 1998. Average weights are calculated by dividing the sum of weights to the respective sectors by the number of funds that have benchmark exposures to those specific asset classes. For this reason, the sum of the weights exceeds 100 percent. The Morgan Stanley Capital International Index includes gross dividends reinvested and is converted back into Australian dollars. The Salomon Brothers Index is hedged back into Australian dollars.

Asset Class	Market Index	Benchmark Weight (%)
Australian Equities	ASX All Ordinaries Accumulation Index	36.5
International Equities	MSCI World (ex-Australia) Accumulation Index	20.9
Australian Direct Property	Towers Perrin Direct Property Index	8.2
Australian Listed Property	ASX Listed Property Accumulation Index	7.1
Australian Fixed Interest	Warburg Dillon Read Composite Bond Index	20.1
International Fixed Interest	Salomon Bros. World Bond Index	6.6
Australian Inflation-Linked Bonds	Warburg Dillon Read Inflation-Linked Bond Index	5.7
Cash	Warburg Dillon Read Bank Bill Index	7.0

Table 2

Pooled superannuation fund performance at the total portfolio level before expenses using the Henriksson-Merton model (Panel A) and Treynor-Mazuy model (Panel B) over the period January 1991 to December 1998. Risk-adjusted performance due to security selection (α_p) is expressed in percentage terms per month.

Panel A: Henriksson-Merton Model

Fund	α_p	$t(\alpha_p)$	β_{p1}	β_{p2}	$t(\beta_{p2})$	R^2
A	-0.014	-0.20	0.985	-0.022	-0.34	0.971
B	-0.026	-0.45	0.966	0.006	0.09	0.968
C	-0.022	-0.22	1.039	-0.082	-0.64	0.924
D	0.050	0.39	0.889	-0.130	-1.18	0.868
E	0.000	0.00	0.947	-0.039	-0.58	0.967
F	0.005	0.06	1.004	0.041	0.54	0.959
G	0.106	1.02	0.920	0.091	1.20	0.927
H	0.168	2.40**	0.933	-0.129	-1.63	0.963
I	0.219	2.32**	0.933	-0.125	-1.36	0.952
J	0.131	1.63	1.096	-0.011	-0.14	0.954
K	-0.024	-0.30	1.065	-0.069	-0.77	0.955
L	0.009	0.09	0.974	-0.065	-0.65	0.933
M	-0.058	-0.59	1.043	0.001	0.01	0.956
N	-0.255	-2.47**	1.065	0.208	2.07**	0.938
O	-0.091	-0.74	1.048	-0.021	-0.21	0.928
P	0.063	0.55	0.966	-0.055	-0.52	0.926
α	9+	7-				
β_2	5+	11-				
α, β_2	2+	4-				
α, β_2 +/-	10					

Panel B: Treynor-Mazuy Model

Fund	α_p	$t(\alpha_p)$	β_p	γ_p	$t(\gamma_p)$	R^2
A	-0.021	-0.40	0.996	-0.003	-0.37	0.971
B	-0.023	-0.54	0.963	0.001	0.06	0.968
C	-0.024	-0.33	1.078	-0.015	-1.09	0.924
D	0.019	0.18	0.952	-0.017	-1.43	0.869
E	-0.015	-0.27	0.965	-0.004	-0.68	0.967
F	0.031	0.56	0.984	0.002	0.31	0.959
G	0.154	1.90*	0.877	0.007	1.03	0.927
H	0.139	2.75***	0.997	-0.019	-2.09**	0.964
I	0.190	2.79***	0.993	-0.016	-1.76*	0.953
J	0.169	2.03**	0.980	0.000	0.00	0.928
K	-0.037	-0.58	1.099	-0.010	-0.96	0.956
L	-0.015	-0.20	1.004	-0.007	-0.57	0.933
M	-0.061	-0.86	1.043	0.001	0.08	0.956
N	-0.164	-2.21**	0.965	0.020	1.91*	0.938
O	-0.097	-1.07	1.058	-0.003	-0.31	0.928
P	0.033	0.38	0.992	-0.004	-0.37	0.926
α	7+	9-				
γ	6+	10-				
α, γ	3+	6-				
α, γ +/-	7					

*Significant at 0.10 level
**Significant at 0.05 level
***Significant at 0.01 level
The *t*-statistics are calculated using White (1980) heteroskedastic consistent standard errors.
The coefficient of determination is the adjusted R^2.

Table 3
Pooled superannuation fund performance at the total portfolio level before expenses using the Henriksson-Merton model over the period January 1991 to December 1998. Performance is measured using the All Ordinaries Accumulation Index is used as the market proxy consistent with Sinclair's (1990) study. Risk-adjusted performance due to security selection (α_p) is expressed in percentage terms per month and market timing estimates are represented in β_{p2}.

