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Performance Evaluation of Australian Superannuation Funds

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A Thesis Submitted for the Degree of Doctor of Philosophy

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My parents are the inspiration for this work. I dedicate every thought I put in this thesis to my beloved parents.

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DECLARATION

I hereby declare that this thesis contains no material that has been accepted for the award of any other degree or diploma in any university or equivalent institution, and that to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

[redacted]

Vijaya Bhaskar Marisetty

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ABSTRACT

This thesis has four objectives. It aims to provide new findings on the historical performance of Australian superannuation funds by first using traditional performance ratios. Some A$ 300 billion is managed by just few hundred retail and wholesale fund managers: the remaining A$ 200 billion is managed by other funds. The effect of fund characteristics on fund expenses and thus fund performance is investigated next. We also investigate whether there is an optimal fund size at which the economies of scale is fully realised: the fixed expenses of funds are spread over a greater number of customers, thus providing reductions in unit costs, which is the source of the economies of scale. The fund managers' skills to secure superior performance are investigated using well established and robust selection and market timing test models. Finally, we devise an improved measure for accurately tracking market timing skills of fund managers. This measure is based on a theoretical approach and incorporates the information structure of the fund managers. This new measure also builds into the model *continuously* changing market conditions instead of the hitherto assumed up– and down– market conditions in the current theories. Hence, a comprehensive re-examination of fund performance along with a new approach to improve a current measure justifies this study.

Superannuation funds can be classified by the modes of contribution of employers and employees: retail funds, where the fund selection is at the discretion of investors; wholesale funds, where contributions are involuntary; and self-managed funds, where investors create and manage their own superannuation funds. The choices embedded in superannuation funds is a topic of intense discussion and public debate. This study is also concerned with this aspect as to whether types of funds are associated with performance.

Appropriate methods, which are widely accepted for performance evaluation, are adapted in this study for application to superannuation funds. For evaluation of historical performance of funds, four popular single period methods, namely the Sharpe ratio, Treynor ratio, Jensen's Alpha and Modigliani and Modigliani (M-Square) method, are used. Next, multiple regression methodology is applied to relate fund characteristics to fund performance to obtain a set of new results on the issue of how fund characteristics are correlated with performance. The study on the existence of economies of scale borrows from the widely-accepted translog cost function. In it, we compute partial derivatives to measure cost elasticity with fund characteristics. On selection and timing skills, Treynor-Mazuy and Henriksson-Merton models are applied. Lee-Rahman model, a third method, measures the quality of market timing for the first time in Australia: it is measured as a ratio of the variance of the fund returns to the variance of market returns. The new method devised in this study is a logistic smooth transition model, based on business cycle studies, to address the information structure problem of fund managers. This model attempts to capture changing probability beliefs of the fund managers reflected on the time-varying portfolio betas with continuously changing market conditions.

Some very interesting and new findings have emerged from the application of the chosen methods for performance attribution. The one-period performance measures indicate that both retail and wholesale superannuation funds *underperform* the market benchmark over the period of the study. These results are consistent with evidence in the literature and no surprises are found. Performance measures based on market and risk-adjusted Jensen's Alpha and M-square measures provide more consistent estimates than the ones from risk-adjusted measures of Sharpe, and Treynor ratios.

Age of the fund is a significant variable that suggest lower expenses in the cases of retail funds that have longer history. Variables such as fund size, fund returns are not significantly related to fund expenses and therefore also with the performance of retail and wholesale funds. Fund objective is positively related to fund expenses, which indicates that fund objectives do influence expenses and therefore performance. Strong evidence on economies of scale for retail superannuation funds is found for funds with asset size above A$30 million. These findings are new suggesting *fund types and fund characteristics* affect fund performance.

Results using Treynor-Mazuy and Henriksson-Merton models for stock selection and market timing skills of the fund managers indicate that retail and wholesale fund managers *do not* posses superior skills. These findings are consistent with Australian evidence on wholesale funds and international evidence in general. Application of the Lee-Rahman model suggests that most retail and wholesale funds have some level of quality in market timing decisions but this did not translate as superior performance.

The logistic smooth transition model yields some interesting results. The lagged yield spread (compared to risk premium) provides a good representation of fund managers' information structure. This indicates retail and wholesale fund managers use yield spread related variables to predict future market conditions. Second, duration of market conditions is an important variable for modeling information structure. Third, the speed of portfolio risk-adjustment to changing market conditions varies between retail and wholesale funds. Retail fund managers rebalance/adjust their portfolio weights more often than wholesale managers. The findings relating to the performance of fund managers against market benchmark is consistent with prior results: that is, fund managers' *underperform* market benchmark.

CHAPTER ONE

CHAPTER ONE

AUSTRALIAN SUPERANNUATION FUNDS: RESEARCH ISSUES

1.1 Background to the Australian superannuation funds

Performance evaluation of managed funds has occupied centre stage in portfolio management research over the last four decades resulting in some important advancement while leaving room for further research on specific areas. Among other issues, agency issue has surfaced as the driving force behind the very active ongoing research about performance evaluation: principal's (investor's) investments decisions are managed by the agents, who are the trustees and fund managers, hence exacerbating agency problem. Apart from that, investors' concern about preserving and modestly growing their billions of dollars invested in managed funds has also contributed in no small measure to the continuing interest driving further research of this study on performance attribution.

Performance evaluation of managed funds, thus, is of great practical significance, since it is designed for the welfare of the investors and the transfer of wealth from one generation to the next in a given economy. The welfare objective is even more significant in the process of management of pension or superannuation funds – income protection plans of a country - designed to create generational transfer of wealth. Superannuation funds in Australia as elsewhere have more defined long-term welfare objectives. An understanding of their performance needs further research attention. These funds have implications for long-term economic stability because of the sheer size of the amount invested in these funds as well as their growth at rates more than income growth in the Australian economy. The growing concern about the retirement income of the ageing population in Australia makes this area of research timely at this point of a continuing debate as to the sufficiency of the superannuation schemes.

Australian superannuation fund market is one of the largest investment vehicles of the economy. They constitute 70 percent of the total managed funds market with A$ 518 billion (as of December, 2002) in assets. The funds are growing at an average annual rate of 11 percent from 1989.[1] This phenomenal growth has been attributed to the introduction in 1984 of a compulsory superannuation scheme for employees. The contribution rate has been on the rise over the years. From 3 percent contribution by the employer at the time of the advent of the scheme, it has been raised to the current 9 percent compulsory rate. Some employers pay as much as 17.5 percent with an additional option available to contribute more than the compulsory employee's rate of 8 percent, subject to a tax charge of 15 percent on the excess contribution.

The responsibility for the management of superannuation funds is in the hands of the trustees. A typical fund may have more than one trustee. As per ASFA (Australian Superannuation and Funds Association) there are six trustees on average for each Australian superannuation fund. There is sizable concentration of trustees in the Australian superannuation funds market. As per the same source, out of 28,000 trustees

[1] The statistics are from the Australian Prudential Regulatory Authority (APRA) 2002 report on superannuation market and the Australian Superannuation Funds Association (ASFA) 2001 report.

(excluding trustees of self-managed funds), the top 20 trustee groups manage nearly 75 percent of the superannuation assets. These top 20 trustees are working within large corporate structures owned by financial institutions including life offices and banks.

Thus, the performance outcomes of a majority of superannuation funds lie squarely on the decision making ability of a small group of investment companies. This makes performance evaluation of superannuation funds even more crucial. The following sections provide a brief account of superannuation funds industry in Australia before identifying research issues and possible contributions of this thesis to this important area of research.

1.1.1 Types of superannuation funds

Australian superannuation funds are broadly divided into four types; wholesale, retail, public-sector and self-managed funds. This division is based on the modes of contribution to the fund. In the case of wholesale funds, the contribution is directly made by the employer with minimal consent on the investment choice of the employees. In most cases the contribution into wholesale superannuation is involuntary. Retail funds receive funds through the voluntary choice of the employees on the investment schemes of a given fund. Employees directly select the fund or in most cases as guided by brokers or financial planners in the selection process of funds. Public-sector funds are managed funds similar to wholesale funds and are for the employees of Federal, state and local governments. Self-managed funds as the name suggests are managed by the contributors without employing fund managers' expertise in managing superannuation. This route is more predominant with small business community. Majority of the small businesses including professionals in Australia follow this mode of saving.

The wholesale funds are further divided as corporate and industry funds as per industry practice and APRA's guidance over time. Corporate funds are contributions from a single employer or group of employers. Industry funds are sponsored by employer and employee organisations of one or more industries. Table 1.1 provides summary statistics of superannuation industry based on the type of funds.

Table 1.1: Australia's Superannuation Industry, July 2002

Type of fund	*Number of funds*	*Assets (AUD $b)*	*Number of Accounts (millions)*
Corporate	2,045	65	1.4
Industry	109	52	7.6
Public sector	78	102	2.9
Retail	240	175	12.7
Small Funds (self-managed funds)	251,756	103	0.4
Total	254,228	497	25.1

Source: Australian Prudential Regulatory Authority (APRA): statistics from annual reports.

As shown in the table, retail funds sector is the largest sector in the Australian superannuation funds market. However, self-managed funds outnumber other sectors in terms of the number of funds. They represent more than 90 percent in terms of the number of funds. Being managed by individual members, there is no centralised database on these funds. Thus there has been no research in these funds. Agency problem is also not an important issue in self-managed funds sector: unlike the case in managed funds, where the agents are the trustees and managers, self-managed funds do not have agents.

1.1.2 Superannuation funds management

Trustees of superannuation funds manage superannuation funds by seeking extensive range of services from various service providers. Large superannuation funds generally follow an integrated approach in managing funds and those include membership administration, investment management, insurance and also tax issues for their members. Small funds outsource these services to professional service providers. Table 1.2 provides average asset allocation of superannuation assets in Australia (excluding self-managed funds).

Table 1.2 provides information on the major asset classes in which superannuation funds have been invested. Investment in equities form the major asset class making up 44 percent or $A 227 billion of investments. Superannuation funds also have significant exposure to overseas investment as indicated by their 19 percent share in offshore investments. It is interesting to note that the investment on fixed income securities is only 17 percent. Investment in cash, loans and property accounts for 8, 4 and 9 percent respectively.

Table 1.2: Asset Allocation of Australian Superannuation Funds as on December 2002

Asset types	*Assets (AUD $billion)*	*Assets (%)*
Cash and Deposits	41	8
Loans and Placements	20	4
Interest-bearing Securities	89	17
Equities in Units and Trusts	227	44
Direct Property	28	5
Overseas	98	19
Other	15	3
Total	518	100

Source: Australian Prudential Regulatory Authority (APRA): statistics from annual reports.

There are several domestic and international asset management companies to provide various services for effective management of superannuation funds. Thus, the agency issues in superannuation funds are multiplied. The ability of trustees to select better service providers becomes critical. The performance of superannuation funds depends on the fund managers employed by the trustees.

1.1.3 Fund administration

The major administrative functions of the superannuation funds are day-to-day operations of member services, administration of fund managers and administration of various consultants including general consultants, asset consultants, custodians, legal experts and actuarial experts. These activities add to the expenses incurred and therefore likely to affect fund performance. Most of the superannuation funds outsource these services, a point noted earlier in this Chapter. Superannuation fund administration is a complex activity, and demands efficient management to undertake these activities to maximise the welfare of the members. Thus, the cost of administration is a critical variable to make an assessment as to the quality of the management of the superannuation funds.

Tables 1.3 and 1.4 provide survey results of Australian Superannuation Funds Association (ASFA) on the operating costs of superannuation funds. Table 1.3 reports the range of costs per member per week based on member size while table 1.4 reports the average expense ratios of superannuation funds during 1996 to 2002.

The statistics in Table 1.3 indicate that the average member expenses decrease with increase in membership. The average expense of a fund with 100,000 or more members is almost a tenth of the expenses of funds with 1,000 or fewer members. It means that fund size is a determinant of expenses and so performance is likely to be affected as well.

Table 1.3: Range of Costs Per Member Per Week of Funds, as at 2002

No. of Members in Funds	*Minimum ($AUD)*	*Maximum ($AUD)*	*Average ($AUD)*
Less than 1000	1.65	20.75	6.67
1000 - 10,0000	0.83	10.75	4.18
10,001 - 30,000	0.70	1.84	1.30
30,001 – 100,000	0.53	2.72	1.00
More than 100,000	0.37	1.80	0.89

Source: Australian Superannuation Funds Association 1999 survey on superannuation funds costs.

Table 1.4: Average Management Expense Ratios[a] of Superannuation Funds over 1996-2002

Fund Type	*Equal-weighted expense ratio*	*Asset-weighted expense ratio*	*Equal-weighted expense ratio to gross return*	*No. of funds*
Corporate	1.24%	0.87%	13%	1134
Industry	1.56%**	1.30%	20%**	100
Public sector	1.33%	0.58%	17%	27
Retail	1.56%**	1.32%	28%**	96
All funds	1.28%	1.07%	15%	1357

Source: Coleman. Esho and Wong (2003), Australian Prudential Regulatory Authority.

[a]Management expense ratio is defined as the percentage of management related expenses (which includes fees to managers, custodians and asset consultants) relative to total assets.

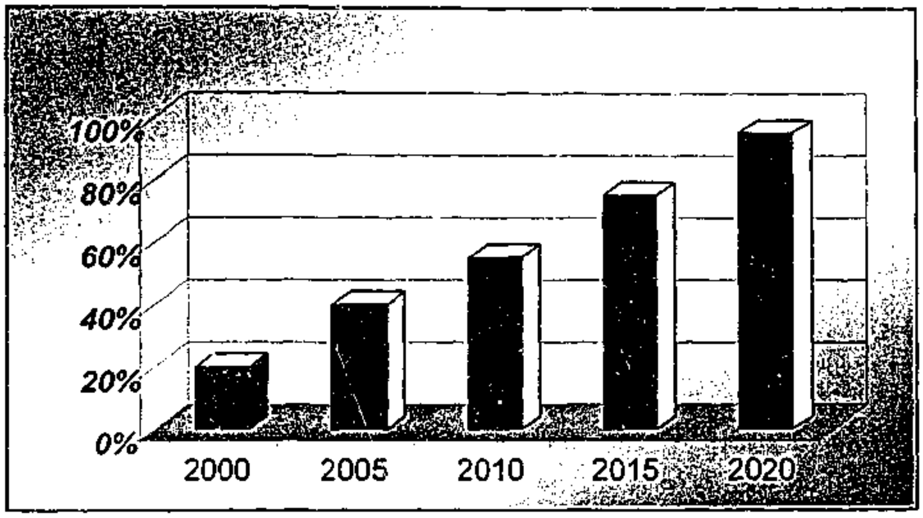
** indicates mean expense ratios within a particular fund category is significantly different from mean expense ratio for corporate funds at 99% confidence level.

In Table 1.4, the expense ratios of various types of superannuation funds are reported using different methods of calculating expense ratios. It indicates that, both by using equal-weighted and asset-weighted methods, corporate and public sector funds have lower expense ratios than industry and retail funds. The results are more prominent when asset weights are applied to arrive at expense ratios. Retail funds have the highest expense ratio of 28 percent of the gross returns and they are also ranked as the highest in terms of proportion of expenses in gross returns. It can also be noted that the industry and retail funds have significantly higher expenses than corporate funds. The lowest expense ratio – example, 13 percent of the gross returns is found in corporate funds. This might be due to the larger account size of corporate funds. Table 1.1 indicates that amount per account invested in corporate funds is much higher than in industry funds.

1.1.4 Future of superannuation funds

The continued increases in growth rates of Australian superannuation funds have been due to policy changes. Policy of compulsory contribution and tax concessions on contributions can be viewed as the two major factors driving growth. However, investor interest on retirement saving and performance of superannuation are important factors for sustained growth. The existing restrictive policy on choice of investment has raised a debate about the investor interest in investing superannuation funds. The recent tax changes, which introduced a surcharge of 15 percent on additional contributions by higher income earners, may encourage investors to look for alternative tax effective investment. It is argued that it is the performance of superannuation funds that determines the long-term future. However, the policy of compulsory contribution and favourable tax policy would be the main influencing factors for most of the future growth of the sector. The bar charts in the Figure 1.1 portray projected growth of superannuation funds as a percentage of GDP based on the figures provided by the Commonwealth Treasury Retirement Income Modeling Group.

Figure 1.1: Projected growth of superannuation fund holding (as percentage of GDP)



Source: Commonwealth Treasury Retirement Income Modeling Group report, 1999.

These numbers in the figure may be construed as indicating the future importance of superannuation funds to the Australian economy. The growth rate not only is encouraging, but is indicative also that the superannuation asset play as an important element in the economic growth since it is providing huge resources for investment activities in the economy. The average annual growth rate of the forecast is 6.7 percent from the base year 2000 to 2020. This is twice the income growth rate of about 3-4 percent per annum.

1.2 Motivations

The motivation for this study is based on two grounds. The primary motivation for the study comes from noting the absence of a comprehensive published study on the Australian superannuation sector. The sheer size of this sector and the limited research to-date on this sector provides an opportunity to address unanswered questions on the performance and management of superannuation funds. Agency issue in the Australian superannuation sector is another major motivating factor. This issue is even more critical due to the choices embedded in the management of the superannuation.[2] Further, this issue has been the driving force of current and continuing claims by fund managers of superior ability to perform and grow the funds are under investigation. Investors can either self-manage or manage through agents. However, this choice is not open to all investors. The findings of this study may help shape some aspects for future policy consideration on the role of the principal-agent issue in superannuation fund management.

Another reason that motivates this study is the gap in the existing literature on performance evaluation. There is a gap in the literature in terms of the description on the information structure used by fund managers. The existing studies measure fund managers' skills using various benchmarks in order to assess whether a given fund manager exceeds the set benchmark. There is no substantial work on the variables that represent fund managers' information structure. The variables that portray fund

[2] See appendix 1.

managers' information process play an important role in managers' strategies to time the market, which ultimately is assumed to reflect or even help secure good performance.

This study attempts to fill this gap by developing a theoretical model for representing information structure/process of the fund managers. It also tests the proposed model using commonly used macroeconomic variables to model the information structure used by fund managers to secure a given performance level for a fund. Thus, this thesis is based on a set of strong motivations to address some notable gaps in performance measurement methods as well as to provide a comprehensive analysis of the Australia's superannuation sector.

1.3 Objectives

The objectives of this study are:

1. to examine the relationship between fund characteristics and fund expenses in the Australian superannuation funds.
2. to investigate the extent of economies of scale in the Australian superannuation funds.
3. to investigate the information structure of the fund managers by developing a theory of the information structure that affects their market timing decisions.
4. to evaluate performance of Australian superannuation funds during a more recent period covering 1989-2002 by using traditional measures of performance measurement.
5. to evaluate the performance of Australian superannuation funds during 1989-2002 by using a new method to address measure the market timing skills of the fund managers.

Thus, the aim of this thesis is to implement a more comprehensive performance evaluation methodology by extending the current literature to cover fund characteristics, economies of scale and fund manager skills to consider the attributes connected with fund performance of the superannuation funds. These issues address the principal-agent problems of the superannuation industry by examining the role of fund managers as agents in protecting the wealth of the investing public as the principal.

1.4 Contributions of study

The contributions of this study flows from accomplishing the objectives specified for this study. The main contributions are detailed in the following sub-sections.

1.4.1 The role of fund expenses in fund performance

This study attempts to bring a new dimension to the Australian superannuation funds performance by examining the contributions of fund expenses to the performance of funds. It examines the impact of fund characteristics on fund expenses in order to investigate which fund characteristics decrease fund expenses. Thus, fund characteristics are viewed as performance related variables. Studying fund characteristics as performance measurement variables is critical for a market where funds have been classified into many types by the policy makers with the resulting differences in the expenses. If different types of funds have the same characteristics, and influences fund expenses in the same manner, then the existing classification needs justification. The study also investigates if economies of scale exist in Australian superannuation sector, again for the same reason. This is the first time fund characteristics have been examined in the Australian managed funds sector. Findings arising from this aspect of the study are expected to contribute new directions for a better understanding of fund characteristics and fund expenses in the context of fund performance.

1.4.2 Performance evaluation of Australian superannuation funds

This is also the first comprehensive study of Australian superannuation market. Earlier studies have various limitations either in terms of study period or sample or methodology.[3] This study aims to overcome these limitations by having a data set over a recent and lengthier period (longest to-date); larger sample size; and more robust methodology. This is also the first study to examine the performance of both wholesale and retail funds. Thus, again it is aimed at securing a better understanding of the Australian superannuation market. We use both single period and multi-period measures including Sharpe (1966), Treynor (1966), Jensen (1969), M-square (1997), Treynor-Mazuy (T-M) (1968), Henriksson and Merton (H-M) (1981) and Lee-Rahman (L-R) (1991), as our traditional methods to evaluate fund performance.

1.4.3 Information structure of the fund managers

This thesis develops a new theory on the information structure of the fund managers as a contributing factor to fund performance literature. We also develop a testable Logistic Smooth Transition Model (LSTM) for measuring fund performance

[3] Praetz (1976), Bird, Chin and Mc Crae (1983), Robson (1986), Sinclair (1990), Hallahan and Faff(1999), Hallahan (1999), Sawicki (2000), Sawicki and Ong (2000), Holmes and Faff (2000), Gallagher (2001) Benson and Faff (2003).

using the theory of information structure. Thus, new contributions are expected from this thesis to enhance our understanding of fund managers' actions on the performance of managed funds.

1.5 Plan of study

This thesis is divided into six chapters. The relevant theories and evidence relating to the study are briefly discussed in Chapter Two. It also introduces a new theory on modeling the market timing skills of fund managers by applying continuous market conditions approach. A detailed discussion on research design, testable hypotheses and data is included as Chapter Three. Chapter Four presents the results of the tests on the next topic: among these are the role of fund characteristics to fund expenses, economies of scale and single period performance measures of funds. The contents of Chapter Five relates to the important results on fund performance using a set of established models: Treynor-Mazuy, Henriksson-Merton and Lee-Rahman models. Included in chapter five are the new results using LSTM model to be described in Chapter Two. The conclusions, limitations and suggestions for future research are discussed in Chapter Six.

CHAPTER TWO

CHAPTER TWO

THEORY AND EVIDENCE: FUND PERFORMANCE MEASUREMENT AND ATTRIBUTION

2.1 Introduction

This chapter contains an overview of the theories and evidence about mutual fund performance measurement and performance attribution. The theories developed over four decades of research and practice are summarised in Section 2.2. The literature review has been arranged as per the generally-agreed categories in the literature. Section 2.3 contains a discussion on the evidence from research and practice; evidence from several countries and different types of funds. Before presenting a summary of this chapter in Section 2.4, new ideas on the measurement of performance are introduced on market timing tests, which we believe is an improvement on existing tests. The discussion is limited on creating a set of the building blocks for the study of fund performance and attribution.

2.2 Literature review

The theoretical literature evolved in four important phases. (1) Friend, Brown, Herman and Vickers (1962), Sharpe (1966) and Jensen (1968) were important studies in phase one. (2) The ideas on fund manager selectivity and timing skills appeared in Treynor and Mazuy(1966), Henriksson and Merton (1981) and Lee and Rahman (1990). (3) Lehman and Modest (1987), Dybvig and Ross (1985), Grinblatt and Titman (1994), Ferson and Schadt (1996) and Kryzanowski, Lakancette and To (1997) incorporated refinements by introducing corrections for bench mark error and constant risk assumptions in prior studies. In the latest phase, Hendricks, Patel, Zeckhauser (1993), Goetzmann and Ibbotson (1994), Carhart (1997), Mcleoad and Malhotra (1997) and Laztko (1999), among others provided ideas on fund characteristics as determining performance.

These developments advanced the literature on performance measurement and performance attribution into a multi-dimensional approach away from a single-dimension approach with which the earlier studies were concerned. By single dimension is meant the reliance, up until 1966, on fund returns as the basis for measuring fund performance. With the introduction of reward-to-risk, a two-dimensional approach by Sharpe (1966), performance measurement has taken a theoretical approach for the first time. This made the connection to the richer theoretical literature in financial economics useful. Barring few new theories which introduced behavioral aspects, managers' irrationality as a third-dimension, almost all theories in performance measurement revolve around a two-dimensional approach.

2.2.1 The early studies

The earliest study on fund performance evaluation (cited in Ippolito, 1993) is by Friend, Brown, Herman and Vickers (1962). That study, commissioned by the U.S. Securities Exchange Commission, compares annual mean returns of 152 mutual funds against the average market benchmark return over 1953 to 1958. Friend and Vickers

(1965) followed a similar approach. Both use single dimension of returns against a benchmark for performance measurement. These two studies predated the idea of systematic risk, beta, by Sharpe (1966). Sharpe introduced two measures of performance of the portfolios: the expected rate of return $E(R_i)$ of fund i and the predicted variability the standard deviation of the returns, σ_{Ri}, of fund i, as the risk measure. This fund performance model is the first based on a theory, which was built with a number of assumptions. The assumptions of the model are: all investors, who do not take risk, are assumed to invest, borrow and lend at risk-free rate; there is a homogeneous belief about future performance of securities and portfolios; and investors are risk-averse, in which case they would want to earn a risk-premium for the amount of risk. Under these conditions the efficient portfolio falls along a straight line as

$$E(R_i) = R_F + b\,\sigma_{Ri} \qquad (2.1)$$

where, R_F is the risk-free rate and b is the risk premium. Since investors are risk-averse b will be positive.

If an investor can borrow and lend at the risk-free rate and/or invest in a portfolio with predicted performance ($E(R_i)$, σ_{Ri}), then allocating funds between portfolio by lending or borrowing at risk-free rate will put the investor on the risk-return line as expressed in Equation (2), which has been expressed by Sharpe (1966) as follows:

$$E(R) = p + [(E(R_i)-p)/\sigma_{Ri}]\,\sigma \qquad (2.2)$$

Equation (2.2) is the introduction of the Capital Asset Pricing Model (CAPM), where capital assets are priced by considering their relative variability from their expected return and risk. Sharpe (1966) thus provided the first building block for performance evaluation literature as, $(E(R_i)\text{-}p)/\sigma_{Ri}$ has been cited as Sharpe measure/ratio.

The next building block came from Treynor's definition of risk, as relative risk to market if diversifiable risk is no longer present in a portfolio as,

$$(E(R_i)\text{-}p)/\ \beta i \qquad (2.3)$$

Since in reality securities are traded continuously in a multi-period setting, Jensen (1968) provided a solution applying the one-period CAPM,

$$E\ (R_p) = R_f + \beta_p\ [E\ (R_m) - R_f] \qquad (2.4)$$

Jensen expressed Equation (2.4) in a multi-period setting of continuous trading as

$$R_{pt} - R_{ft} = \alpha_p + \beta_p\ (R_{mt}\text{-}R_{ft}) \qquad (2.5)$$

where, α_p is the intercept, which is, Jensen's performance evaluation measure for a portfolio. A positive (negative) significant alpha represents superior (inferior) performance of the portfolios *expost* the trade. In Jensen (1968), portfolio's risk level is assumed to be constant through time.

Jensen's model has solved an important problem by measuring performance on a continuous basis. This model has been extended by others in three different directions. Namely, (1) The decomposition of alpha into selection and timing ability of the fund managers was the first contribution; (2) Ross's (1976) theoretical contribution on arbitrage pricing theory which led to the development of multi-factor approaches in order to eliminate bench-mark inefficiency and (3) conditional CAPM to resolve the constant risk criticism of CAPM.

Practitioners even today use single period measure to evaluate managed funds performance. This is due to their desire for simplicity and intuitive appeal. Modigliani and Modigliani (M-square) (1997) is one such extension of Sharpe model tries to refine the single period measures like Sharpe and Treynor measures. M-square first tries to equate any given portfolio to the market portfolio in terms of its risk. Then the portfolio as per M-square is termed as risk-adjusted portfolio (RAP). The second step in their analysis is to measure and rank portfolios using the redefined measure.

2.2.2 Studies on fund manager selection and timing skills

The literature on fund manager skill attribution for measuring fund performance is based on Fama's (1972) paper on components of investment performance. Treynor and Mazuy (1966) provided a new direction by introducing a nonlinear version of CAPM for studying market timing skills of fund managers. The authors argued that, if fund managers could forecast future market conditions, they could increase their portfolio risk on the market up-cycle, and decrease it on the down-cycle thereby altering the linear securities line as a nonlinear function. This theory introduced a quadratic function as:

$$(R_{pt}) = \beta_p (R_{mt}) + \gamma_p \ (R_{mt})^2 \qquad (2.6)$$

where, γ_p is the coefficient measuring a fund manager's timing ability. A positive coefficient indicates excess return on portfolio due to changing the portfolio's risk by anticipating future positive market conditions correctly. Even though there are no specification tests to substantiate the use of non-linear model, this model is in vogue even today due to its simplicity.

As per Fama (1972), selectivity is defined as the difference between the return on a managed portfolio and the return on a naively selected portfolio with the same level of risk. Abnormal returns due to selectivity are attributed to the microeconomic skills (short-term forecasting skills) of fund manager. *Manager's timing refers to the ability to change the risk of the portfolio in the long run to the changing risk of the market that occur as market conditions change.* Timing component is termed as the macro-economic skills of fund managers or long –term forecasting skills.

In a simple case, Treynor and Mazuy (1966) can be used to represent Fama's components of performance. By rephrasing the model with risk-premium on both sides of the equation, the intercept in the equation transforms into Jensen's alpha:

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p (R_{mt} - R_{ft})^2 \quad (2.7)$$

where, α_p captures macro-economic stock selection skill of the fund manager and γ_p captures the micro-economic market timing skill while β_p is the relative risk.

Henriksson and Merton's model (1981) is also built on Fama's framework. The model is based on Merton's (1981) theoretical work on market timing. As per this model market timing is the ability of fund manager to predict whether the market return would be more or less than the risk-free rate. Based on whether the market return would be more or less than risk-free rate, a fund manager would estimate total return which is the sum of market return and return from a put option, which is operational if the market return is less than the risk-free rate. They developed a model based on Merton's alternative definition of market timing. This can be expressed as:

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_{p1} (R_{mt} - R_{ft}) + \beta_{p2} \max (0, R_{ft} - R_m) \quad (2.8)$$

Positive (negative) β_{p1} and β_{p2} coefficients signify superior (inferior) selection and market timing skills of manager. One major criticism of this model is by Dybvig and Ross (1985). The model tests only if investment managers have private information rather than whether the information is used accurately.

Lee and Rahman (1990) is another noted paper in the line of Fama's framework, and they extended Treynor and Mazuy's model. The model measures the quality of market timing information, which is represented by ρ in:

$$\rho^2 = \sigma_\pi^2 / (\sigma_\pi^2 + \sigma_\varepsilon^2) \qquad (2.9)$$

where,

ρ: quality of market timing information,

σ_π^2: variance of market return (R_{mt} as defined by Jensen, 1972), and

σ_ε^2: variance of the residual term in the regression Equation (2.10).

The values σ_π^2 and σ_ε^2 are obtained from the following quadratic regression equations:

$$R_{pt} = \alpha_p + \theta E(R_m)(1.\psi) R_{mt} + \psi\theta (R_{mt})^2 + \theta \psi \varepsilon_t R_{mt} \qquad (2.10)$$

Equation (10) can be rearranged in Treynor-Mazuy quadratic form as follows:

$$R_{pt} = \eta'_0 + \eta'_1 R_{mt} + \eta'_2 (R_{mt})^2 + \omega_t \qquad (2.11)$$

where,

η'_0: α_p,

η'_1: $\theta E(R_{mt})(1.\psi)$,

η'_2: $\psi\theta$ and

ω_t : $\theta \psi \varepsilon_t R_{mt} + u_{pt}$.

Then $(\omega_t)^2 = \theta^2\psi^2\sigma_\varepsilon^2 (R_{mt})^2$ where, $(\omega_t)^2$: the square of residual term obtained through Treynor and Mazuy model. $\theta^2\psi^2\sigma_\varepsilon^2$: the coefficient of the above simple regression equation (the value $\theta^2\psi^2$ is the same as the square of ψ_p in Treynor and Mazuy's model); $(R_{mt})^2$ is the square of market return in excess of risk-free rate.

By regressing $(\omega_t)^2$ on $(R_{mt})^2$, the variance of the residual, σ_ε^2, can be obtained from the following:

$$(\omega_t)^2 = \theta^2\psi^2\sigma_\varepsilon^2 (R_{mt})^2 + \zeta_t \quad (2.12)$$

σ_π^2, which represents variance of mean-adjusted market return ($\pi = R_{mt} - E(R_m)$, as defined in Merton's (1980) derivation is as follows:

$$\sigma_\pi^2 = \{\Sigma^n_{k=1} [\ \ln(1+R_{mt})\ ]^2\}/n. \quad (2.13)$$

The quality of manager's timing information can be derived from Equation (2.9) with the knowledge of σ_π^2 and σ_ε^2. Thus Lee and Rahman (1990) extended Treynor and Mazuay procedure to measure the quality of market timing of the fund managers. Even though the approach is rigorous it suffers from the same problems as that of Treynor and Mazuy.

The literature on fund manager skills that followed in the 1990s to-date has been more to do with empirical testing of these models. There has been no further theoretical breakthrough despite shortcomings of these three models. Most of the research in 1980s focused on multi-factor models as suggested by Ross (1976) and Roll (1977) in their seminal works on arbitrage pricing theory.

2.2.3 Studies on bench mark inefficiencies and multi-factor models

Dybvig and Ross (1985) provided a theoretical explanation for the reasons behind the inefficiencies of CAPM framework. They argued that if the observer has chosen a benchmark for the market, which by itself is inefficient following Roll's critique, then abnormal returns relative to the securities market line may simply reflect this inefficiency and neither superior nor inferior information is implied. Lehman and Modest (1987) investigated the number of factors needed for a multi-factor-benchmark in an APT framework. Grinblatt and Titman (1994) addressed the reasons behind the observed negative Jensen's alpha. They argued that an equally weighted benchmark portfolio creates benchmark inefficiency. By constructing positive weighted portfolio measures to address this error, they demonstrated that the systematic risk estimator is biased when Jensen's measure is established.

Ferson and Schadt (1997) introduced a new dimension to understand fund managers' trading strategies. Their approach was aimed not only to address benchmark assumption but also the constant risk assumption. They introduced conditional beta to measure fund performance by relying on work relating to time-varying risk by Campbell (1989) and Ferson and Campbell (1991). Their model assumes fund managers as conditioning their investment decisions based on recent past economic conditions. In other words, the model incorporates time-varying beta rather than a constant beta. The rate of return on a portfolio p, in their model, can be represented as:

$$(R_p - R_f)_{t+1} = \beta_p (Z_t) (R_m - R_f)_{t+1} \quad (2.14)$$

where, Z_t is the information set available for fund manager at time t for generating return at time t+1. $\beta_{pm} (Z_t)$ is the time varying beta with two components as follows:

$$\beta_p (Z_t) = b_{o,p} + B_p z_t \quad (2.15)$$

where, b_{op} is the unconditional mean of the conditional beta and z_t is the difference between the information set variables at time t and the unconditional mean of the information set variables. In other words z_t represents deviations from the unconditional means of the information set variables. Then the conditional CAPM is:

$$(R_p - R_f)_{t+1} = b_{o,p}(R_m - R_f)_{t+1} + \beta_p [(z_t) (R_m - R_f)_{t+1}] \quad (2.16)$$

Thus, Ferson and Schadt (1996) revised Treynor and Mazuay's (1966) and Henriksson and Merton's (1981) measures in order to vary beta across time to incorporate changing market conditions.

The conditional Treynor and Mazuay equation has been modified as:

$$(R_p - R_f)_{t+1} = \alpha_p + b_p(R_m - R_f)_{t+1} + C_p[(z_t)(R_m - R_f)_{t+1}] + \gamma_{tmc}[(R_{mt} - R_{ft})^2_{t+1}] \quad (2.17)$$

The coefficient C_p in Equation (2.17) captures the response of manager's beta to the public information and economic conditions Z_t. The coefficient γ_{tmc} measures the sensitivity of manager's beta to private market timing signals. By controlling the public information variables through the term $C_p[(z_t)(R_m - R_f)_{t+1}]$, Ferson and Schadt (1996) resolved the bias ofcoefficients in the original Treynor and Mazuy model.

Henriksson-Merton model in conditional form has been expressed as:

$$(R_p - R_f)_{t+1} = b_d(R_m - R_f)_{t+1} + B_d[(z_t)(R_m - R_f)_{t+1}] + [b_{up} - b_d](R_{mt} - R_{ft})^*_{t+1} + [B_{up} - B_d][(z_t)(R_{mt} - R_{ft})^*_{t+1}] \quad (2.18)$$

where, $(R_{mt} - R_{ft})^*_{t+1} = (R_{mt} - R_{ft})_{t+1}\{(R_{mt} - R_{ft})_{t+1} - E((R_{mt} - R_{ft})_{t+1}|Z_t)>0\}$.

Note that the conditional beta in Equation (2.18) can be represented as down-market and up-market beta as: $\beta_{up}(Z_t) = b_{up} + B_{up} z_t$ for up-market beta; and $\beta_d(Z_t) = b_d + B_d z_t$ for down-market beta. b_d is the unconditional beta.

Kryzanowski, Lakancette and To (1997) extended Ferson and Schadt (1996). Ferson and Schadt assumed that the fund managers change their expectations based on the information at t-1. Kryzanowski *et al.* (1997) argued that if the managers strictly make their investment decisions based on t-1 information, then Jensen's alpha of the portfolio will be zero. The alpha in Ferson and Schadt (1996) is biased and do not reflect the superior selectivity skills of the fund managers. They incorporated conditional variance of the factors as per their proportional constant weights. Thus they allowed risk sensitivities to change due to private information of the fund managers not included in t-1.

2.2.4 Studies attributing performance to fund characteristics

Performance attribution literature has shifted from fund manager skills – the prior focus of researchers - to fund characteristics in the 1990s. Empirical research results on persistence in fund performance provided much needed momentum for this change in direction. Brown, Goetzmann, Ibbotson and Ross (1992) provided theoretical foundations for survivorship bias. Survivorship states that past performance influences future performance. A winner (loser) fund is more likely to continue as a winner (loser) in the future. In other words, past performance is a fund characteristic, which can be used to predict future performance. Such persistence has been attributed to "hot hands" of the fund managers (Hendricks, Patel and Zeckhuaser, 1993 and Goetzmann and Ibbotson, 1994). Jagadeesh and Titman (1993) and Wermers (1995) attribute persistence to the momentum strategies of fund managers.

Most papers prior to Carhart (1997) attribute persistence to fund manager skills. Carhart (1997) provided a broad explanation for the persistence in fund performance. He used fund-specific characteristics along with fund manager momentum strategies to redirect attribution to fund characteristics. He used Fama and French's (1992) three-factor model to represent firm specific characteristics and Jagadeesh and Titman (1993) used momentum strategy to represent fund managers' skills. Carhart also examined the role of expense ratios, turnover, load fees, fund age and fund size (net of assets).

Carhart used the following equations for persistence in attribution analysis:

$$R_{it} = \alpha_{it} + b_{it}RMRF_t + s_{it}SMB_t + h_{it}\ HML_t + p_{it}\ PR1YR_t + e_{it} \qquad (2.19)$$

where, R_{it} is the risk-adjusted portfolio's return and RMRF, SMB, HML and PR1YR are returns on value-weighted, zero-investment and factor-mimicking portfolios on the market proxy, size, book-to-market equity and one-year momentum in stock returns respectively.

A cross-sectional regression model for characteristics attribution has been suggested:

$$\alpha_{it} = a_i + b_iX_{it} + e_{it} \qquad (2.20)$$

where, α_{it} represent the abnormal returns of fund i as shown in Equation (2.19). X_{it} represent a list of fund characteristics namely, expense ratio, turnover and load fees. Equation (20) tries to attribute abnormal returns generated by a fund to its characteristics.

Carhart thus provided a comprehensive measurement and attribution of fund performance for the first time. The importance of expenses for fund performance attribution was recognised at least.

Expenses have thus become an integral part in performance evaluation. Malhotra and Mcleoad (1997) investigated fund expenses with a more detailed approach. They studied the relationship between fund expenses and with other fund characteristics. Their objective was to identify the variables that affect fund expenses. They extended the fund characteristics list of Carhart (1997) by including fund size, fund age, fund objectives, fund group and fund returns.

The relationship used by Malhotra and Mc Leoad (1997) can be represented:

$$E_j = a + b_1 \ln AGE_j + b_2 \ln SIZE_j + b_3 \, OBJECTIVE_j + b_4 \, SALES\ CHARGES_j + b_5 \, FUND\ COMPLEX_j + b_6 \, RETURN_j \qquad (2.21)$$

where,

E: expense ratio,

ln AGE: natural logarithm of age of the fund in number of years,

ln SIZE: natural logarithm of total assets at the end of the year,

OBJECTIVE: represents the fund' investment objective group,

SALES CHARGES: percentage of sales charge in effect for that year,

FUND COMPLEX: dummy variable that equals 0 if the sample includes no fund complex and 1 if the fund is part of a fund complex, and

RETURN: risk-adjusted return of the funds.