Fund	α_p	$t(\alpha_p)$	β_{p1}	β_{p2}	$t(\beta_{p2})$	R^2
A	0.254	1.95*	0.518	-0.107	-1.74*	0.903
B	0.150	1.22	0.427	-0.061	-1.01	0.882
C	0.398	2.52**	0.475	-0.213	-2.82***	0.851
D	0.444	2.00**	0.436	-0.208	-2.26**	0.801
E	0.424	2.49**	0.514	-0.155	-1.66	0.836
F	0.380	2.36**	0.483	-0.088	-1.14	0.849
G	0.418	3.77***	0.510	-0.041	-0.73	0.895
H	0.486	3.24***	0.411	-0.164	-2.30**	0.840
I	0.580	3.51***	0.466	-0.223	-2.68***	0.848
J	0.521	2.90***	0.505	-0.144	-1.54	0.852
K	0.350	2.06**	0.532	-0.146	-1.73*	0.867
L	0.178	1.38	0.519	-0.070	-1.08	0.888
M	0.324	1.96*	0.544	-0.126	-1.84*	0.858
N	0.104	0.68	0.577	0.008	0.11	0.863
O	0.282	1.79*	0.524	-0.129	-1.58	0.874
P	0.569	3.37***	0.457	-0.207	-2.68***	0.807

*Significant at 0.10 level
**Significant at 0.05 level
***Significant at 0.01 level
The *t*-statistics are calculated using White (1980) heteroskedastic consistent standard errors.
The coefficient of determination is the adjusted R^2.

Table 4
The performance of pooled superannuation funds before expenses across the three major investment sectors using the Henriksson-Merton model. The period of evaluation is January 1991 to December 1998 where risk-adjusted performance due to security selection (α_p) is expressed in percentage terms per month and market timing estimates are represented in β_{p2}.

	Australian Equities				International Equities				Australian Fixed Interest			
Fund	α_p	$t(\alpha_p)$	β_2	$t(\beta_2)$	α_p	$t(\alpha_p)$	β_2	$t(\beta_2)$	α_p	$t(\alpha_p)$	β_2	$t(\beta_2)$
A	-0.009	-0.10	-0.042	-1.03	-0.063	-0.30	-0.084	-0.78	0.033	1.02	-0.024	-0.27
C	0.032	0.28	-0.055	-0.92	-0.374	-0.86	0.013	0.05	0.050	0.73	-0.091	-0.74
D	0.086	0.49	-0.086	-1.05	0.069	0.19	0.069	0.34	0.100	1.44	-0.270	-1.81
E	0.306	2.37 **	-0.075	-1.16	-0.481	-2.80 ***	0.073	0.83	0.041	0.44	-0.002	-0.02
F	-0.029	-0.25	0.067	1.12	0.067	0.44	-0.088	-0.95	0.010	0.22	-0.016	-0.19
G	0.403	2.23 **	0.030	0.33	0.218	0.48	0.093	0.44	0.030	0.38	-0.069	-0.45
H	0.191	2.51 **	-0.034	-0.93	0.085	0.42	-0.071	-0.60	0.049	1.40	-0.075	-1.13
I	0.198	2.57 **	-0.040	-1.13	0.103	0.47	-0.075	-0.61	0.083	1.59	-0.153	-1.29
J	0.488	2.77 ***	-0.062	-0.68	-0.281	-0.86	0.035	0.17	0.099	1.92	-0.164	-1.54
K	0.230	2.04 **	-0.129	-2.25**	-0.006	-0.03	-0.128	-1.11	0.023	0.60	0.051	0.65
L	0.026	0.22	-0.041	-0.68	0.024	0.07	-0.091	-0.51	0.002	0.02	-0.045	-0.41
M	0.033	0.29	0.002	0.03	-0.165	-0.72	0.081	0.73	0.079	1.03	-0.227	-1.62
N	0.014	0.12	0.013	0.19	-0.280	-1.43	0.139	1.55	0.171	2.61**	-0.327	-2.26 **
O	0.055	0.44	-0.038	-0.57	-0.103	-0.43	-0.018	-0.15	-0.017	-0.33	-0.074	-1.15
P	0.088	0.91	-0.101	-1.84*	0.343	0.93	0.060	0.30	0.000	-0.01	-0.006	-0.11
α	13+	2-			α	7+	8-		α	14+	1-	
β_2	4+	11-			β_2	8+	7-		β_2	1+	14-	
α, β_2	3+	1-			α, β_2	3+	3-		α, β_2	1+	1-	
α, β_2 +/-	11				α, β_2 +/-	9			α, β_2 +/-	13		

*Significant at 0.10 level
**Significant at 0.05 level
***Significant at 0.01 level
The *t*-statistics are calculated using White (1980) heteroskedastic consistent standard errors.