Latzko (1999) extended the analysis of fund expenses analysis to explore the presence of economies of scale in mutual funds. In the case of mutual funds, assets may grow in the future with an increase in cash inflows due to sale of new shares. This may cause expense ratios and operating costs to decline. Scale and scope economy studies are important to help individual funds design growth and risk strategies. He used a translog-cost function- well established in such studies in the economics literature- to demonstrate the relationship between fund expenses and fund size as:

$$\ln COST = \beta_0 + \beta_1 \ln ASSETS + \frac{1}{2} \beta_2 (\ln ASSETS)^2 + \Sigma_j \beta_j X_j \qquad (2.22)$$

COST is the dollar amount of a fund's total operating expenses, ASSETS is total fund asset, and X_j includes the control factors that affect the costs of management and administration of a fund. The control variables are: average expense ratio for funds with the same investment objective; annualised return; age of the fund and a dummy variable for sales charges. Thus, the literature on fund performance and its attribution has evolved from a simple one-dimension based on return to risk-reward modeling to a very exhaustive set of factors and their relationship to fund performance. Section 3.4.2, and the Footnote 5 provide detailed descriptions on the widely-applied translog cost function.

2.3 A new measure of fund manager skills attribution to fund performance

The above discussion on theories has increased the scope of performance measurement and its attribution. However, it is now acknowledged that the existing models do not offer the realistic measurement of fund performance due to their restrictive assumptions. The need for more realistic model has been apparent in the latest developments in behavioral finance. Assumptions like homogenous expectations and identical prior beliefs have been challenged (see Barberis and Thaler (2001) for a detailed survey of the behavioral finance literature.) Apart from that, there is no theory to describe the information structure of the fund managers. Most of the studies attribute fund performance either to fund manager skills or fund characteristics based on *expost* information. Unless we clearly understand how fund managers process information to build strategies with changing market conditions, such attribution is incomplete. An understanding of the information structure of fund managers and their changing behaviour with changing market conditions will make fund manager skills attribution more informative.

2.3.1 Need for a new theory

As mentioned in Section 2.2, Ferson and Schadt (1996) is among the first to measure market timing skills of the fund managers with changing economic conditions. However, there are four major drawbacks with the Ferson and Schadt type of models. First, they retain the linearity assumption; no allowance is given for the likely magnitude of the market condition, which is both restrictive and unrealistic. There is a growing body of evidence that suggests that security and portfolio returns are well approximated as nonlinear distributions (See Lunde and Timmerman, 2002). Second, it is hard to assume in a real world all fund managers have same threshold for rebalancing their portfolios.

In reality fund managers tend to have various thresholds based on the varying transaction costs, varying levels of inventory and varying information levels. In other words, there will be a continuum of thresholds as fund managers change their portfolios' risk at different levels of market conditions. There is no model to represent a continuum of market conditions ranging from extremely down- to extremely up-market conditions. Under some what more realistic conditions, one would expect betas to incorporate the full extent of market conditions. Third, as pointed out by Kryzanowski, Lakancette and To (1997), if the managers strictly make their investment decisions based on t-1 information, then the Jensen's alpha of the portfolio will be zero. The model cannot capture the abnormal performance of the fund managers that can be attributed to their real time market timing skills. Thus, fund managers' information structure is more dynamic than just t-1 information of the macroeconomic variables.

Lastly, existing conditional models do not offer any behavioral explanations for a fund manager's actions. For instance, if a fund manager is very aggressive by being over-confident, and is reacting well before the change in market conditions, then such an over-reaction results in a greater change in the portfolio's risk compared to the change in the market at a given time. If the fund manager under-reacts, then the rate of change in the portfolio's risk will be less compared to the change in the market. In both cases, the fund manager liquidates his/her position, and receives positive or negative payoffs based on the directions of changes in the market. The studies on fund manager skills to-date tried to measure *ex post* performance of the funds based on the payoffs received by the fund with the change in the risk of their portfolios.

There is no theory which explored the actions of the fund managers just before the change in market conditions or when market conditions are indecisive/neutral about future direction. If one can measure the speed of adjustment - rather than just assume two extreme bull and bear market conditions - of fund managers' portfolios to changes in market conditions, then one can also provide a measure for the aggressiveness/over-confidence of the fund manager. In fact, a measure of fund managers' speed of portfolio's risk adjustment during market indecisiveness ($R_m - R_f = 0$) is a real test of market timing skills. The above said reasons provide enough validity to propose a newer measure/approach on continuous change in market conditions.

2.3.2 Information structure of fund managers

It is a well-established fact that fund managers change their portfolio weights based on their probability beliefs of the ensuing market condition (Ferson and Schadt, 1996). The relationship between the probability beliefs of the fund manager and the market indicator R^* can be hypothetically represented as shown in Figure 2.1.

Figure 2.1: Portfolio Rebalancing Decisions

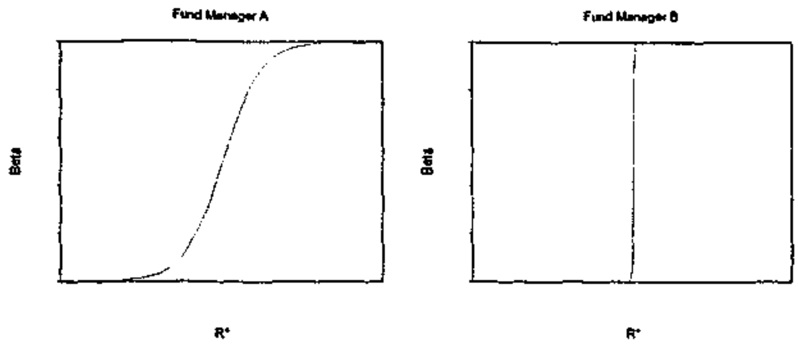


Figure 2.1 shows this relationship for two hypothetical fund managers A and B respectively. Funds beta is shown on the y-axis: on the x-axis the values of R^* represents an indicator function of changes in market conditions. The latter ranges from extreme negative condition (bear market) on the left side to the extreme positive condition (bull market) on the right side of the axis. Theoretically, R* ranges between $-\infty$ and $+\infty$, and the variable is a continuous one instead of the two extreme values under Henriksson-Merton model. Fund managers use R^* as a continuous variable while rebalancing their portfolios. The probability beliefs, as reflected in the portfolio betas, range from the belief of extreme bear market condition represented by the lower bound to the belief of extreme bull market conditions represented by the upper bound, corresponding to values of the market indicator R^* that are extremely negative and extremely positive respectively. At the midpoint of the horizontal axis R^* is zero. As shown in the figure 2.1, fund manger B fully rebalances his/her portfolio when R^* crosses the threshold of zero. Fund manager A on the other hand follows a continuous rebalancing policy that takes the magnitude of R^* as well as its sign into account. Fund manager B's simple dual

response seems unrealistic. Chance and Helmer (2001) have shown that the real rebalancing decisions of fund managers are more frequent. Fund managers will exercise *continuous* rebalancing in response to changing market conditions.

Thus the representation of fund manager A offers a more realistic representation. In the following section we develop a theory of market timing with this more realistic assumption in mind but also represent the unrealistic dual response a special case of the former. Popular models like Henriksson-Merton (1981) measures performance of fund managers only at the two extreme market conditions.

2.3.3 A new theory on market timing

We propose a new approach based on continuous change in market conditions to represent fund manager information structure.

Lemma 1:

The systematic risk of a single security is a function of the market condition indicator R^*.

$$\beta_i^* = g(R^*) \tag{2.23}$$

Proof:

Let R^* be a real valued scalar variable that describes the stock market, with better conditions implied by larger values of this market indicator. Then a conditional CAPM is deduced as follows. Define $\mu_i^* = E[R_i|R^*]$, $\mu_p^* = E[R_p|R^*]$ and let $w_0, w_1, \cdots, w_N$ be the weights of the risk-free security and the N risky securities in an individuals portfolio, with $\sum_{i=0}^{N} w_i = 1$, $R_p = \sum_{i=0}^{N} w_i R_i$. Then

$$\mu_p^* - R_f = \sum_{j=1}^{N} w_j (\mu_j^* - R_f) \tag{2.24}$$

and $\partial\mu_p^*/\partial w_i = \mu_i^* - R_f$. Also implied is:

$$V_p^* = \mathrm{var}\left(R_p|R^*\right) = E\left[\left(\sum_{j=1}^{N} w_j\left(R_j - \mu_j^*\right)\right)^2 |R^*\right] \tag{2.25}$$

and $\partial V_p^*/\partial w_i = E\left[2\left(R_i - \mu_i^*\right)\sum_{j=1}^{N} w_j\left(R_j - \mu_j^*\right)|R^*\right] = 2\sum_{j=1}^{N} w_j \operatorname{cov}\left(R_i, R_j|R^*\right)$.

The conditional utility function of the investor is:

$$\textit{Utility function} = U\left(\mu_p^*, V_p^*\right) \tag{2.26}$$

Maximizing this conditional utility function involves solving the following system of N first order conditions:

$\partial U\left(\mu_p^*, V_p^*\right)/\partial w_i = 0$, $i = 1, \cdots, N$. Equivalently:

$\left(\mu_i^* - R_f\right)\left(\partial U/\partial\mu_p^*\right) + 2\operatorname{cov}\left(R_i, R_p|R^*\right)\left(\partial U/\partial V_p^*\right) = 0, i = 1, \cdots, N$

Equilibrium is then characterized by equating these demands to existing supplies. This corresponds to equating the desired portfolio p, with the market portfolio M or in other words treating the w_i as given, and equal to the proportions in the aggregate market. Thus rewriting the first order conditions with R_p, μ_p^*, V_p^* *and* w_i replaced by R_M, μ_M^*, V_M^* *and* w_i respectively gives:

$$\left(\mu_i^* - R_f\right)\left(\partial U/\partial\mu_p^*\right) + 2\operatorname{cov}\left(R_i, R_m|R^*\right)\left(\partial U/\partial V_p^*\right) = 0, i = 1, \cdots, N$$

or

$$\mu_i^* - R_f = -\frac{2\,\partial U/\partial V_p^*}{\partial U/\partial\mu_p^*}\operatorname{cov}\left(R_i, R_m|R^*\right) \tag{2.27}$$

Then if we sum all N equations using the market portfolio weights we get

$$\mu_m^* - R_f = \frac{-2\partial U/\partial V_p^*}{\partial U/\partial \mu_p^*} = \frac{\mu_m^* - R_f}{\text{var}(R_m|R^*)} \quad \text{or} \quad -2\frac{\partial U/\partial V_p^*}{\partial U/\partial \mu_p^*} = \frac{\mu_m^* - R_f}{\text{var}(R_m|R^*)}$$

Now going back to equation (4) gives $\mu_i^* - R_f = \dfrac{\mu_m^* - R_f}{\text{var}(R_m|R^*)}\text{cov}(R_i, R_m|R^*)$

or

$$\mu_i^* - R_f = \beta_i^*(\mu_m^* - R_f) \text{ with } \beta_i^* = \frac{\text{cov}(R_i, R_M|R^*)}{\text{var}(R_M|R^*)} \qquad (2.28)$$

Thus we have the important implication that systematic risk is a function of the market indicator R^*:

$$\beta_i^* = g(R^*) \qquad (2.29)$$

Given that β_i^*, the systematic risk of security i is a function of the market indicator R^* we know that a rational fund manager will change his portfolio beta in response to a change in market conditions. In other words, since the conditional CAPM for portfolios is:

$$\mu_p^* - R_f = \beta_p^*(\mu_M^* - R_f) \text{ with } \beta_p^* = \sum_{j=1}^{N} w_j \beta_j^* \qquad (2.30)$$

and

$$\beta_p^* = f(R^*, w_1, w_2, \cdots, w_N) \qquad (2.31)$$

Given that a fund manager will have a target value for β_p^*, a change in R^* will have to be compensated by an appropriate adjustment of the weights.

Given that β_i^*, the systematic risk of security i, is a function of the market indicator R^* we know that a rational fund manager will change his portfolio beta in response to a change in market conditions. In other words, since the conditional CAPM for portfolios is

$$\mu_p^* - R_f = \beta_p^*\left(\mu_M^* - R_f\right) \text{ with } \beta_p^* = \sum_{j=1}^{N} w_j \beta_j^* \tag{2.32}$$

and

$$\beta_p^* = f\left(R^*, w_1, w_2, \cdots, w_N\right) \tag{2.33}$$

and given that a fund manager will have a target value for β_p^* a change in R^* will have to be compensated by an appropriate adjustment of the weights.

Proposition 1:

Fund managers' probability beliefs follow a logistic smooth transition process. The probability beliefs can be represented by $\pi^* = 1/\left(1+\exp\left(-\gamma R^*\right)\right)$

Proof:

Let π^* be the fund managers' probability belief that the stock market is bullish given the value of R^*. Then a reasonable assumption is that his log odds ratio $\ln\left(\pi^*/\left(1-\pi^*\right)\right)$ is a monotonic increasing function of the market indicator R^*.

$$\ln\left(\pi^*/\left(1-\pi^*\right)\right) = h\left(R^*\right);\ 0 \le \pi^* \le 1,\ h' > 0 \tag{2.34}$$

We assume that $h\left(R^*\right)$ is a linear function. This is not restrictive since we are mostly concerned with movements in R^* around zero where the behavioral response of fund managers is most important since it represents the point of transition. Further justification for the linearity around zero assumption comes from the fact that the first order Taylor series approximation of $h\left(R^*\right)$ in a neighborhood of zero is $h\left(R^*\right) \approx h(0) + h'\left(R^*\right)\big|_{R^*=0} \cdot R^*$. Or $h(R^*) = \phi + \gamma R^*$ with $\gamma > 0$. Thus we have $\ln\left(\pi^*/\left(1-\pi^*\right)\right) = \phi + \gamma R^*$. Next, since

$R^* = 0$ gives no indication that the market will be one way or the other we also assume that $R^* = 0$ implies $\pi^* = 0.5$. Therefore ϕ must be zero and we have $\ln\left(\pi^*/(1-\pi^*)\right) = \gamma R^*$, implying that:

$$\pi^* = 1/\left(1+\exp(-\gamma R^*)\right) \tag{2.35}$$

Thus, we have a logistic smooth transition model of the probability beliefs of fund managers.

Proposition 2:

The systematic risk of a portfolio is a weighted average of the systematic risk in the two extreme market conditions (β_{bull} and β_{bear}). These extreme market condition betas represent implicit limits on the amount of risk the fund manager is able or willing to take.

Proof:

From Equation (2.35) the adjustment of beta should depend on R^* through the manager's beliefs as measured by $F_\gamma(R^*) = 1/\left(1+\exp(-\gamma R^*\right)$ and this implies $\beta_p^* = G\left(F_\gamma(R^*)\right)$.

Let β_{bull} be the systematic risk of the extreme up-market, β_{bear} be the systematic risk of the extreme down-market and $\beta_p^* = E\left(\beta_p^*\right) = \beta_{bull}\pi^* + \beta_{bear}(1-\pi^*)$ or $\beta_p^* = \beta_{bear} + (\beta_{bull} - \beta_{bear})\pi^*$. So that we have:

$$\beta_p^* = \beta_{bear} + (\beta_{bull} - \beta_{bear})F_\gamma(R^*) \tag{2.36}$$

Now, while the threshold dual beta market (DBM) model used by others is appealing because it reflects the intuition that fund managers adjust their risk in response to R^*, the implied dual response assumes that only the sign of R^* is relevant and that fund managers ignore most of the information contained in R^*. This is unrealistic given that the cost of rebalancing a fund would certainly be dependent on the magnitude of the change in beta. A large value of R^* would be required to justify the belief that the bear market will sustain itself long enough to cover the larger costs associated with the rebalancing process.

Notice that in this model we replace the indicator function $I(R^*)=1$ if $R^*>0$ and zero otherwise used in the DBM model with $F_\gamma(R^*)$ and offer the following Logistic Smooth Transition Market (LSTM) model:

$$R_{pt}=\alpha+\left(\beta_1+\beta_2 F_\gamma\left(R_t^*\right)\right)R_{mt}+\varepsilon_{pt} \qquad (2.37)$$

where, in Equation (2.37) and in all of what will follow R_{pt} and R_{mt} can be either gross or excess returns on the fund and market portfolios respectively. For simplicity of expression, we replace β_{bear} with β_1 and $(\beta_{bull}-\beta_{bear})$ with β_2. Equation 2.37 is a LSTM regression model, which has been widely used in the economics literature to model business cycles (see Anderson and Teräsvirta, 1992).

Note that, the LSTM model is a reaction or behavioral response model. In practice R_t^* could be the fund managers' best forecast of $(R_m-R_f)_t$ given his information set at time $t-1$. For example he might behave as though he is using the rolling autoregressive forecasting model $est(R_m-R_f)_t=\hat{\delta}_0+\hat{\delta}_1(R_m-R_f)_{t-1}+\cdots+\hat{\delta}_k(R_m-R_f)_{t-k}$ in place of R_t^* in the LSTM model.

Note that since this model includes the constant risk and dual beta market (DBM) models as special cases, it can represent a wide range of behaviors. It may be the case that simulations using the LSTM model for a range of $\beta_2 > 0$ and $\gamma > 0$ in conjunction with forecasts of $(R_m - R_f)$, obtained using established econometric techniques, will produce a series for which the DBM β_2 estimates are either insignificant or significantly negative, thereby mimicking, the adverse timing results found in empirical work. We will investigate this phenomenon in the results section. Taking the LSTM as the behavioral model and the DBM as a testing device we may then conclude that although fund managers try to time the market ($\beta_2 > 0$ in the LSTM DGP) they turn out to be poor timers as can be determined using the DBM as a result of an inability to forecast $(R_m - R_f)$ accurately.

2.3.4 Relating the logistic smooth transition model (LSTM) to asset pricing models

An unconditional beta for any asset or portfolio can be estimated using the constant risk in the Market Model (CRM) regression:

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \varepsilon_{pt} \tag{2.38}$$

where, R_{pt} is the raw or excess return on portfolio p for period t, R_{mt} is the raw or excess return on the market index for period t, $\beta_p = \mathrm{cov}\left(R_{pt}, R_{mt}\right)/\sigma^2_{mt}$ and ε_{pt} is the disturbance term which has zero mean and is assumed to be serially independent and homoscedastic. Under this specification α_p and β_p are constant with respect to time.

A dual beta market model (DBM) can be specified as:

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \beta_p^U \cdot D_t \cdot R_{mt} + \varepsilon_{pt} \tag{2.39}$$

where D_t is a dummy variable defining up and down markets by taking the value 1 if the return on the market indicator R_t^* exceeds zero and zero otherwise. Notice that in this specification the difference between the up and down market value of the slope coefficient is β_p^U.

Now consider the logistic smooth transition regression (LSTR) model derived above, which has (2.38) and (2.39) as special limiting cases:

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \beta_p^U \cdot F(R_t^*) \cdot R_{mt} + \varepsilon_{pt} \tag{2.40}$$

With

$$F(R_t^*) = (1 + \exp[-\gamma\, R_t^*])^{-1}, \gamma > 0. \tag{2.41}$$

The superscript U signifies an up-market differential value of the parameter β, F is the logistic smooth transition function with transition variable R_t^* and the critical threshold value for the R_t^* series is 0 and $\varepsilon_{pt} \sim niid(0, \sigma_p^2)$. Note that in our application to Australian mutual funds R_t^* is either the excess market return, $R_{mt} - R_{ft}$ or a duration dependent version of this variable. Clearly, beta in the state dependent model (2.40) changes monotonically with the independent variable R_t^* as (2.41) in (2.40) is a smooth continuous increasing function of R_t^* and takes a value between 0 and 1, depending on the magnitude of R_t^*. When $R_t^* = 0$ the value of the transition function is 0.5 and the current regime is half way between the two extreme upper and lower regimes.

When R_t^* is large and positive R_{pt} is effectively generated by the linear model $R_{pt} = \alpha_p + (\beta_p + \beta_p^U)R_{mt} + \varepsilon_{pt}$, while when R_t^* is large and negative R_{pt} is virtually generated by $R_{pt} = \alpha_p + \beta_p R_{mt} + \varepsilon_{pt}$. Intermediate values of R_t^* give a mixture of the two extreme regimes. Note that the DBM obtains as a special case since when γ

approaches infinity in (2.40), $F(R_t^*)$ becomes an indicator function with $F(R_t^*)=1$ for all values of R_t^* greater than 0 and $F(R_t^*)=0$ otherwise. Also notice that the constant risk market model is a special case since as the smoothness parameter, γ, approaches zero, and Equation (2.40) becomes the constant risk market model (CRM).

2.3.5 Market conditions and information structure

The definition of market conditions R_t^* might vary between fund managers based on their decision variables and probability believes. Researchers have used various lagged macro economic variables to define market conditions. For instance, Ferson and Schadt (1996) uses GDP, yield spread as market condition variables. However, there is no consistency on the definition of market conditions. The major issue is whether to use these market condition variables directly in the testing model like Ferson and Schadt (1996). We believe that fund managers certainly use these variables in the information structure for timing decisions for desired data generating process. However, their performance should be tested only against risk premium (Rm-Rf). By controlling market conditions in the testing procedure as shown in Ferson and Schadt (1996) one may attract criticism as in Kryzanowski, Lakancette and To (1997). Resnick and Shoesmith (2002) methodology of differentiating modeling information structure from testing performance is more realistic. We follow Resnick and Shoesmith (2002) model for information structure of fund managers. The model assumes that fund managers use the past yield spread to time market. Then we test performance of the fund against risk premium using both Henriksson-Merton and LSTM models.

2.3.6 Duration dependence and information structure

We would now like to explore the role that the duration or the length of the market condition plays on the information structure of the fund manager. It is clearly evident from Mahue and Mc Curdy (2000), and Lunde and Timmermann (2002) that investors risk preferences change with the duration of being in a particular market condition. The duration dependent transition variable is obtained by simply multiplying the value of the excess market return $(R_m - R_f)$ or the demeaned yield spread at each point in time by the contemporaneous duration of the state the market is in at that particular point in time.

Mahue and McCurdy's (2000), finding that the volatility of stock returns increases as the duration of both bull and bear markets substantiates our approach. It appears even more obvious that fund managers would take the duration of the market condition into consideration when forming their rebalancing decisions. It seems logical that a fund manager would be, all other things being the same, more willing to increase/decrease his/her beta the longer the duration of the current up/down market.

Fund manager would not simply take the sign of the risk premium as his signal to rebalance, but would instead utilise more of the information at his disposal. Certainly the longer the market has been up/down and the larger the absolute value of the risk premium the more confident the manager would be that the market will remain up/down long enough to recoup the costs associated with the rebalancing process. The information given by a risk premium sensitive and duration dependent signal would certainly be considered more reliable than a simple dichotomous sign of the risk premium. The reason for the upper and lower limits on beta risk implied by the LSTM model are that a fund manager would want to take an infinitely large negative/positive value of systematic risk whenever the risk premium is negative/positive his behavior is limited by legal and political constraints.

2.3.7 Market timing when market conditions are indecisive

From Equation (2.40) one can estimate fund managers' actions during market indecisiveness ($R_t^* = 0$) as follows:

$$\frac{\partial \hat{R}_t}{\partial R_t^*} = \beta_2 F_\gamma\left(R_t^*\right)\left(1 - F_\gamma\left(R_t^*\right)\right) R_{mt}\gamma\Big|_{R_t^*=0} = \frac{1}{4}\beta_2 R_{mt}\gamma \qquad (2.42)$$

Equation (2.42) estimates the change in portfolio's return when the change in market conditions is zero. Thus, Equation (2.42) provides an estimate of the speed of portfolio risk adjustment to the change in market condition when market conditions are indecisive.

2.4 Evidence

There have been extensive empirical applications and verifications of the theoretical models discussed in Section 2.2 (except LSTM) in different markets. A large number of research papers tested the theories on performance measurement and its attribution. Given good review papers in recent literature, it is convenient to limit this review to a selected list of the vast literature. However, an overview of the significant papers evidencing support or rejection of the theories is provided. For convenience and consistency, evidence on fund performance has been categorised into four based on the division applied for discussing the theoretical literature in Section 2.2. Australian evidence is discussed in a separate section. There are two useful survey papers namely, Shukla and Trzcinka (1992) and Ippolito (1993) on managed funds performance. We follow these papers and extend the coverage to include the papers in the last ten years.[4]

2.4.1 *Evidence based on the first studies*

As discussed in Section 2.2, the first extensive and systematic study of mutual funds was done by Friend, Brown, Herman and Vickers (1962). The study considered 152 mutual funds with annual data from 1953 to 1958. They created an index of Standard & Poor's indices of five securities, with the elements weighted by their representation in the mutual fund sample. Using this benchmark, the authors found that, over the period of their study, mutual funds earned an (un-weighted) average annual return of 12.4 percent, while their composite benchmark earned a return of 12.6 percent.

The study also compared the returns of the funds across turnover categories and expense categories. The authors concluded that the analysis reveals no strong relationship between turnover rates and performance. They came to a similar conclusion on expenses. Treynor and Mazuy (1966) was the second published paper. They tested whether any of the 57 mutual funds in their sample evinced market-timing abilities of managers over the 1953-62 test period. Using F-tests, they concluded that there was no evidence of successful market timing. The test employed, however, was inefficient, as it came to be known later. Instead of asking whether all their data, taken together, is consistent with successful timing, they asked whether each fund individually evinced success in a statistically significant way. Because each fund had only 10 observations, it was difficult

[4] Publications upto 1993 is from Ippolito (1993).

for a fund individually to pass the test. The alternative question whether funds as a whole show evidence of successful market timing was not tested.

In the same year Sharpe calculated the reward-to-volatility ratios - an important move to two-dimensional review - for a sample of 34 mutual funds, for which he had data over 1954 to 1963. He found that the ratio for his sample was 40 basis points lower than the ratio calculated for the Dow Jones Index over the same period. Sharpe also compared his ratios across funds according to their levels of investment fees. He found that the superior-performing funds tended to be those with lower expenses. He did not report a coefficient or standard error on this finding. Based on these results, Sharpe concluded that the evidence is consistent with efficient market theory (EMT) that funds' expenditures seemingly are at least partly wasted.

Jensen (1968) used 115 funds in his sample, 56 of which had 20 years of data starting in 1945 and ending in1959; 10 years of data started in 1955. He found the average alpha of these funds was minus 110 basis points (1.1 percent). He did not report test of significance of this average. Instead, he used the strong test against Efficient Market Theory. He asked whether a statistically significant number of his funds had negative alphas using the 95 percent confidence interval on each fund individually. He found a statistically important number of funds had negative alphas.

Friend, Blume and Crockett (1970) is the next noted paper. It used a value-weighted New York Stock Exchange (NSYE) Index as the market portfolio. They concluded that the results do not support recent studies to conclude that there is a negative correlation between fund performance and management expense ratios. The study also found that results for the period 1960-68 as a whole provide some evidence of a slight positive relation between performance and turnover.

The same paper introduced a theme that has characterised many later studies. The study found that the average performance of an equally-weighted NYSE index yielded a return of 12.4 percent per annum (versus 9.9 percent for the value-weighted index). The authors attributed the difference to the relatively strong performance of small stocks, a difference they reported as not being fully reflected in the estimated beta. The authors caution against using a benchmark that effectively tricks the alpha calculation by overweighting small-firm returns. Thus, the adoption of an appropriate benchmark became an important issue in subsequent research.

Robert Carlson (1970) emphasised and also cautioned against any conclusions drawn from calculations of returns that depend on the tested time period, type of funds and the choice of benchmark. As one of his exercises, Carlson essentially recalculated the Jensen and Sharpe results using annual data for 82 common stock funds over the 1948-67 period. His results contradicted both Sharpe and Jensen. Using the Jensen equation and the S&P 500 benchmark, Carlson found an average alpha of positive 60 basis points for his sample. The Sharpe reward-to-variability ratio for his sample was 0.57. The same ratio for the Dow Jones benchmark was 0.43 over the same period. Carlson noted that, just as Sharpe's results were statistically significant in favour of funds underperforming the market, his results were equally significant in the opposite direction.

McDonald (1974) studied the performances of 123 funds using monthly data over the 1960-69 period. Using a CAPM model and an equally-weighted NYSE index, he found an average alpha of 62 basis points. He concluded that mutual fund performance over the period was "neither superior nor inferior" to market performance. Taking into account fees and expenses embodied in the alphas, he concluded that the evidence suggests some small degree of success in stock selectivity and market timing. Mains (1977) replicated Jensen's study for 70 of the Jensen funds that provided Mains with monthly data over the Jensen's test period of 1955-64. Mains argued that the monthly data yielded more efficient estimates of beta and reduced the impact of allocating expenses and capital gains. Using annual data (as did Jensen), Mains found an average alpha of -62 basis points. Using monthly data over the same period, he found an alpha of nine basis points.

Kon and Jen (1977) also used data over mostly 1960s (1960-71). Following Treynor and Mazuy, they used a nonlinear version of CAPM to accommodate funds' changing risk positions (market timing). Using an equally-weighted CRSP index, they found an average alpha of positive six basis points. They concluded that on average the mutual fund sample is able to predict security prices well enough to outperform the naive policy (combination risk-free asset and market portfolio) given their selected levels of systematic risk, and to recoup all management fees and brokerage commissions.

Shawky (1982) also reported results that contradicted the Sharpe-Jensen paradigm. He studied 255 funds using monthly data from 1973 to 1977 and a CAPM equation with an equally-weighted market portfolio. He found an alpha of -0.43 basis points, which is statistically indistinguishable from zero. He concluded that the returns of the mutual fund industry as a whole conform almost exactly to the equally-weighted NYSE returns. Thus, the paper which replicated the works of Sharpe, Jensen, Treynor and Mazuy did not totally agree with their findings. In fact, some papers exhibited quite the opposite results.

2.4.2 Evidence based on fund manager skills

There are several papers which tested the selectivity and timing skills of the fund managers. Some of the prominent papers are Alexander and Stover (1980), Veit and Cheney (1982), Kon (1983), Chang and Llwellen (1984), Henriksson (1984) and Lee and Rahman (1990). These studies were directed mainly at testing for the market-timing abilities of mutual funds. Hence all researchers used a nonlinear version of the CAPM with value-weighted CRSP (Center for Research in Securities Prices) or NYSE indexes, and all based their estimates on monthly data from the 1960s and 1970s. (Veit and Cheney used annual data from 1944-78 and an S&P 500 market index.) All concluded that there was little evidence of successful market timing, although they used tests requiring funds individually to show evidence of successful market timing. Each of these studies found that holding market-timing effects constant, the average alpha (measuring stock selection ability) was positive.

Lee and Rahman found evidence of successful selectivity and timing skills of funds on individual basis. They found that a majority of the funds does not have the often-claimed quality of market timing. Berkowitz, Finney and Logue (1988) came to similar conclusions. They were interested mainly in measuring investment performance in pension funds, but for comparison they also studied mutual fund performance using quarterly data over a 1976-83 test period. They did not, however, interpret their result as consistent with efficient use of information by mutual funds. Instead, because they measured a higher alpha for growth funds, they assumed the finding is an evidence of the small-firm effect proxying for market timing.

2.4.3 Evidence based on multi-factor benchmark studies

Lehman and Modest (1987) examined whether the results of performance measurement comparisons can be affected by the choice of the benchmark. They examined the impact of using different benchmarks. They used a data base of monthly returns over three separate periods from 1968 through 1982. They showed, for example, using a 10-factor arbitrage pricing model (APT), their estimated alphas over each sub-period are anywhere from -385 to -545 basis points with orders-off-magnitude larger than negative alphas ever found before in studies of mutual fund performance. Not only are the results inconsistent with the hypothesis that alpha is zero, they are also inconsistent with the hypothesis that the average alpha is -200 basis points.

It is difficult to explain how performance can be worse than the outcome that would result if the mutual fund entirely wasted all its expenditures. Lehman and Modest solved the puzzle by reporting that a value-weighted NYSE index also earned a negative alpha using this benchmark (the alpha goes unreported in the paper). When they used a value-weighted CRSP benchmark in a CAPM model using a maximum likelihood procedure, they found alphas for the three periods of -141 basis points, -79 basis points and +140 basis points.

Grinblatt and Titman (1989) took Lehman and Modest to the next logical step. They searched a large number of benchmarks to find those that generally deliver zero alphas when measured against well known passive portfolios. That is, they took the commonsense approach that, before using a benchmark to conclude something about mutual fund performance, it should first be determined that the benchmark does not generate a positive or negative alpha for simple index funds. They rejected the equally weighted CRSP and the Lehman-Modest 10-factor benchmark as biased toward negative alphas. They concluded that their so-called eight-portfolio benchmark yielded the most efficient test, in the sense that it most consistently generated the smallest absolute alphas for passive portfolios.

They used this benchmark to test mutual fund performance for the stock portions of 157 fund portfolios over the 1975-84 test period. They found an average alpha of +60 basis points. The two-standard-deviation bounds on the estimate were -140 and +260 basis points. Thus they could reject the hypothesis that, net of all expenses (except load charges), mutual funds earned a return equal to an indexed market portfolio. They could reject the hypothesis that all mutual fund expenses were wasted. Grinblatt and Titman pursued a stronger test for the null hypothesis. They tested whether mutual funds earned gross returns statistically different from zero when compared with the market portfolio. To accomplish this, they collected the actual fund portfolios for each quarter over the sample-period and independently calculated the rates of return on each security, using data from the CRSP tapes. Based on their eight-portfolio benchmark, they found an alpha of 180 basis points with a t-statistic of 2.53. The authors concluded that Jensen measures employing their benchmark indicate that superior performance may in fact exist.

2.4.4 Evidence based on studies of fund characteristics

Grinblatt and Titman (1989), Hendricks, Patel, Zeckhauser (1993), Goetzmann and Ibbotson (1994) were the main researchers to recognise the importance of fund characteristics for measuring fund performance. However, it is Carhart (1997) who established the important role of fund characteristics on fund performance. He created a unique and large database of equity funds over a test period of 1962 to 1993. He selected survivorship bias free funds numbering 509 along with their characteristics including fund expense ratios, load fees, fund size and fund age.

The analysis was conducted in two stages. First he ran a regression of fund returns on Fama and French three factors along with also the Jagadeesh and Titman (1993) momentum strategy. Second, the residual, which represents the abnormal return after controlling for size, book-to-market, leverage and momentum effects, of the first regression was regressed on fund characteristics. Thus, such a process based on fund characteristics can be attributed to the abnormal return (persistence). Carhart found that fund expenses are the only variable that can be attributed to fund persistence in performance. He found that low expenses funds perform better than high expenses funds.

Ferris and Chance (1987) is among the earlier researchers to investigate the role of load fees on the total expenses of the funds. However, they did not look at the role of expenses on fund performance. They looked for the effects of 12b-1 plan (load-fees in the U.S) of Securities Exchange commission in the U.S on fund expenses. They found load-fees are dead-weight costs, and have positive relationship with total expenses. Trzcinka and Zwieg (1990) observed that returns are more volatile than expenses and that investors have difficulty in distinguishing between performance of mutual fund due to skill of funds manager and performance due to luck.

Malhotra and McLeod (1997) reported that, in the case of closed-end bond and equity mutual funds, larger as well as more matured funds with low sales charges, show low expense ratios. The results differ between bond and equity funds in the case of expense ratios and yields of the funds. In the case of bond funds, funds with higher sales charges and higher expense ratios have higher yields. Baumol, Goldfeld, Gordon, and Koehn (1990) find significant economies of scale in the mutual fund industry in the mid-1980s. Dermine and Roller (1992) report significant economies of scale (using the widely-applied translog function) for small to mid-sized fund complexes, with scale economies vanishing for the largest Fund complexes. In a recent study, Latzko (1999) reports economies scale for mutual funds for the year 1997. Malhotra, Martin, and Christoffersen (2001) examine economies of scale for closed-end funds for the year 1996 through 1998 and fund similar results.

2.4.5 Evidence based on conditional measures of performance

Ferson and Schadt (1996) is the first paper to extensively test the importance of time-varying economic conditions in fund performance. Using 67 mutual funds traded during 1968 and 1990, they found that risk exposures change in response to public information in the economy. By modifying Treynor and Mazuy's and Henrikkson and Merton's models with conditional betas they found neutral performance by the fund managers whereas the same model in unconditional format resulted in negative performance. They attributed the poor results of the traditional models to common time-variation in the conditional betas and expected returns. Such a poor performance is a result of negative covariance between mutual fund betas and the conditional expected market return. When the common variation is controlled they found neutral rather poor performance of the funds. Kryzanowski, Lakancette and To (1997) who extended Ferson and Schadt (1996), by incorporating conditional variance of the factors as per their proportional constant weights, found similar evidence.

2.4.6 Australian evidence

Australian studies by and large are replications of US studies. The existing studies do not cover all the areas of performance evaluation as discussed in the Section 2.2.

Praetz (1976), Leslie (1976), Robson (1979), Bird, Chin and Mc Crae (1983) are the earlier papers which replicated Jensen measure to Australian superannuation funds. Bird, Chin and Mc Crae (1983) find that only one out of 27 managers showed some evidence of superior performance through security selection skills. Sinclair (1990) replicated Treynor-Mazuy and Henriksson and Merton. Using 16 pooled superannuation funds for 83 monthly observations, he found evidence of funds exhibiting positive alphas.

Benson and Faff (2003) tested the performance of 70 Australian international equity trusts. They found that international equity trusts during 1990-1999 exhibited negative timing and selection skills. Further they investigated the role of survivor bias on fund performance. They concluded that survivor bias do not have any effect on fund performance. A recent working paper by Sawicki and Ong (2003) using Ferson and Schadt on 97 wholesale Australian superannuation funds, for the time period between 1983-1995 found that the negative market timing reported in earlier studies will disappear after controlling for changing market conditions, which is similar to Ferson and Schadt (1996). However, as discussed earlier Kryzanowski, Lakancette and To (1997) proved that the methodology is wrong..

Gallagher (2001) evaluated the market timing and selection skills of 33 wholesale superannuation fund managers for a test period over during 1992-1998 and found no evidence of superiors timing and selection skills.

2.5 Chapter summary

In this chapter we reviewed various theories and empirical studies about fund performance. The theories have been discussed as an evolutionary process from a single – dimension based attribution to performance using funds' return to a multi-dimensional attribution to performance (risk and return, fund characteristics, fund manager skills). We discussed various limitations in the measurement procedures at various stages of development of the literature. The existing current issues also have been highlighted. Based on the limitations in the existing literature both in the theories and test procedures we developed a theoretical approach – based on LSTM framework used in business cycle studies- to understand the information structure of fund managers by using logistic function. We argue that the new approach provides a more realistic representation of fund managers' information structure. The model can be used to measure fund managers' performance based on their speed of adjustment to the changing market conditions. The discussion on the existing empirical evidence indicates that the results of various studies point to very mixed evidence on funds performance. Most of the papers on fund managers' skill attribution revealed that fund managers do not possess superior skills to out-perform market benchmark. Performance persistence of funds has been related more to fund characteristics than fund manager skills in timing or selection.

CHAPTER THREE

CHAPTER THREE

RESEARCH ISSUES, DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes the research process that drives this study. Section 3.2 identifies the research issues/problems. Section 3.3 describes the data and variables developed/ applied in this study. Section 3.4 specifies the research design by introducing the operational models as well as explaining the process of testing the hypotheses. The model specifications are followed by statistical test specifications, by adding new materials and operationalising a proposed new approach to address performance measurement of Australian superannuation funds. Test hypotheses are specified in Section 3.5. The chapter ends with a summary in Section 3.6.

3.2 Research issues

There are a number of research issues that need close attention in performance measurement literature. Chapter two provided a brief about the evolution of performance measurement methods. Performance measurement has branched into expanding areas as the dimensions to be included for the study increased over time to cover more aspects of fund performance. Thus, contemporary issues relating to performance measurement have become multi-dimensional. The main focus here is on the important issues relating to performance measurement literature in general and specific issues relating to performance measurement of the Australian superannuation funds an area that is yet fully studied. The following two sections raise questions/issues that are being addressed in this thesis.

There are several issues that need to be addressed about the performance of Australian superannuation funds. First, there is a dearth of research on superannuation fund performance. The existing studies are dated in terms of the time period covered, methodology applied and even the coverage of industry. The major issues that need attention are:

(1) measuring performance of superannuation funds based on traditional measures of performance, which can update the findings to cover recent years,

(2) the structure of superannuation funds and their role in fund performance,

(3) the role of superannuation fund characteristics on fund performance, and

(4) economies of scale in superannuation funds.

3.2.1 Performance measurement with traditional measures

The traditional measures of fund performance namely, Sharpe, Treynor and Jensen methods, are not tested widely for Australian superannuation funds. The existing studies using these methods are dated at least twenty years ago. As discussed in chapter one there has been substantial changes in the superannuation industry. There is a need to reexamine the performance of the superannuation funds using the traditional methods as well as the latest M-Square ratio. Even though some of these traditional methods are out-dated they will provide a descriptive summary of the fund performance within the mean-variance framework which is still widely used by researchers and significantly by also the practitioners.

3.2.2 Superannuation structure and fund performance

The structure of the Australian superannuation system provides interesting insights which - as far as known - have not yet been explored by researchers. As discussed in Chapter One, the contribution by employers and employees to superannuation funds are divided into retail, wholesale and self-managed funds. Almost all the existing studies are based on wholesale superannuation funds. The wholesale fund is an integral part of the industry: though it represents 1.65 percent in terms of the number of funds, it accounts for 22.5 percent in terms of assets. Retail funds, on the other hand, represent 35 percent of all superannuation assets with self-managed funds representing more than 90 percent in terms of the number of funds and about 21 percent in assets. Even though the choice of method of contribution is a controversial and highly debated topic in the Australian Parliament, there is negligible evidence on the comparative performance of funds by the other three methods of contribution. There is a need to understand the effectiveness of these contribution systems. Performance measurement may provide much needed help in this understanding.