Table 5
Pooled superannuation fund performance at the total portfolio level and sector level before expenses using the geometric attribution framework. Performance is expressed as the mean active performance per month in percentage terms over the period January 1991 to December 1998. Funds are partitioned on the basis of their predominant portfolio management style.

	Total Portfolio			Australian Equities		International Equities		Australian Fixed Interest	
Fund	**Tot**	**R_s**	**R_a**	**R_s**	**R_a**	**R_s**	**R_a**	**R_s**	**R_a**
Panel A: Top-Down Portfolio Management									
A	-0.036	-0.034	-0.002	-0.029	-0.005	-0.043*	-0.017	0.006*	0.007
B	-0.035	-0.004	-0.030	-0.022	-0.004	-0.033**	-0.014	0.006	0.013
D	-0.101	-0.091	-0.010	-0.007	0.001	-0.004	-0.002	-0.007	0.011
E	-0.061	-0.039	-0.022	0.071**	0.003	-0.070***	-0.002	0.006	0.018
J	0.167***	0.109**	0.059**	0.159***	0.012	-0.033	0.000	0.005	0.002
K	-0.038	-0.057	0.020	0.027	0.011	-0.055**	-0.022**	0.011***	0.003
L	-0.047	-0.054	0.007	-0.001	0.005	-0.046	0.001	-0.001	0.004
P	0.004	0.045	-0.041*	-0.013	-0.003	0.066	-0.004	-0.001	0.002
Panel B: Bottom-Up Portfolio Management									
F	0.034	-0.013	0.047*	0.023	-0.001	-0.025	-0.001	-0.005	0.016
G	0.128*	0.195***	-0.067**	0.180***	-0.001	0.007	-0.002	-0.006	0.024**
H	0.054	0.034	0.021	0.030**	0.003	-0.019	0.010**	-0.002	-0.001
I	0.092	0.081*	0.011	0.036**	0.002	-0.025	0.009**	-0.005	0.003
N	-0.064	-0.025	-0.039	0.028	0.012	-0.029	0.009	-0.003	0.002
O	-0.081	-0.112*	0.031	0.012	0.010	-0.061	0.002	-0.003	0.021*
SS		5+	9-	9+	5-	2+	12-	5+	9-
MT		7+	7-	9+	5-	6+	8-	13+	1-
SS, MT		3+	5-	7+	3-	0+	6-	5+	1-
SS, MT +/-		6		4		8		8	

*Significant at 0.10 level
**Significant at 0.05 level
***Significant at 0.01 level

Table 6
Evaluation of the ability of portfolio managers to make correct forecasts in their investment decision-making over the period January 1991 to December 1998.

	Total Portfolio (%)		Australian Equities (%)		International Equities (%)		Australian Fixed Interest (%)	
Fund	**R_s**	**R_a**	**R_s**	**R_a**	**R_s**	**R_a**	**R_s**	**R_a**
				Panel A: Top-Down Portfolio Management				
A	40.6*	50.0	47.9	45.8	46.9	37.5**	61.5**	55.2
B	47.9	42.7	47.9	47.9	46.9	37.5**	61.5**	58.3
D	37.5**	56.3	38.5**	52.1	53.1	54.2	50.0	62.5**
E	46.9	45.8	60.4*	49.0	32.3***	46.9	47.9	61.5**
J	55.2	58.3	63.5***	55.2	45.8	46.9	59.4*	53.1
K	43.8	47.9	58.3	53.1	40.6*	43.8	58.3	46.9
L	43.8	53.1	49.0	57.3	49.0	49.0	52.1	57.3
P	55.2	37.5**	47.9	55.2	61.5**	46.9	49.0	54.2
				Panel B: Bottom-Up Portfolio Management				
F	47.9	55.2	52.1	42.7	47.9	44.8	42.7	57.3
G	67.7***	36.5***	68.8***	37.5**	47.9	45.8	49.0	61.5**
H	55.2	55.2	59.4*	61.5**	43.8	63.5***	53.1	50.0
I	55.2	47.9	59.4*	59.4*	42.7	65.6***	49.0	60.4*
N	45.8	45.8	52.1	47.9	44.8	55.2	53.1	56.3
O	40.6*	57.3*	53.1	57.3*	41.7	52.1	47.9	60.4*

*Significant at 0.10 level
**Significant at 0.05 level
***Significant at 0.01 level