3.2.3 Fund characteristics and fund performance

Fund characteristics have emerged as an important issue on fund performance. Studies like Carhart's (1996) has made fund characteristics an integral part of performance measurement. Fund characteristics have been linked to fund expenses in papers such as Malhotra and Mcleod (1996). The authors argue that fund expense, a directly controllable variable, is a better measure of fund performance than fund manger skills, which are hard to control or measure. They demonstrated that there exists a causal relationship between fund expenses and the various fund characteristics, which included fund size, fund age, fund complex, fund objectives and fund load fees. By establishing the relationship between these characteristics and fund expenses, they asserted, one could address how fund expenses can be reduced by controlling fund characteristics. A study on the role of fund characteristics on fund expenses is much needed for all managed funds and in this study on the Australian superannuation funds. It is likely that different structures of superannuation funds exhibit different characteristics that might separately influence fund expenses.

3.2.4 Economies of scale and fund performance

Another research issue is on economies of scale. This issue is also linked to the structure issue. Superannuation funds have a good deal of variation in the size of funds by fund structures. Wholesale funds are substantially large compared to retail funds while retail funds are substantially large compared to self-managed funds. This varied size begs answers to the question of economies of scale. Assuming that wholesale funds exhibit significant economies then it raises questions about the existence of the self-managed funds. There is yet a study that addresses this issue for the Australian superannuation funds industry. This makes economies of scale an important research issue. Apart from that, an investigation on the fund size at which economies are triggered would immensely help policy formulation of fund types. It is therefore evident that any research design adopted in this study needs to consider these relevant issues.

With the above discussion, the following important research issues are explored in this thesis as:

(1) Does fund performance differ between retail, wholesale and self-managed funds?

(2) Do fund characteristics influence fund expenses in the Australian superannuation funds? If yes, does the influence vary between retail and wholesale funds?

(3) Do economies of scale vary between retail, wholesale funds and self-managed funds and how?

(4) At what level of fund size do economies of scale start to be binding?

3.2.5 Issued related to performance measurement literature

As described in the last chapter the performance literature is divided on the basis of different theories that evolved over a period of time. The risk-to-reward ratio of Sharpe, the systematic risk-to-reward ratio of Treynor and the abnormal performance measure, alpha of Jensen, are amongst traditional foundations for studying fund performance. The issues that later evolved have taken different dimensions. Fund manager skills and fund characteristics are two prominent newer directions of research. The various issues that have been addressed in these methods are selectivity and timing skills of fund managers in both a static and a continuously changing market conditions. The role of fund characteristics in the persistence of fund performance is another issue that has begun to receive wide attention. The role of fund expenses in fund performance and the economies of scale are other issues related to fund characteristics.

Market-timing skills of fund managers impose a very restrictive assumption that the market condition is either up or down (when in fact this varies across a spectrum). Hence, it is existing models are unrealistic, and therefore the resulting findings are suspect. We attempt to bring more realistic conditions to measure market timing skills of fund managers. Some of the important issues that are not addressed in the market timing literature are:

(1) How do fund managers build information with changing market conditions?

(2) Is the change in beta attributable to varying market conditions or to market timing skills of fund managers?

(3) How do fund managers rebalance their portfolios when market conditions are inconclusive (R_m - R_f = 0)?

(4) Do fund managers under- or overreact with changing market conditions?

This study is aimed at incorporating a design that should address these questions.

3.3 Data

Data unavailability on superannuation funds has limited studies on this class of funds under study since these data are not publicly available. In Australia, there are only two research agencies that maintain data on superannuation funds: ASSIRT Research agency and Morningstar research agency. Morningstar is relatively new, which started in the late 1990s. ASSIRT has been collecting data from late 1980s. We acquired most of our data from ASSIRT for this study. Data on the market index are from the Australian Stock Exchange: the All Ordinaries Accumulated Index is used as a market proxy. Most widely used 13-week Treasury bill yield published by the Reserve Bank of Australia is used as the risk-free rate.

The study requires two types of data sets for the two separate research issues. For measuring security selection and market timing skills of the fund managers, we collected time series data as the monthly closing prices of funds over January 1989 to December 2002. The study covers 14 years, which is the longest available and includes a more recent time period compared to all existing Australian studies. The data set covers 37 wholesale and 59 retail funds. All the funds are balanced growth funds with investment in multi-sectors ranging from debt (low risk) to equity (high risk). Multi-sector funds actively rebalance their portfolio weights from low beta to high beta and vice versa when changes in market conditions. These funds increase their market exposure with improving market conditions (R^* moving towards right side in Figure 2.1) by increasing the fund's beta and reducing the beta under bearish conditions. Thus multi-sector funds are good representatives for measuring market timing skills. We also selected 35 all-equity funds for comparison. The summary statistics of the time series data is presented in Tables 3.1a and 3. 1b.

Table 3.1a: Data Description, Summary Statistics and Constant Risk Beta for Monthly Percentage Returns during 1989-2002 on 37 Australian Wholesale Superannuation Funds

WHOLESALE FUNDS	Mean	Std. Dev	Skewness	Kurtossis	Beta Estimate
1) w1	0.214	1.547	-0.439	2.604	0.375
2) w2	0.320	1.964	-0.447	2.676	0.492
3) w3	0.171	1.070	-0.301	2.749	0.248
4) w4	0.359	2.689	-0.526	2.883	0.662
5) w5	0.333	2.004	-0497	2.935	0.483
6) w7	-0.088	0.945	0.382	3.210	0.172
7) w8	0.320	2.138	-0.429	2.824	0.504
8) w9	0.193	1.961	-0.374	3.134	0.455
9) w10	0.200	1.196	-0.447	3.102	0.234
10) w11	0.244	13.319	1.153	32.70	0.619
11) w12	0.239	1.3.32	-0.623	4.161	0.251
12) w13	0.291	2.206	-0.396	3.349	0.536
13) w14	0.147	1.140	-0.430	3.193	0.229
14) w15	0.274	2.018	-0.414	3.013	0.493
15) w17	0.200	1.199	-0.277	3.023	0.244
16) w19	0.254	1.625	-0.410	2.724	0.380
17) w20	0.331	1.773	-0.261	2.890	0.426
18) w21	0.347	2.001	-0.305	2.554	0.493
19) w22	0.174	1.111	-0.231	2.743	0.261
20) w24	0.221	1.266	-0.519	3.621	0.224
21) w25	0.369	1.986	-0.501	3.235	0.468
22) w26	0.099	0.959	0.183	3.542	0.191
23) w27	0.340	2.208	-0.278	2.671	0.528
24) w28	0.524	1.773	-0.295	3.100	0.443
25) w29	0.156	2.770	-4.610	40.09	0.365
26) w30	0.168	1.039	-0.454	3.190	0.231
27) w31	0.393	2.084	-0.509	3.100	0.502
28) w32	0.290	1.985	0.397	2.979	0.464
29) w33	0.330	1.901	-0.716	4.167	0.450
30) w34	0.351	2.155	-0.470	2.943	0.530
31) w35	0.378	2.034	-0.294	3.091	0.478
32) w36	0.317	1.636	-0.333	2.654	0.393
33) w37	0.371	2.060	-0.217	3.253	0.498
34) w39	0.250	1.243	-0.422	3.519	0.237
35) w40	0.299	1.909	-0.204	2.552	0.443
36) w42	0.396	1.993	-0.403	3.421	0.473
37) w43	0.397	1.929	-0.401	3.656	0.442
Average	**0.249**	**1.911**	**-0.305**	**2.908**	**0.403**

Note: For all 37 funds the p-values of the beta estimates based on White's Heteroscedastic Consistent Standard Error estimates are 0.000.

Table 3.1a provides descriptive statistics for 37 wholesale superannuation funds returns. There is wide variation in the means and standard deviations of fund monthly returns during 1989 to 2002. Fund W 7 has been the worst performer in terms of mean return as -0.088 percent return and fund W43 has given the highest mean return at 0.397 percent. However, average market return (All Ordinaries Index) for the same time period is 0.67 percent per month, which is much higher than any of the wholesale funds. The standard deviation which represents the total risk of the funds ranges widely among the funds, ranging from 0.945 to 13.331 percent. The market standard deviation for the same period stood at 3.756 percent. Except for W11 and W 12, all other wholesale funds have standard deviation lower than market value. Thus, wholesale superannuation funds have consistent risk-return trade-off compared to market. This average beta value of 0.403 substantiates the lower risk properties of the wholesale superannuation funds. The average skewness of wholesale funds is negative with a value of -0.305 indicating that the mean return of the return data is below its median value: suggests left skewness. The skewness, thus, indicates that majority of the funds exhibited positive returns during the study period.

Similar data for retail funds are shown in Table 3.1b. The results on an average are almost same for retail funds except that the performance of retail funds has been much lower compared to the market average.

Retail funds recorded only 0.158 percent average monthly return. However, the total risk - represented by standard deviation - indicates on an average lower than that of wholesale funds: the average beta is also lower. Retail fund returns are also negatively skewed.

Table 3.1b: Data Description, Summary Statistics and Constant Risk Beta for Monthly Percentage Returns during 1989-2002 on 59 Australian Retail Superannuation Funds

RETAIL FUNDS	Mean	Std. Dev	Skewness	Kurtossis	Beta Estimate
1) R1	0.161	1.110	-0.533	3.562	0.229
2) R2	0.066	1.066	-0.309	2.555	0.246
3) R3	0.101	1.358	0.268	4.126	0.251
4) R4	0.179	1.172	-0.506	3.360	0.227
5) R5	0.040	1.172	-0.573	3.614	0.218
6) R6	0.162	1.185	-0.315	3.435	0.171
7) R7	0.111	1.150	-0.421	3.218	0.230
8) R8	0.104	1.240	0.298	5.287	0.234
9) R9	0.091	1.146	-0.366	2.921	0.241
10) R10	0.010	0.941	0.046	4.163	0.184
11) R11	0.058	1.165	-0.012	3.138	0.229
12) R12	0.160	1.269	-0.557	3.971	0.242
13) R13	0.071	1.171	-0.524	3.209	0.234
14) R14	0.077	1.058	-0.560	3.545	0.132
15) R15	0.168	1.050	-0.501	3.801	0.193
16) R16	0.093	1.090	-0.635	3.496	0.206
17) R17	0.115	0.852	-0.322	3.013	0.170
18) R18	0.138	1.059	-0.121	2.839	0.225
19) R19	0.078	1.154	-0.912	4.918	0.207
20) R20	-0.133	0.541	-0.321	15.011	0.077
21) R21	0.183	1.164	-0.210	3.292	0.208
22) R22	0.044	1.497	-1.247	12.990	0.224
23) R23	-0.065	0.514	-0.295	13.201	0.032
24) R24	0.101	1.352	0.295	4.257	0.249
25) R25	0.042	1.074	-0.552	3.391	0.223
26) R26	0.179	1.114	-0.465	3.541	0.243
27) R27	0.176	1.562	-0.596	3.127	0.383
28) R28	0.226	1.506	-0.227	2.542	0.351
29) R29	0.225	1.833	-0.366	3.790	0.376
30) R30	0.223	1.974	-0.448	2.714	0.496
31) R31	0.229	1.935	-0.363	3.229	0.401
32) R32	-0.068	1.544	-0.663	8.399	0.221
33) R33	0.151	1.952	-0.397	3.012	0.448
34) R34	0.285	2.113	-0.426	3.078	0.528
35) R35	0.216	1.972	-0.397	2.871	0.461
36) R36	0.168	1.985	-0.423	3.116	0.476
37) R37	0.283	2.235	-0.603	3.767	0.488
38) R38	0.179	1.661	-0.499	2.873	0.403
39) R39	0.205	1.847	-0.368	2.825	0.424
40) R40	0.135	2.027	-0.741	3.940	0.458
41) R41	0.260	2.230	-0.412	2.938	0.523
42) R42	0.296	1.880	-0.405	3.892	0.428
43) R43	0.307	2.007	-0.514	3.144	0.490
44) R44	0.257	1.858	-0.457	3.004	0.438
45) R45	0.237	2.071	-0.023	4.224	0.426
46) R46	-0.291	6.606	-10.111	11.199	0.484
47) R47	0.200	1.891	-0.511	2.919	0.462
48) R48	0.423	1.891	-0.170	3.873	0.415
49) R49	0.257	1.960	-0.329	3.541	0.437
50) R50	0.275	1.929	-0.215	2.572	0.450
51) R51	0.151	1.672	-0.077	3.087	0.362
52) R52	0.371	2.272	-0.040	4.363	0.415
53) R53	0.219	2.153	-0.493	2.842	0.522
54) R54	0.191	1.828	-0.555	3.152	0.451
55) R55	0.302	1.916	-0.355	3.515	0.468
56) R56	0.143	1.883	-0.649	3.987	0.406
57) R57	-0.030	3.071	-1.186	6.193	0.594
58) R58	0.325	2.341	-0.375	3.471	0.518
59) R59	0.313	1.958	-0.345	3.493	0.450
Average	0.158	1.671	-0.532	2.993	0.341

Note: For all 59 funds the p-value of the beta estimates are based on White's Heteroscedasticity Consistent Standard Error estimates are 0.000.

A second data set was set up for investigating the role of fund characteristics on fund performance. This data set is a cross-sectional matrix of data on fund characteristics. The main variables are Fund Expenses, which defined as Management Expense Ratio (MER), Fund Age, Fund Size, Fund Objective, Fund Sales Charges, Fund Membership and Fund Returns. Such information is normally not found in a conventional database. We used multiple sources to collect this information and these included the ASSIRT, Morningstar and annual report files of the funds. We collected information relating to 96 retail funds and 54 wholesale funds. A more detailed description of the variables is provided in Section 3.4.2a.

The summary statistics of the cross-sectional data are presented in Table 3.2. Six types of funds based on fund objectives, namely, domestic cash, domestic debt, domestic equity, international equity, international debt and multi-sector funds were used. The funds are classified based on the place of investment (domestic and international) and sector of investment (cash, debt, equity and multi-sector). The data are yearly and cover the years 1999 to 2001. Data for other years are not available. This study attempts to analyse for the first time the role of fund characteristics to determine fund performance of superannuation funds for the first time: we feel this information would add new and useful findings for future research.

3.4 Research design and methods

The research methods are varied due to the divergent research issues addressed in this study. We have adopted different techniques to address the different research issues. The ensuing pages describe the research design on the basis of each specific research issue.

3.4.1 Security selection and market timing skills of the Australian superannuation fund managers

In order to study the skills of the fund manager as a preliminary to more advanced analyses, Treynor and Mazuy's (1966) and Henriksson and Merton's (1981) methods are very useful starting points. These methods have not only been popular, but have been extensively used in several international studies and hence research design is to produce comparative findings. For testing the quality of market timing, the Lee and Rahman (1990) method is applied. These tests were be carried out on 35 retail equity-based superannuation funds, 48 wholesale multi-sector superannuation funds and 59 retail multi-sector superannuation funds. Not all funds could be included because of insufficient data.

Three variables namely, fund return, market return and risk-free rate are needed for this analysis. Fund and market returns are calculated assuming continuous compounding as follows:

$R_p = Ln\ (P_t / P_{t-1})$ for fund return and (3.1)

$R_m = Ln\ (P_{mt} / P_{mt-1})$ for market return. (3.2)

where, R_p and R_m are return on portfolio "p" and return on market "m" respectively. Ln represents natural logarithm. P_t and P_{t-1} are monthly closing prices of portfolio "p" for t

Table 3.2: Summary Statistics of Cross-Sectional Data on Superannuation Funds, 1999-2000

Investment Objectives	*Number of Funds*		*Average Assets in $A millions*				*Average Age*				*Average Expense Ratio*			
	Retail	*Wholesale*	Retail		Wholesale		Retail		Wholesale		Retail		Wholesale	
			1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Domestic cash	10	7	30.06	23.71	2026	13.7	7.4	8.4	9.57	10.57	1.766	1.69	0.49	0.51
Domestic debt	10	12	7.233	6.145	109.3	104.1	6.8	7.8	5.91	6.92	1.91	1.94	0.49	0.53
Domestic equity	30	7	35.61	46.77	89.24	97.25	7.74	8.74	3.71	4.71	1.997	2.04	0.63	0.54
International debt	5	2	0.462	0.024	247.2	306.1	5	6	6	7	1.84	1.84	1.35	1.30
International equity	11	5	46.04	32.12	118.5	253.3	7.9	8.9	4.4	5.4	1.97	2.08	0.66	0.63
multi sector	30	21	46.04	83.86	214.5	378.2	7.93	8.93	6.19	7.19	1.93	1.97	0.82	0.90
Total	96	54	30.89	47.23	165.3	235.9	7.56	8.52	6.07	7.07	1.93	1.97	0.68	7.07
Standard Deviation			49.31	118.31	205.5	382.9	3.67	3.67	3.60	3.60	0.32	0.37	0.34	3.60

and t-1 time periods whereas, P_{mt} and P_{mt-1} are monthly closing prices of market portfolio "m" for t and t-1 time periods.

3.4.1a Test procedure

3.4.1a (i) Treynor and Mazuy (1966) model

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p (R_{mt} - R_{ft})^2 + \varepsilon_{pt} \qquad (3.3)$$

where,

$(R_{pt} - R_{ft})$: risk- adjusted return of the portfolio,

α_p: the intercept to measure the security selection skill of the fund manager,

β_p: coefficient of the market return, representing the systematic risk,

$(R_{mt} - R_{ft})$: risk- adjusted return of the market $(R_m\text{-}R_f)$,

γ_p: coefficient that measures the market timing ability of the fund manager,

and

ε_{pt}: residual term.

Hypotheses:

H1: $\alpha_p = 0.$

H2: $\gamma_p = 0.$

3.4.1a (ii) Henriksson and Merton (1981) model

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_{p1} (R_{mt} - R_{ft}) + \beta_{p2} \max (0, R_{ft} - R_{mt}) + \varepsilon_{pt} \qquad (3.4)$$

where,

$(R_{pt} - R_{ft})$: risk- adjusted return of the portfolio,

α_p: the intercept to measure the security selection skill of the fund manager,

β_{p1}: coefficient of the market return, representing the systematic risk,

$(R_{mt} - R_{ft})$: risk- adjusted return of the market $(R_m\text{-}R_f)$,

β_{p2}: coefficient that measures the market timing ability of the fund manager, and

ε_{pt}: residual term in the regression.

Hypotheses:

H3: $\alpha_p = 0.$

H4: $\beta_{p2} = 0.$

3.4.1a (iii) Lee and Rahman (1990) model

Lee and Rahman's (1990) model is an extension of Treynor and Mazuy (1966). The model measures the quality of market timing information, which is represented by ρ through the following equations:

$$\rho^2 = \sigma_\pi^2 / (\sigma_\pi^2 + \sigma_\varepsilon^2) \qquad (3.5)$$

where,

σ_π^2: Variance of the mean-adjusted ($\pi = R_{mt} - E(R_m)$) market return obtained from Merton's (1980) definition:

σ_π^2 : $\{\Sigma^n_{k=1} [\ln(1+ R_{mt})]^2\}/n$, and

σ_ε^2: Variance of the residual term, obtained through the following procedure Lee and Rahman's (1990) definition of portfolio return, R_{pt}.

$$R_{pt} = \alpha_p + \theta E(R_m) (1.\psi) R_{mt} + \psi\theta (R_{mt})^2 + \theta \psi \varepsilon_t R_{mt} + u_{pt} \qquad (3.6)$$

which can be rearranged as a Treynor-Mazuy (1966) quadratic form as follows:

$$R_{pt} = \eta'_0 + \eta'_1 R_{mt} + \eta'_2 (R_{mt})^2 + \omega_t' \qquad (3.7)$$

where,

η'_0 : α_p (coefficient for security selection ability),

η'_1 : $\theta E(R_m)(1-\psi)$ (conditional beta of the portfolio),

η'_2 : $\psi\theta$ (a measure of fund manager's response to information) and

ω_t : $\theta \psi \varepsilon_t R_{mt} + u_{pt}$ (residual term in the equation).

By regressing $(\omega_t)^2$ on $(R_t)^2$ the variance of the residual, σ_ε^2 can be obtained from the following simple regression equation:

$$(\omega_t)^2 = \theta^2 \psi^2 \sigma_\varepsilon^2 (R_{mt})^2 + \zeta_t \qquad (3.8)$$

Hypothesis

H5: $\rho <= 0.$

3.4.2 *Fund characteristics and fund performance*

In order to test the role of fund characteristics on fund performance, we follow the Malhotra and McLeod (1996) methodology. The methodology is based on a multiple regression that relates fund expenses to other fund characteristics. The motive is to identify those characteristics that decrease/increase fund expenses. The model can be expressed as follows:

$$E_j = a + b_1 \ln AGE_j + b_2 \ln SIZE_j + b_3 OBJECTIVE_j + b_4 SALES\ CHARGES_j + b_5 FUND\ COMPLEX_j + b_6 RETURN_j + e_j \quad (3.9)$$

where,

E_j : expense ratio of the j-th fund,

$\ln_j$: indicates the natural logarithm of the j-th fund,

AGE: the age of the fund in number of years,

SIZE: total assets at the end of the year,

OBJECTIVE: fund's investment objectives in a group[5],

SALES CHARGE: sales charge in effect for that year,

COMPLEXITY: a scaled variable, and

RETURNS: adjusted return of the funds.

3.4.2a Model specifications

The expenses include the administrative, investing and legal expenses to manage the funds. They are given as management expense ratio (MER) in the ASSIRT Database, which is the ratio of fund expenses to net assets. It is computed as a ratio of fund

[5] To account for the impact of a fund's objective on the expense ratio, we included the average expense ratio for *each* objective category in the regression as an independent variable to control for the inherent differences in fund expenses due to differing investment objectives. Thus, we have a column that includes the average expense ratio for *each* investment objective category. We do not use dummy variable for each objective because Latzko (*Journal of Financial Research*, 1999), shows that using the average values is more consistent when objectives are classified into more than two items. Latzko (1999) is generally accepted in the literature, which predisposes the tests to avoid dummy variable approach.

expenses to *average* net assets. There are a number of factors, which we identified as having potential to affect the expense ratio of a fund.

There is strong evidence from previous research that *age* has a significantly negative relationship with fund expenses. Older and mature funds normally have lower expenses than newer funds. An established fund should be able to perform better in terms of achieving greater operating efficiency in comparison to newly established funds. Older funds learn from their past mistakes and operate at a lower cost. We hypothesise that older funds will have a lower expense ratio. Funds of the same complexity may experience more economies of scale. It may be hypothesised that a negative relationship exists between expense ratios and fund complexity. It is perhaps obvious that a larger fund will have smaller expense ratios compared to smaller funds on account of economies of scale. So, we expect asset size to have a significant negative relationship with fund expenses.

Fund expenses may vary depending on the objectives of the funds. For instance, funds with an objective to invest in international stocks and/or bonds may incur more expenses due to currency risk and more research and trading expenses than funds investing domestic markets. In order to find the influence of fund objectives, the funds are categorised into six categories - Domestic equity, Domestic debt, International equity, International debt, Multi-sector (Investment in both domestic debt and domestic equity) and Domestic cash (investment in cash securities). Equity funds in general and international funds in particular are expected to have significantly higher expenses than the rest of the funds.

It has been reported by previous researchers that, sales charge or load increases fund expenses. Retail superannuation funds, which collects funds directly from the public normally charges more sales charges than wholesale funds. In general, sales charges are incentives to the sales representatives of the company. So, higher sales charges should motivate the sales representatives to increase the investor base in turn increasing the assets size. A fund with large asset base should have low expenses. So, a significant negative relation is predicted between *sales charges* and expense ratios.

A fund belonging to a large asset management company, which has several funds in its complex structure, should normally incur low expenses due to vast expertise and resources. As all funds in the study are members of a fund complex, we divided the funds based on the number of funds in a given group. By assigning value 0 for company with only one fund marketed, 0.5 for *low* complexity funds if there were 0-5 funds and 1 for companies with more than 5 funds, a scaled metric was computed. It is expected that fund complexity may have a significant negative relation with fund expenses.

Generally the investors, through more contributions into the funds, reward funds that can generate higher return. A significant negative relation is hypothesised between fund returns and fund expenses. All Ordinaries Accumulation Index and the 13-week (3-

month) Treasury bill rates are used as market and risk-free returns while calculating the market-adjusted return.

In summary, the factors that probably explain cross-sectional variations in equity fund expense ratios are size, sales charge, objective of the fund, age, fund complexity, and the adjusted return.

Hypotheses

H6: b1 negative.

H7: b2 negative.

H8: b3 positive.

H9: b4 negative.

H10: b5 negative.

H11: b6 negative.

3.4.3 Economies of scale in Australian superannuation funds

If economies of scale for funds are present, one would expect, up to a certain level, to observe a decrease in fund expenses as funds grow in size. To investigate the existence of economies of scale and the effects selected factors have on costs of the retail funds, we use a translog cost function, as is the norm in the literature when studying financial firms.[5] In financial economics, the translog model is the most pervasive

[5] A translog cost function is a Taylor series expansion to estimate the dual of a Cobb-Douglas production function. In models of producer behaviour, the paper by Arrow, Chenery, Minhas, and Solow (1961) call into question the inherent restriction of the Cobb-Douglas model: all elasticities of factor substitution are assumed to be equal to 1 in Cobb-Douglas. Researchers have since developed numerous flexible functions that allow substitution to be unrestricted. The

approach for an analysis of economies of scale. The translog cost model implicitly assumes U-shaped average cost function. Translog cost function is used because it allows economies of scale to vary with level of fund assets. The estimation of scale economies requires cost and output measures.

For the superannuation funds, the outputs are measured as total assets (capitalisation value) under management in each of the superannuation funds. Total cost of each retail superannuation fund is defined as the total expenses of operating the fund, and it includes a management fee. A fund's total operating expense is modeled as a function of total assets along with control variables that may also affect levels of expenses. OLS regression is applied to estimate the coefficients of independent variables in the translog function. After estimating the translog function, the cost elasticity for groups of funds is found by taking the partial derivatives of the translog cost function. Equation 3.10 is the translog cost function used in this study.

$$\text{Ln COST} = \beta_0 + \beta_1 \ln \text{ASSETS} + \tfrac{1}{2}\beta_2 (\ln \text{ASSETS})^2 + \Sigma_j \beta_j X_j + e \quad (3.10)$$

In the translog function, COST is the management expense ratio (MER) of each fund, which is a ratio of the fund's total operating expenses over the net total assets of funds; ASSETS represent the total assets; and X_j includes the control factors that affect the costs of management and administration. The control variables are (1) average

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transcendental logarithmic, or translog function is the most frequently used flexible function. The function was developed by Kmenta (1967) as a means of approximating the production function. According to Guilkey, Lovell, and Sickles (1983), translog function is the most reliable of the several available alternatives. Hence we applied this method.

expense ratio for funds with the same investment objective, (2) annualised return, (3) age of the fund, and (4) a dummy variable for sales charges (which take the value of 1 if the fund charges sales charges and 0 otherwise).

Cost elasticity

The most common measure of operating efficiency in economies of scale studies is the elasticity of cost with respect to the output. When the rate of increase in output exceeds the rate of increase in cost in an industry, economies of scale are said to characterise that industry. Cost elasticity with respect to assets can be used to evaluate the existence and the extent of economies of scale in the administration and management of Australian retail superannuation funds. It is measured as the percentage change in cost associated with a percentage change in fund assets. We calculate this elasticity by taking the first derivative of the translog cost function (Equation 3.10) with respect to assets. The result is Equation 3.11.

$$\partial(\ln \text{COST}) / \partial(\ln \text{ASSETS}) = \beta_1 + \beta_2(\ln \text{ASSETS}) \qquad (3.11)$$

If the cost elasticity is less than one, superannuation funds expenses increases are less than proportionate changes in fund assets. This implies that economies of scale exist, or that there is increasing returns to scale. If the elasticity is greater than one, diseconomies of scale exists setting in decreasing returns to scale.

To evaluate the existence of economies of scale, we use the "average" method suggested by Noulas, Ray, and Miller (1990). The average method estimates the scale economy measure for each observation, and is averaged across observations to derive the group scale economy measure. The cost elasticity is found for each observation. The average across observations is the group average elasticity. We are limiting our analysis on economies of scale only to retail funds due to very small sample size of wholesale funds.

Hypotheses

> *H 12: Larger funds will exhibit more economies compared to smaller funds.*
>
> *H 13: Funds with different objectives will have significantly different economies of scale.*

3.4.4 Market timing skills of fund managers – a new method of measurement

The existing methods do not have any theoretical base to measure market timing skills with *continuously changing* market conditions. Chapter Two introduced what is proposed as a new approach based on prior research on business cycles where market conditions are assumed to have continuous degrees of change rather a discrete number of market conditions. The test procedure for the implementation of this model is explained here.

The logistic smooth transition regression (LSTR) model, henceforth called the logistic smooth transition market (LSTM) model can be represented as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \beta_i^U \cdot F(R_t^*) \cdot R_{mt} + \varepsilon_{it} \qquad (3.12)$$

with

$$F(R_t^*) = (1 + \exp[-\gamma\, R_t^*])^{-1}, \gamma > 0. \qquad (3.13)$$

The superscript U signifies an up market differential value of the parameter β, F is the logistic smooth transition function with transition variable R_t^* and the critical threshold value for the demeaned R_t^* series is 0 and $\varepsilon_{it} \sim niid(0, \sigma_i^2)$. Note that in our case R_t^* is Rm-Rf.

The beta in the state dependent model (3.12) changes monotonically with the independent variable R_t^* as *F(R*)* in (3.13) is a smooth continuous increasing function of R_t^* and takes a value between 0 and 1, depending on the magnitude of R_t^*. When $R_t^* = 0$ the value of the transition function is 0.5 and the current regime is half way between the two extreme upper and lower regimes. When R_t^* is large and positive R_{it} is effectively generated by the linear model $R_{it} = \alpha_i + (\beta_i + \beta_i^U)R_{mt} + \varepsilon_{it}$, while when R_t^* is large and negative R_{it} is virtually generated by $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$. Intermediate values of R_t^* give a mixture of the two extreme regimes. Note that the DBM obtains as a special case since when γ approaches infinity in (3.12), $F(R_t^*)$ becomes an indicator function with $F(R_t^*) = 1$ for all values of R_t^* greater than 0 and $F(R_t^*) = 0$ otherwise. Also notice that the constant risk market model is a special case since as the smoothness parameter, γ approaches zero, (3.12) and becomes the constant risk market model (CRM).

Market timing when market conditions are indecisive

The equation for measuring fund managers' actions during market indecisiveness is:

$$\frac{\partial \hat{R}_t}{\partial R_t^*} = \beta_2 F_\gamma\left(R_t^*\right)\left(1 - F_\gamma\left(R_t^*\right)\right) R_{mt}\gamma\Big|_{R_t^*=0} = \frac{1}{4}\beta_2 R_{mt}\gamma \qquad (3.14)$$

Hypotheses

H 14: β'' =0.

H15: γ varies between fund managers.

H16: Fund managers' actions differ when market conditions are indecisive.

H17: Retail fund manager will have smaller γ value (smooth transition) compared to wholesale funds.

3.4.4a Statistical tests[6]

As mentioned in the earlier subsection, when γ approaches zero, Equation (3.12) becomes the CRM, implying that the constant risk market model is nested in the LSTM model. Therefore, our first step in specifying the model is to test for linearity against the LSTM form. If the null of linearity cannot be rejected we shall conclude that the constant risk market model adequately represents the data generating process. On the other hand, if linearity is rejected we go on to estimate the highly nonlinear LSTM form using the nonlinear least squares (NLS) method.

From equations (3.12) and (3.13), it can be seen that testing $H_0: \gamma = 0$ is a nonstandard testing problem since Equation (3.12) is identified only under the alternative $H_1: \gamma \neq 0$. Thus standard t- and F-testing methods are not appropriate steps to arrive at a model choice. Therefore, following Luukkonen *et al.* (1988), we replace $F(R_t^*)$ by either a first order or a third order Taylor series linear approximation in a version of (3.12) that allows the intercept as well as the slope coefficient to vary and expand to form an

[6] The statistical specifications tests are same as Woodward and Anderson (2002).

auxiliary model with which to test the equivalent null hypothesis that both α_i^u and β_i^u are not zero or $\gamma \neq 0$ in Equation 3.12.

When a third order Taylor series approximation is used, the expanded and reparameterised equation is:

$$\begin{aligned} R_{it} = \phi_0 + \phi_1 R_{mt} + \phi_2 R_t^* + \phi_3 (R_t^*)^2 + \phi_4 (R_t^*)^3 + \phi_5 R_{mt} R_t^* \\ + \phi_6 R_{mt} (R_t^*)^2 + \phi_7 R_{mt} (R_t^*)^3 + u_{it} \end{aligned} \quad (3.15)$$

where, in this reparameterised form, the null hypothesis is: $H_0: \phi_j = 0\,(j = 2,\ldots,7)$. The test is then carried out as follows:

(i) Regress R_{it} on $\{1, R_{mt}\}$, form the residuals $\hat{\varepsilon}_{it}$ $(t = 1,\ldots,T)$ and the residual sum of squares $SSE_0 = \sum \hat{\varepsilon}_{it}^2$.

(ii) Regress $\hat{\varepsilon}_{it}$ on $\{1, R_{mt}, R_t^*, (R_t^*)^2, (R_t^*)^3, R_{mt}R_t^*, R_{mt}(R_t^*)^2, R_{mt}(R_t^*)^3\}$, form the residuals $\hat{\eta}_{it}$ $(t = 1,\ldots,T)$ and $SSE_2 = \sum \hat{\eta}_{it}^2$.

(iii) Compute the test statistic $S_3 = \left(\frac{T-8}{6}\right)(SSE_0 - SSE_2)/SSE_2$.

Under H_0, S_3 is approximately F distributed. When a first order Taylor series is used the test statistic is denoted S_1 and is derived similarly. In this case the test regressors are {1, R_{mt}, R_t^*, $R_{mt}R_t^*$}. An S_1^* test statistic with test regressors {1,R_{mt},R_t^*, $R_{mt}R_t^*$, $R_{mt}R_t^{*3}$} will also be used. Because S_1, S_1^* and S_3 are Lagrange Multiplier type test statistics they can be expected to have reasonable power. Further, both Luukkonen *et al.* (1988) and Petruccelli (1990) have shown that these tests are powerful in small samples when the true alternative is either the smooth transition regression or the abrupt regime switch form. Thus we can expect that in this case there will be reasonable power against the DBM as well. In this paper we will use the S_1, S_1^* and S_3 statistics. Though S_3 is not as powerful as S_1 or S_1^* when the up-market and down-market intercept terms are the same, it is generally more powerful if that assumption does not hold.

We also use Tsay's (1989) test of nonlinearity. This procedure involves sorting the bivariate observations (R_{it}, R_{mt}) in ascending or descending order based on the ranked order of the corresponding threshold variable R_t^*. A sequence of OLS regressions is then run starting with the first b ranked bivariate observations. Then OLS is again performed for the first $b+1$ observations and so on until we come to the last ordered pair. The standardised one-step ahead predictive residuals $\hat{e}$ are then regressed on the corresponding (reordered) regressor R_{mt}

$$\hat{e}_t = \omega_0 + \omega_1 R_{mt} + \varepsilon_t \tag{3.16}$$

and the associated F-statistic $F(2, n\text{-}b\text{-}2) = \{[(\Sigma\hat{e}_t\text{-}\Sigma\acute{\varepsilon}_t^2)/2]/(\Sigma\acute{\varepsilon}_t^2/(n\text{-}b\text{-}2)\}$ is calculated.

The power of this test comes from the fact that the sequential OLS estimates are consistent estimates of the lower regime parameters as long as the last bivariate observation used in the regression does not belong to the upper regime and there are a sufficient number of observations to estimate the parameters of the lower regime. In this case the predictive residuals are orthogonal to the corresponding regressor R_{mt}. However, for the residuals corresponding to R_t^* greater than the unknown threshold value c the predictive residuals are biased because of the model change at this unknown change point.

3.5 Hypotheses

The hypotheses generated from the research issues are listed below. Although several hypotheses were detailed in the discussion on models, this thesis is concerned with five major hypotheses on the still-to-be researched areas.

3.5.1 Strategic hypotheses

(i) Hypotheses on fund manager skills attribution to fund performance

(1) Australian superannuation fund managers with balanced growth and equity objectives do not possess security selection skills and market timing ability.

(ii) Hypotheses on fund characteristics attribution on fund performance

(2) Large superannuation funds exhibit economies of scale compared to small funds.

(3) Fund characteristics have a significant relationship with fund expenses. Fund size, sale charges, returns, age and complex should exhibit significant negative relation ship with fund expenses. Fund objectives should exhibit significant positive relationship with fund expenses.

(iii) Hypotheses for time-varying beta and market timing with changing market conditions

(4) The change in the beta should be due to both time varying market conditions and portfolio rebalancing of the fund managers. The change in the beta should not only be due to the sign of the market condition but also due to the change in the magnitude of the market condition.

(5) Fund managers reactions differ with changes in market conditions. Some change their beta by continuous rebalancing while others rebalance less frequently.

3.6 Chapter summary

This chapter describes the research issues and the methodology which also include descriptions of data set, design and statistical specifications. The research issues are discussed in two parts in this chapter. The importance of research on Australian superannuation funds has been identified. The research focuses on the (1) performance measurement, (2) the role of fund characteristics, and (3) economies of scale of Australian wholesale and retail superannuation funds. As a second part, the problems associated with existing models on market timing were highlighted. Detailed test procedures to address the research issues were discussed in Section 3.4. The test procedures were supplemented with statistical specification in the same section. (4) Based on the research issues various hypotheses have been developed in Section 3.5 to correctly estimate market timing. The hypotheses have been categorically arranged as three strategic hypotheses with several subsidiary hypotheses under each strategic hypothesis.

CHAPTER FOUR

CHAPTER FOUR

PERFORMANCE ATTRIBUTION USING TRADITIONAL MEASURES

4.1 Introduction

The results of this study are organised in this and the next chapter. This chapter reports preliminary performance scores namely the Sharpe ratio, Treynor ratio, Jensen's alpha and the Modigliani and Modigliani (M-square) measure as described in Section 3.2. Section 4.2 is a summary of preliminary performance attribution results. Section 4.3 contains results on economies of scale of funds. These are new findings that establish the importance of economies of scale for performance characterisation of funds. In Section 4.4 are a set of new findings that relate fund expenses to fund characteristics. The chapter ends with a summary at the end of the chapter.

4.2 Preliminary performance measures

The Sharpe ratio, Treynor ratio, Jensen's alpha and M-square measures are used as preliminary measures to study the risk-return relationship of Australian superannuation funds. The four measures are widely used in the literature and are also popular among practitioners as measures of fund performance. A detailed description of these measures is found in the previous chapter. The results are found in tables 4.1 to 4.6.

Each of the tables reports these four performance measures in four columns. Tables 4.1 and 4.2 are for *retail* superannuation funds. Table 4.1 reports values based on the performance measures and Table 4.2 reports ranking of funds based on the four performance measures. A Similar reporting procedure has been applied to *wholesale* funds, which results are summarised in Tables 4.3 and 4.4. The funds used for the study are balanced objective funds with investment in multi-sectors including equity and debt.

4.2.1 Results of Australian retail superannuation funds: preliminary performance measures

Table 4.1 provides the performance of retail Australian superannuation funds during 1989-2002 using Sharpe, Treynor, Jensen and M-Square measures respectively. The table also provides estimates of betas of these funds for the same time period. As shown in the table, performance varies among the funds. However, the Sharpe and Tryernor measure - based average performance of all sample funds is lower than the market benchmark. Consistent with these results are the average Jensen's Alpha and M-Square values of the funds. Both these values are negative indicating that, on an average, retail funds underperformed the market benchmark. Funds R48 and R52 are exceptions. The performance of these two funds exceeded the market benchmark for the study period. However, after equating these funds' standard deviations to the market's standard deviation as in M-Square measure, even these two funds underperformed after adjustment for total risk

Table 4.1: Performance of Australian Retail Superannuation Funds During 1989-2002 based on Preliminary Performance Measures

Funds	Beta	S R	T R	J A	M S
R1	0.228	0.011	0.055	0.042	-0.493
R2	0.245	-0.078	-0.338	-0.062	-0.810
R3	0.251	-0.035	-0.191	-0.031	-0.657
R4	0.226	0.026	0.132	0.060	-0.441
R5	0.217	-0.093	-0.503	-0.074	-0.864
R6	0.171	0.011	0.075	0.072	-0.493
R7	0.230	-0.033	-0.165	-0.010	-0.650
R8	0.234	-0.036	-0.192	-0.019	-0.661
R9	0.241	-0.050	-0.239	-0.035	-0.711
R10	0.184	-0.147	-0.753	-0.086	-1.059
R11	0.228	-0.078	-0.399	-0.062	-0.810
R12	0.242	0.009	0.047	0.034	-0.499
R13	0.235	-0.067	-0.332	-0.052	-0.770
R14	0.131	-0.068	-0.545	0.009	-0.774
R15	0.192	0.019	0.102	0.068	-0.467
R16	0.206	-0.051	-0.271	-0.015	-0.715
R17	0.170	-0.039	-0.196	0.026	-0.675
R18	0.225	-0.011	-0.049	0.020	-0.571
R19	0.206	-0.042	-0.233	-0.030	-0.751
R20	0.177	-0.521	-1.592	-0.226	-2.400
R21	0.207	0.030	0.167	0.075	-0.426
R22	0.224	-0.070	-0.468	-0.073	-0.779
R23	0.131	-0.416	-1.633	-0.134	-2.026
R24	0.249	-0.036	-0.163	-0.030	-0.657
R25	0.223	-0.100	-0.480	-0.075	-0.888
R26	0.243	0.027	0.123	0.052	-0.437
R27	0.383	0.017	0.070	-0.025	-0.468
R28	0.350	0.051	0.220	0.043	-0.348
R29	0.376	0.042	0.204	0.029	-0.379
R30	0.495	0.037	0.149	-0.036	-0.394
R31	0.401	0.042	0.201	0.019	-0.380
R32	0.220	-0.140	-0.985	-0.183	-1.030
R33	0.448	0.001	0.005	-0.083	-0.524
R34	0.528	0.064	0.257	0.008	-0.298
R35	0.461	0.034	0.147	-0.025	-0.406
R36	0.476	0.010	0.040	-0.081	-0.494
R37	0.487	0.060	0.276	0.028	-0.313
R38	0.403	0.018	0.074	-0.032	-0.466
R39	0.424	0.030	0.132	-0.017	-0.420
R40	0.457	-0.007	-0.031	-0.105	-0.553
R41	0.522	0.050	0.214	-0.013	-0.349
R42	0.428	0.078	0.343	0.072	-0.250
R43	0.491	0.079	0.323	0.050	-0.246
R44	0.438	0.058	0.248	0.028	-0.320

R45	0.426	0.043	0.208	0.015	-0.375
R46	0.484	-0.066	-0.907	-0.544	-0.761
R47	0.462	0.027	0.112	-0.041	-0.431
R48	0.415	0.145	0.660	0.205	-0.012
R49	0.437	0.055	0.248	0.029	-0.331
R50	0.451	0.066	0.280	0.039	-0.295
R51	0.362	0.001	0.006	-0.039	-0.525
R52	0.414	0.098	0.536	0.154	-0.179
R53	0.521	0.033	0.136	-0.053	-0.410
R54	0.451	0.023	0.093	-0.045	-0.447
R55	0.468	0.080	0.327	0.057	-0.244
R56	0.406	-0.003	-0.013	-0.069	-0.538
R57	0.594	-0.058	-0.300	-0.340	-0.733
R58	0.518	0.075	0.340	0.054	-0.259
R59	0.449	0.084	0.366	0.078	-0.229
Average	**0.342**	**-0.012**	**-0.069**	**-0.023**	**-0.574**
Market Portfolio	**1.00**	**0.146**	**0.523**	-----	-----

Note: SR: Sharpe ration; TR: Treynor ratio; JA: Jensen Alpha and MS: M-Square.

Table 4.2 shows the ranking of each fund including that of the market benchmark with the same information as shown in Table 4.1. Ranking funds helps us to easily measure the consistency of each of these measures. As shown in the table there is reasonable level of consistency among these different performance measures. The consistency between market-adjusted and risk-adjusted measures namely, Jensen's Alpha and M-Square, seems to be higher compared to risk-adjusted measures including those using Sharpe and Treynor measures. However, these measures being one-period measures, may not provide concluding evidence on the consistency of fund performance. Thus, the preliminary evidence indicates that the average performance of retail superannuation funds is below the market benchmark. Many funds exhibited negative/adverse performance.

Table 4.2: Ranking of Australian Retail Superannuation Funds During 1989-2002 based on Preliminary Performance Measures

Ranks	SR	TR	JA	MS
1	M	R48	R48	R48
2	R48	R52	R52	R52
3	R52	M	R59	R59
4	R59	R59	R21	R55
5	R55	R42	R6	R43
6	R43	R58	R42	R42
7	R42	R55	R15	R58
8	R58	R43	R4	R50
9	R50	R50	R55	R34
10	R34	R37	R58	R37
11	R37	R34	R26	R44
12	R44	R49	R43	R49
13	R49	R44	R28	R28
14	R28	R28	R1	R41
15	R41	R41	R50	R45
16	R45	R45	R12	R29
17	R29	R29	R29	R31
18	R31	R31	R49	R30
19	R30	R21	R37	R35
20	R35	R30	R44	R53
21	R53	R35	R17	R39
22	R39	R53	R18	R21
23	R21	R4	R31	R47
24	R47	R39	R45	R26
25	R26	R26	R14	R4
26	R4	R47	R34	R54
27	R54	R15	R7	R38
28	R15	R54	R41	R15
29	R38	R6	R16	R27
30	R27	R38	R39	R1
31	R1	R27	R8	R6
32	R6	R1	R35	R36
33	R36	R12	R27	R12
34	R12	R36	R24	R33
35	R51	R51	R19	R51
36	R33	R33	R3	R56
37	R56	R56	R38	R40
38	R40	R40	R9	R18
39	R18	R18	R30	R7
40	R7	R7	R51	R3
41	R3	R3	R47	R24
42	R24	R8	R54	R8
43	R8	R24	R13	R17
44	R17	R17	R53	R9

45	R19	R19	R11	R16
47	R16	R16	R56	R19
48	R57	R57	R22	R46
49	R46	R13	R5	R13
50	R13	R2	R25	R14
51	R14	R11	R36	R22
52	R22	R22	R33	R2
53	R2	R25	R10	R11
54	R11	R5	R40	R5
55	R5	R14	R23	R25
56	R25	R10	R32	R32
57	R32	R46	R20	R10
58	R10	R32	R57	R23
59	R23	R20	R46	R20
60	R20	R23		

Note: M- indicates the score ranked for market portfolio; Market Index; SR: Sharpe ration; TR: Treynor ratio; JA: Jensen Alpha and MS: M-Square.

4.2.2 Results of Australian wholesale superannuation funds: preliminary performance measures

The results of the wholesale funds are reported in Tables 4.3 and 4.4. In the cases of wholesale funds the results are encouraging compared to retail funds as shown in Table 4.3. However, even retail funds performed below the market benchmark. Only 5 out of 37 wholesale funds have negative Jensen's Alpha. This indicates most of the funds are above the Security Market Line (SML), even before adjustment to the transaction costs. A very low average Jensen's Alpha indicates that, after adjusting for transaction costs even these funds may exhibit adverse performance. M-Square measure provides consistent results in line with our conclusions. The average M-Square for the wholesale funds is negative, However, the value is lower than that for Retail funds.

Table 4.3: Performance of Australian Wholesale Superannuation Funds During 1989-2002 based on Preliminary Performance Measures

	Beta	SR	TR	JA	MS
W1	0.375	0.042	0.175	0.018	-0.379
W2	0.491	0.087	0.348	0.063	-0.218
W3	0.248	0.021	0.091	0.042	-0.458
W4	0.662	0.078	0.318	0.013	-0.248
W5	0.483	0.092	0.381	0.080	-0.201
W6	0.172	-0.250	-1.374	-0.178	-1.426
W7	0.504	0.080	0.340	0.057	-0.242
W8	0.455	0.022	0.097	-0.045	-0.448
W9	0.234	0.043	0.220	0.078	-0.379
W10	0.619	0.007	0.154	-0.080	-0.497
W11	0.255	0.068	0.356	0.106	-0.288
W12	0.536	0.064	0.265	0.010	-0.298
W13	0.230	-0.001	-0.007	0.027	-0.537
W14	0.493	0.062	0.254	0.016	-0.307
W15	0.244	0.043	0.211	0.073	-0.379
W16	0.379	0.065	0.279	0.056	-0.298
W17	0.426	0.103	0.428	0.108	-0.162
W18	0.492	0.099	0.403	0.090	-0.175
W19	0.261	0.023	0.097	0.038	-0.451
W20	0.224	0.057	0.324	0.104	-0.327
W21	0.467	0.111	0.472	0.125	-0.132
W22	0.191	-0.051	-0.258	-0.001	-0.718
W23	0.527	0.087	0.363	0.064	-0.219
W24	0.443	0.212	0.847	0.292	0.225
W25	0.365	0.003	0.019	-0.035	-0.517
W26	0.231	0.018	0.082	0.047	-0.468
W27	0.501	0.117	0.488	0.131	-0.109
W28	0.464	0.071	0.304	0.047	-0.275
W29	0.450	0.096	0.404	0.095	-0.188
W30	0.530	0.094	0.382	0.074	-0.192
W31	0.478	0.113	0.479	0.128	-0.126
W32	0.393	0.103	0.428	0.111	-0.163
W33	0.497	0.108	0.447	0.111	-0.144
W34	0.237	0.081	0.426	0.126	-0.242
W35	0.443	0.079	0.339	0.067	-0.248
W36	0.472	0.124	0.525	0.149	-0.085
W37	0.442	0.128	0.561	0.165	-0.070
Average	**0.403**	**0.062**	**0.261**	**0.064**	**-0.308**
Market	**1.00**	**0.146**	**0.523**	**-----**	**-----**

Note: SR: Sharpe ration; TR: Treynor ratio; JA: Jensen Alpha and MS: M-Square.

Table 4.4: Ranking of Australian Wholesale Superannuation Funds During 1989-2002 based on Preliminary Performance Measures

Ranks	S R	T R	J A	M S
1	W24	W24	W24	W24
2	M	W37	W37	W37
3	W37	W36	W36	W36
4	W36	M	W27	W27
5	W27	W27	W31	W31
6	W31	W31	W34	W21
7	W21	W21	W21	W33
8	W33	W33	W32	W17
9	W32	W32	W33	W32
10	W17	W17	W17	W18
11	W18	W34	W11	W29
12	W29	W29	W20	W30
13	W30	W18	W29	W5
14	W5	W30	W18	W2
15	W2	W5	W5	W23
16	W23	W23	W9	W7
17	W34	W11	W30	W34
18	W7	W2	W15	W4
19	W35	W7	W35	W35
20	W4	W35	W23	W28
21	W28	W20	W2	W11
22	W11	W4	W7	W16
23	W16	W28	W16	W12
24	W12	W16	W28	W14
25	W14	W12	W26	W20
26	W20	W14	W3	W1
27	W9	W9	W19	W9
28	W15	W15	W13	W15
29	W1	W1	W1	W8
30	W19	W10	W14	W19
31	W8	W19	W4	W3
32	W3	W8	W12	W26
33	W26	W3	W22	W10
34	W10	W26	W25	W25
35	W25	W25	W8	W13
36	W13	W13	W10	W22
37	W22	W22	W6	W6
38	W6	W6		

Note: M- indicates the score ranked for market portfolio; SR: Sharpe ration; TR: Treynor ratio; JA: Jensen Alpha and MS: M-Square.

Table 4.4 provides statistics on the fund ranking using the information in Table 4.3. Similar to retail funds, wholesale fund ranking shows that there is a higher consistency in ranking funds using Jensen's Alpha and M-Square measures. The table indicates that, compared to retail funds, more funds are ranked above the market benchmark. However, the overall conclusion is the same for the wholesale and the retail funds: both retail and wholesale funds, on average, performed below the market benchmark.

With inconsistent findings revealed by the use of different measures, there is no clear conclusion a researcher could draw about the performance of funds based on these popular but simple preliminary measures. These measures only provide descriptions, unreliable ones at that, on fund performance. It can be safely concluded that fund performance requires more rigorous and robust measures. The following sections (and Chapter Five) report results of more refined comprehensive statistics on performance.

4.3 Results on economies of scale

The theory relating fund performance to economies of scale was described in Chapter Two. Economies of scale measure the relationship between fund size and the costs of maintaining the funds. The relationship was measured by first running a regression representing the translog cost function, and then obtaining the first derivatives of the coefficients obtained in the regressions. Further analyses on cost elasticity of funds with different fund objectives led to interesting findings and these results are also reported. The average cost elasticity of funds to identify the point(s), where economies occur for different funds with different objectives, provides very useful information relating to the fund size that promotes efficiency.

4.3.1 Translog cost function results

Table 4.5 reports a large adjusted R-square values for the retail superannuation funds. The values show that the cost function explains 99 percent of the variability of fund costs over the test period. The natural logarithm of assets has positive coefficient estimates that are all statistically significant. This implies positive cost elasticity in that the level of assets directly affects fund costs The relationship is proportionate because the estimated coefficients are equal to 1.0 for retail superannuation funds. So, a one percentage change in assets will lead to an equal percentage increase in costs.

Table 4.5: Results of Translog-cost Function of Australian Retail Superannuation Funds

$\ln COST_j = \beta_0 + \beta_1 \ln ASSETS_j + \frac{1}{2}\beta_2 (\ln ASSETS_j)^2 + \Sigma_j \beta_j X_j + e_j$

Variables	1999	2000
Ln of Assets	1	1
t-values	(107.95)*	(78.07)*
½ of Ln of Assets Squared	-0.002	0.001
t-values	(-0.91)	-0.31
Average Expense Ratio	0.49	0.49
t-values	(2.50)*	(1.69)**
Net Asset Value Return	0	0.001
t-values	(-0.04)	(-0.76)
Age	-0.02	-0.02
t-values	(-3.29)*	(-3.18)*
Load	0.17	0.1
t-values	(2.89)*	(2.09)*
Number of Observations	96	96
R-Square	0.99	0.99
Adjusted R-Square	0.99	0.99

The dependent variable is the natural log of total fund expenses.

*Denotes significance at 0.01 rejection level.

Table 4.6: Results of Translog-cost Function of Australian Retail Superannuation Funds with Dummy Specification of Fund Objectives

	Retail	funds		
Year	1999	(t-value)	2000	(t-value)
Intercept	-3.636	-23.490*	-1.798	-11.280*
Ln(Assets)	0.990	35.480*	0.990	65.260*
½ Ln (Asset Square)	0.003	0.257	-0.001	-0.210
Ln (Age)	-0.020	-2.980*	-0.017	-3.250*
Sales Charges	-0.170	-1.890**	0.181	2.841*
Domestic Cash	-0.168	-0.961	0.052	0.326
Domestic Debt	0.166	1.026	0.134	0.900
Domestic Equity	0.018	0.125	0.211	1.387
International Equity	0.311	1.924**	0.208	1.144
Multisector	0.006	0.041	0.198	1.304
Risk-Adjusted Return	0.001	0.507	0.005	0.006
Adjusted R-Square	0.983	-	0.994	-

The regression equation is:
Ln $COST_j = \beta_0 + \beta_1$ ln $ASSETS_j + ½\, \beta_2 (\ln ASSETS_j)^2 ++ \beta_2\, AGE_j + \beta_3$ SALES $CHARGES_j + \beta_4$ DOMESTIC $CASH_j + \beta_5$ DOMESTIC $DEBT_j + \beta_6$ DOMESTIC $EQUITY_j + \beta_7$ INTERNATIONAL $EQUITY_j + \beta_8$ MULTISECTOR SALES $CHARGES_j + \beta_9\, RETURN_j + e_j$
The dependent variable is the expense ratio of the superannuation fund.

Table 4.6 shows translog results with dummy variable for fund objectives. The statistics in the table clearly shows that, even with the inclusion of the dummy variable, the results on economies of scale remain the same.

Results for the control variables are interpreted as follows:

- Average expense ratios have the expected positive coefficient estimates, which are statistically significant So, if an expense ratio is large due to the fund objective, the fund's costs will be greater.
- The estimated coefficients for annualised net asset RETURN yielded mixed results although none are statistically significant. A positive coefficient estimate suggests that higher costs of funds result from higher fees paid to fund advisors. We obtained one positive and one negative coefficient estimates.
- The estimated coefficients on AGE of the retail funds are negative as is expected, and are statistically significant in all cases. The greater the age of the fund, the more efficiently it will be managed with lower costs.
- Consistent with findings reported in American studies on mutual fund expenses, we find that load funds carry high costs. This is evidenced by the statistically significant positive coefficient estimates on the LOAD variable.

4.3.2 Cost elasticity results

Table 4.7 presents the average cost elasticity for fund divided into two categories by size.

Table 4.7: Average Cost Elasticities based on Fund Size

Fund Size (in $A millions)	*1999*	*2000*
Greater than 30	1.100	1.000
Standard Deviation	-0.012	-0.010
Less than 30	0.960	0.790
Standard Deviation	-0.001	-0.030

For funds below the asset size of A$30[7] million, we find no economies of scale as the cost elasticity for each of the two years is equal to one. For superannuation funds with asset size greater than A$30 million, the cost elasticity for in each of the two years are below one, and are statistically significant. Thus, economies of scale exist for funds above asset size of A$30 million.

Table 4.8 shows average cost elasticity for funds grouped by fund objective categories.

Table 4.8: Average Cost Elasticity based on Fund Objective

Fund Objective	**No. of Funds**	**1999**	**2000**
Domestic cash	10	0.99 (-0.07)	1 (-0.07)
Domestic debt	10	0.89 (-0.12)	0.97 (-0.01)
Domestic equity	30	0.993(-0.01)	1.01 (-0.003)
International debt& equity	16	1.1 (-0.03)	1.09 (-0.003)
Multi-Sector	30	0.995 (-0.001)	0.995 (-0.01)

Numbers in (.) are standard deviations.

Except for domestic debt funds, all other fund categories show no economies of scale. Domestic debt funds exhibit cost elasticity below one. Also, international debt and international equity funds have a cost elasticity greater than one, which actually shows diseconomies of scale due to higher research costs and possibly also exchange rate effect associated with international funds.

[7] We chose A$30 million as the cutoff point to divide the fund sample into two categories. This cutoff was chosen to ensure that there are about equal number of observations on the two categories. Similar procedure has been applied to search for cut off points in the literature. Change to the text will make this clear in the thesis.

In summary, positive cost elasticity have been found for all years and for all groupings of funds. The elasticity is equal to 1.0 for retail superannuation funds. We find that the economies of scale are triggered only when the funds exceed the size of A$30 million. We do not find any variations in the cost elasticity of domestic cash, domestic equity, and multi-sector funds. However, domestic debt funds and international debt and equity funds show variations in cost elasticity with domestic funds cost elasticity scores being less than one, and international debt and equity cost elasticities at more than one. This means that the economies of scale is favourable to domestic funds but is unfavourable to international funds (both equity and debt).

4.4 Fund expenses analysis results

Table 4.9 summarises the regression results of both the retail and wholesale superannuation funds by fund expense. These tests are done for the first time with Australian data.

Strikingly, the results vary between wholesale and retail funds. There is no significant relationship between fund *size* and fund *expenses*: the results are the same for both retail and wholesale superannuation funds. This finding about the size is inconsistent with the US results, however, the US results were for mutual funds, and not for superannuation funds, a category that does not exist in that country. This means, on average, there are no differences associated with size and expenses. However, this finding is consistent with the results on the economies of scale reported in the previous section.

We also did dummy specification of fund objectives and the results are in Table 4.10. The statistics in the table provide some interesting results. The relation between expenses ratio and fund objectives differs between retail and wholesale funds. In the case of retail funds, fund expenses have a positive relation with fund objectives. International equity funds have the highest expense compared to other funds. In the case of wholesale funds, the relationship is negative. Domestic cash and domestic debt funds incur the lowest expense compared to domestic equity, international equity, international debt and multi-sector funds.

Table 4.9: Regression results of Australia Retail and Wholesale Superannuation Funds' Expenses

$$E_j = a + b_1 \ln AGE_j + b_2 \ln SIZE_j + b_3\, OBJECTIVE_j + b_4\, SALES\ CHARGES_j + b_5\, FUND\ COMPLEX_j + b_6\, RETURN_j + e_j$$

	Retail	funds			Whole sale	funds		
Year	1999	(t-value)	2000	(t-value)	1999	(t-value)	2000	(t-value)
Ln(Assets)	0.001	(0.037)	-0.011	(-0.81)	0.001	(0.062)	0.011	(0.556)
Ln (Age)	-0.188	(-2.77)*	-0.216	(-2.63)*	0.100	(1.665)	0.087	(1.058)
Fund Complex	-0.012	(-0.04)	-0.007	(-0.02)	-0.057	(-0.34)	-0.099	(-0.55)
Sales Charges	0.192	(2.059)*	0.239	(2.212)*	-0.089	(-0.44)	0.027	(0.126)
Fund Objectives	0.899	(1.818)	0.913	(2.475)*	1.04	(5.494)**	1.007	(5.164)**
Risk-Adjusted Return	0.003	(0.004)	0.005	(0.012)	-0.006	(-1.31)	0.003	(1.046)

*Denotes significance at 0.05 rejection level and ** at 0.01 level.

Retail funds appear to be significantly negatively related to fund's *age*. So the older and mature funds in the retail sector incur low expenses compared with the newer funds. This result is similar to that found in U.S. studies. In the case of wholesale funds, the same relation does not hold: no significant relationship between funds' age and funds' expenses exists for wholesale funds.

Being a member of a large and complex fund management company did not reduce expenses and goes against the common belief in the industry. This holds good for both retail and wholesale funds. The results are not statistically significant for both sectors. These results are similar to those in the US for mutual funds. Contrary to the maintained hypothesis, sales charges have significant *positive* relationship in the retail funds. In the case of wholesale sector, the results are not significant. That makes the retail sector behaviour similar to that reported in the US, but not the behaviour of wholesale sector.

A positive and significant coefficient estimated for fund objective means that higher costs are associated with funds with complex objectives. Both retail and wholesale superannuation funds exhibited this positive relation. There is no significant relationship between funds' returns and funds' expenses for both the retail, and the wholesale funds. This is intuitively obvious since returns are from the year after the expenses: we did not specify a lagged relation in the model. The results are unlikely to be different with a lagged variable.

Table 4.10: Regression results of Australia Retail and Wholesale Superannuation Funds' Expenses with dummy specification

Variables	Retail Funds 1999	Retail Funds 2000	Wholesale Funds 1999	Wholesale Funds 2000
Number of Observations	96	96	54	54
R-Square	0.18	0.23	0.42	0.43
Adjusted R-Square	0.08	0.14	0.29	0.31
Intercept	1.79	1.50	1.24	1.25
	(5.08)*	(3.52)*	(5.01)*	(4.47)*
Ln of Assets	-0.002	-0.03	0.000	0.02
	(-0.09)	(-1.42)	(0.70)	(0.00)
Age	-0.03	-0.03	0.02	0.02
	(-3.32)*	(-3.10)*	(1.31)	(1.03)
Domestic Cash	0.09	0.36	-0.92	-0.91
	(0.48)	(1.74)**	(-3.87)*	(-3.57)*
Domestic Debt	0.19	0.22	-0.86	-0.88
	(1.08)	(0.95)	(-3.88)*	(-3.59)*
Domestic Equity	0.27	0.50	-0.61	-0.77
	(1.62)**	(2.35)*	(-2.58)*	(-3.02)*
International Equity	0.23	0.58	-0.65	-0.75
	(1.18)	(2.18)**	(-2.64)*	(-2.67)*
Multisector	0.20	0.45	-0.48	-0.75
	(1.16)	(2.04)**	(-2.20)**	(2.00)**
Sales Charge	0.22	0.30	-0.05	0.07
	(2.28)*	(2.52)*	(-0.24)	(0.31)
Fund Complex	-0.02	0.10	-0.11	0.11
	(-0.06)	(0.31)	(-0.62)	(-0.59)
Risk-Adjusted Return	0.004	-0.002	-0.007	0.003
	(0.82)	(-0.48)	(-1.23)	(0.96)

The regression equation is:
$E_j = \alpha + \beta_1$ LNG SIZE$_j$ + β_2 AGE$_j$ + β_3 DOMESTIC CASH$_j$ + β_4 DOMESTIC DEBT$_j$ + β_5 DOMESTIC EQUITY$_j$ + β_6 INTERNATIONAL EQUITY$_j$ + β_7 MULTISECTOR$_j$ + β_8 SALES CHARGES$_j$ + β_9 FUND COMPLEX$_j$ + β_{10} RETURN$_j$ + e. The dependent variable is the expense ratio of the superannuation fund.
Numbers in parentheses are t-statistics.
*Significant at 0.01 significance level. ** Significant at 5-percent significance level.

4.5 Chapter summary

In this chapter we reported empirical results based on preliminary performance measures, economies of scale and fund characteristics. We found no consistency in ranking by using the traditional performance measures, which, though widely applied by the industry, are erroneous for ranking fund's performance. The interesting finding is that the Australian superannuation funds performed adversely based on popular performance measures, a finding that is similar to those reported all over the world with these measures. We found that, on average, superannuation funds, including wholesale and retail funds performed below the market benchmark. However, these measures do not provide consistent conclusions. With these four measures market-adjusted and risk-adjusted measures seem to yield more consistent and thus reliable results compared to using only the risk-adjusted measures.

The results on the economies of scale of superannuation funds indicate that, on average, retail superannuation funds do not have economies of scale. However, when funds were divided based on fund size, there is some evidence that funds with more than $A30 million in assets exhibited economies of scale. We found domestic debt funds and international debt and equity funds show variations in cost elasticity with domestic funds cost elasticity scoring less than one and international debt and equity cost elasticity scoring more than one.

An analysis of fund characteristics indicated that the results vary between wholesale and retail funds. We found no significant relationship between fund size and fund expenses. The results are the same both for retail and wholesale superannuation funds. Retail funds appear to be significantly negatively related to fund's age. In the case of wholesale funds, the same relation does not hold. We also found that being a member of a large and complex fund management company will not reduce expenses. A positive and significant coefficient estimated for fund objective has been verified as an important factor in performance. Finally, we found no significant relationship between funds' returns and funds' expenses. Thus, these findings reported through widely-used traditional measures indicated results of doubtful accuracy, while the results using two newer measures – economies of scale and fund expenses – appear to indicate that the superannuation funds do not appear to perform efficiently, which conclusions are also similar to those reported in the U.S studies.

CHAPTER FIVE

CHAPTER FIVE

PERFORMANCE ATTRIBUTION: DO FUND MANAGERS POSSESS SKILLS?

5.1 Introduction

This chapter presents a summary of empirical tests, which address the very important issue of whether fund mangers possess stock selection and market timing skills long attributed to them. The results relate to selection and timing skills of Australian superannuation fund managers using various methods as modeled in Chapter Three. In section 5.2, we discuss the results from applying the relevant models namely, Treynor–Mazuy (T-M) (1966) and Henriksson-Merton (H-M) (1981) models on both wholesale and retail superannuation funds. A newer test on the quality of market timing based on Lee-Rahman (L-R) (1990) model was also applied. The findings are presented and discussed in Section 5.3. The findings on market timing skills using a newly developed approach adapted from business cycle studies are presented in Section 5.4. These findings relate first to a set of linearity tests, then the rolling regression results, which is followed by the main results. The chapter ends with a brief summary in Section 5.5.

5.2 Results based on traditional measures

5.2.1 Results of Australian retail superannuation funds

Tables 5.1 and 5.2 contain a summary of test results using T-M and H-M models respectively relating to the Australian retail superannuation funds. The data used are monthly return series covering 14 years from 1989 to 2002. In both tables, α refers to the abnormal returns of the funds that are due to *security selection skill* of the fund managers while β_2 represents abnormal returns attributable to *market timing skill* of the fund managers.

Adjusted R-square values in both tables indicate that the data fits the model well. Most of the values are above 0.60 indicating high coefficient of determination. The statistical significance of α and β_2 coefficients are indicated by the t-values shown in the next column after each coefficient. The results based on the T-M model indicate that only two funds out of fifty-nine have significant α values. That means lack of selection skills on part of the fund managers. Fund R20 has a negative α value, which indicates adverse security selection skill of the fund manager. Fund R48 has positive α value indicating superior security selection skill of the fund manager. Six funds exhibited significant β_2 values (R14, R38, R40, R53, R54, R58). However, all these six funds have negative market timing skills. The remaining funds have insignificant β_2 values. This indicates that no retail fund manager possess superior market timing skills. In fact, some of them have significant adverse timing skills.

Table 5.1: Performance of Australian Retail Superannuation Funds during 1989-2002
using Treynor-Mazuy Method
$(R_{pt} - R_{ft}) = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p (R_{mt} - R_{ft})^2 + \varepsilon_{pt}$

Fund	α_1	t-values	β_1	t-values	β_2	t-values	$\bar{R}^2$
R1	0.066	(0.854)	0.228	(13.790)*	-0.001	-(0.051)	0.588
R2	-0.071	-(1.210)	0.245	(19.490)*	0.007	(0.294)	0.74
R3	0.003	(0.032)	0.25	(10.920)*	-0.002	-(0.512)	0.471
R4	0.118	(1.347)	0.225	(11.990)*	-0.004	-(1.090)	0.522
R5	-0.005	-(0.062)	0.216	(11.020)*	-0.004	-(1.220)	0.481
R6	0.177	(1.640)	0.168	(7.300)*	-0.007	-(1.610)	0.295
R7	-0.0002	-(0.002)	0.229	(12.890)*	-0.005	-(0.163)	0.554
R8	0.008	(0.085)	0.233	(11.410)*	-0.001	-(0.452)	0.493
R9	-0.0246	-(0.032)	0.24	(14.530)*	-0.006	-(0.194)	0.612
R10	-1.102	-(1.460)	0.184	(12.360)*	0.001	(0.411)	0.531
R11	-0.082	-(0.950)	0.229	(12.400)*	0.001	(0.416)	0.533
R12	0.023	(0.240)	0.242	(11.690)*	0.007	(0.191)	0.78
R13	-0.033	-(0.390)	0.233	(12.790)*	-0.001	-(0.322)	0.55
R14	0.151	(1.513)	0.128	(5.970)*	-0.009	-(2.370)**	0.23
R15	0.032	(0.389)	0.193	(10.840)*	0.002	(0.721)	0.465
R16	0.013	(0.160)	0.205	(11.420)*	-0.001	-(0.540)	0.494
R17	0.034	(0.552)	0.17	(12.870)*	-0.004	-(0.192)	0.553
R18	-0.019	-(0.280)	0.226	(15.140)*	0.002	(0.975)	0.63
R19	-0.012	-(0.120)	0.206	(10.320)*	-0.011	-(0.304)	0.44
R20	-0.116	-(2.350)**	0.075	(7.160)*	-0.003	-(1.910)	0.293
R21	0.081	(0.859)	0.207	(10.260)*	-0.004	-(0.105)	0.438
R22	-0.04	-(0.290)	0.223	(7.710)*	-0.002	-(0.390)	0.305
R23	-0.062	-(1.140)	0.031	(2.690)**	-0.001	-(0.570)	0.14
R24	-0.33	-(0.031)	0.248	(10.860)*	-0.001	-(0.390)	0.468
R25	-0.023	-(0.320)	0.221	(14.070)*	-0.003	-(1.130)	0.601
R26	0.082	(1.170)	0.242	(16.230)*	-0.002	-(0.706)	0.665
R27	0.05	(0.745)	0.381	(26.620)*	-0.005	-(1.810)	0.844
R28	0.042	(0.530)	0.35	(20.330)*	0.007	(0.020)	0.756
R29	0.156	(1.230)	0.372	(13.720)*	-0.008	-(1.655)	0.591
R30	0.014	(0.192)	0.494	(31.450)*	-0.003	-(1.090)	0.88
R31	0.122	(0.916)	0.398	(14.010)*	-0.006	-(1.260)	0.599
R32	-0.03	-(0.264)	0.217	(7.200)*	-0.01	-(1.710)	0.291
R33	0.028	(0.266)	0.445	(19.250)*	-0.007	-(1.690)	0.739
R34	0.053	(0.650)	0.526	(30.250)*	-0.002	-(0.860)	0.873
R35	0.026	(0.249)	0.459	(20.600)*	-0.003	-(0.770)	0.762
R36	-0.009	-(0.099)	0.474	(23.420)*	-0.004	-(1.220)	0.806
R37	0.175	(1.250)	0.484	(16.230)*	-0.01	-(1.740)	0.669
R38	0.069	(0.875)	0.4	(23.540)*	-0.006	-(2.100)**	0.81
R39	0.04	(0.392)	0.422	(19.160)*	-0.003	-(0.890)	0.735

R40	0.087	(0.758)	0.453	(18.410)*	-0.013	-(2.750)**	0.726
R41	0.114	(0.988)	0.519	(21.040)*	-0.008	-(1.800)	0.77
R42	0.197	(1.850)	0.425	(18.790)*	-0.008	-(1.950)	0.73
R43	0.135	(1.530)	0.488	(25.800)*	-0.005	-(1.550)	0.836
R44	0.117	(1.230)	0.435	(21.530)*	-0.006	-(1.530)	0.77
R45	0.157	(1.090)	0.422	(13.830)*	-0.009	-(1.640)	0.595
R46	-0.729	-(1.040)	0.488	(3.280)**	0.013	(0.450)	0.16
R47	0.056	(0.687)	0.459	(26.140)*	-0.006	-(0.194)	0.83
R48	0.266	(2.260)**	0.413	(16.450)*	-0.002	-(0.830)	0.67
R49	0.151	(1.290)	0.433	(17.330)*	-0.008	-(1.710)	0.697
R50	0.06	(0.589)	0.449	(20.490)*	-0.001	-(0.305)	0.75
R51	0.01	(0.100)	0.36	(15.800)*	-0.003	-(0.740)	0.653
R52	0.042	(0.235)	0.417	(10.790)*	0.007	(1.040)	0.463
R53	0.067	(0.684)	0.518	(24.830)*	-0.002	-(2.010)**	0.825
R54	0.059	(0.787)	0.448	(27.820)*	-0.007	-(2.270)**	0.855
R55	0.087	(1.030)	0.467	(15.640)*	-0.001	-(1.100)	0.834
R56	0.012	(0.103)	0.404	(15.640)*	-0.005	-(1.100)	0.65
R57	-0.35	-(1.540)	0.594	(12.010)*	0.001	(0.152)	0.517
R58	0.233	(1.640)	0.513	(17.010)*	-0.012	-(2.080)**	0.691
R59	0.173	(1.590)	0.447	(19.240)	-0.006	-(1.430)	0.738

Note: t-values, based on heteroscedasticity consistent standard errors, are in parentheses beneath the parameter estimates.

*signifiacnt at 1% level; ** significant at 5% level.

Variables: $(R_{pt} - R_{ft})$: risk- adjusted return of the portfolio, α_p: the intercept to measure the security selection skill of the fund manager, β_p: coefficient of the market return, representing the systematic risk, $(R_{mt} - R_{ft})$: risk- adjusted return of the market $(R_m - R_f)$, γ_p: coefficient that measures the market timing ability of the fund manager, and

ε_{pt}: residual term.

Overall, T-M model indicates that there is no evidence of superior selection nor market timing skills on the part of the fund managers managing the Australian retail funds. The results based on H-M model as shown in table 5.2 convey the same message. However, H-M model finds only one fund has significant α values. Fund R20 exhibits negative security selection skill. And no fund has significant β_2 value – indicating no evidence of superior market timing skills. Therefore, a conclusion that seems unavoidable

Table 5.2: Performance of Australian Retail Superannuation Funds during 1989-2002 using Henriksson-Merton Method

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_{p1} (R_{mt} - R_{ft}) + \beta_{p2} \max (0, R_{ft} - R_{mt}) + \varepsilon_{pt}$$

Fund	α_1	t-values	β_1	t-values	β_2	t-values	$\overline{R}^2$
R1	0.134	(-1.07)	0.247	(-9.04)*	-0.174	(-0.84)	0.59
R2	-0.098	(-1.02)	0.238	(11.41)*	0.07	(-0.44)	0.74
R3	0.015	(-0.091)	0.26	(6.85)*	-0.085	(-0.029)	0.47
R4	0.129	(-0.902)	0.24	(7.7)*	-0.12	(-0.54)	0.51
R5	-0.08	(-0.53)	0.21	(-6.62)*	0.013	(-0.055)	0.475
R6	0.177	(-1.002)	0.191	(4.98)*	-0.19	(-0.678)	0.28
R7	-0.017	(-0.126)	0.228	(7.73)*	0.016	(-0.074)	0.55
R8	0.075	(-0.485)	0.253	(7.47)*	-0.17	(-0.69)	0.49
R9	-0.005	(-0.04)	0.246	(9.01)*	-0.05	(-0.261)	0.613
R10	-0.109	(-0.96)	0.179	(7.26)*	0.045	(-0.241)	0.531
R11	-0.11	(-0.78)	0.218	(7.15)*	0.093	(-0.404)	0.53
R12	0.101	-(0.644)	0.255	(7.45)*	-0.12	(-0.48)	0.5
R13	-0.11	-(0.820)	0.22	(7.32)*	0.12	(-0.527)	0.55
R14	-0.112	(-0.67)	0.107	(2.97)**	0.229	(-0.84)	0.21
R15	-0.028	(-0.212)	0.173	(5.86)*	0.184	(-0.827)	0.465
R16	-0.0333	(-0.02)	0.208	(6.99)*	-0.019	(-0.088)	0.493
R17	0.009	-(0.090)	0.166	(7.62)*	0.032	(-0.19)	0.55
R18	-0.05	(-0.479)	0.21	(8.48)*	0.14	(-0.763)	0.629
R19	-0.004	(-0.02)	0.211	(6.39)*	-0.046	(-0.187)	0.44
R20	-0.158	(-1.95)	0.079	(4.51)*	-0.027	(-0.203)	0.273
R21	0.184	-(1.200)	0.229	(6.87)*	-0.206	(-0.817)	0.441
R22	0.116	-(0.532)	0.262	(5.48)*	-0.358	(-0.99)	0.3
R23	-0.12	(-1.39)	0.12	(2.17)**	0.079	(-0.544)	0.14
R24	0.004	-(0.023)	0.255	(6.74)*	-0.061	(-0.21)	0.468
R25	0.047	-(0.395)	0.247	(9.47)*	-0.22	(-1.16)	0.6
R26	0.145	-(1.270)	0.261	(10.6)*	-0.175	(-0.93)	0.66
R27	0.037	-(0.290)	0.394	(16.4)*	-0.105	(-0.58)	0.84
R28	-0.088	(-0.68)	0.3243	(11.41)*	0.251	(-1.17)	0.75
R29	-0.066	(-0.32)	0.356	(7.85)*	0.185	(-0.53)	0.584
R30	-0.19	(-1.6)	0.46	(17.91)*	0.29	(-1.51)	0.88
R31	0.09	(-0.43)	0.415	(8.77)*	-0.139	(-0.38)	0.59
R32	-0.09	(-0.39)	0.23	(4.75)*	-0.017	(-0.44)	0.27
R33	-0.12	(-0.708)	0.43	(11.35)*	0.08	(-0.28)	0.733
R34	-0.068	(-0.514)	0.512	(17.74)*	0.15	(-0.688)	0.87
R35	-0.02	(-0.16)	0.45	(12.41)*	0.012	(-0.04)	0.76
R36	-0.04	(-0.271)	0.483	(14.34)*	-0.07	(-0.27)	0.804
R37	-0.22	(-1.007)	0.435	(8.78)*	0.492	(-1.31)	0.66
R38	-0.129	(-0.986)	0.383	(13.42)*	0.187	(-0.868)	0.8
R39	-0.15	(-0.899)	0.396	(10.87)*	0.257	(-0.932)	0.735
R40	0.039	-(0.207)	0.486	(11.63)*	-0.269	(-0.854)	0.712
R41	-0.256	(-1.36)	0.473	(11.54)*	0.466	(-1.504)	0.77

R42	0.203	(-1.17)	0.454	(11.98)*	-0.246	(-0.86)	0.724
R43	-0.029	(-0.206)	0.473	(15.05)*	0.157	(-0.66)	0.83
R44	0.011	(-0.075)	0.434	(12.85)*	0.035	(-0.137)	0.77
R45	-0.199	(-0.852)	0.383	(7.52)*	0.408	(-1.06)	0.59
R46	-1.87	(-1.67)	0.216	(2.88)**	2.53	(-1.37)	0.17
R47	-0.181	(-1.34)	0.433	(14.77)*	0.27	(-1.21)	0.83
R48	0.298	(-1.56)	0.433	(10.39)*	-0.172	(-0.546)	0.67
R49	0.053	(-0.277)	0.44	(10.53)*	-0.042	(-0.13)	0.69
R50	-0.172	(-1.04)	0.407	(11.3)*	0.406	(-1.49)	0.76
R51	-0.129	(-0.743)	0.343	(9.08)*	0.175	(-0.611)	0.653
R52	0.224	(-0.762)	0.428	(6.67)*	-0.13	(-0.26)	0.458
R53	-0.208	(-1.3)	0.49	(14.03)*	0.299	(-1.13)	0.821
R54	-0.08	(-0.712)	0.44	(16.25)*	0.08	(-0.42)	0.85
R55	0.185	(-7.35)*	0.493	(16.52)*	-0.23	(-1.06)	0.83
R56	0.126	(-0.645)	0.445	(10.4)*	-0.367	(-1.13)	0.65
R57	-0.141	(-0.377)	0.633	(7.73)*	-0.371	(-0.599)	0.518
R58	0.138	(-0.59)	0.534	(10.52)*	-0.155	(-0.404)	0.681
R59	0.187	(-1.05)	0.47	(12.17)*	-0.203	(-0.695)	0.735

Note: t-values, based on heteroscedasticity consistent standard errors, are in parentheses beneath the parameter estimates.

*signifiacnt at 1% level; ** significant at 5% level.

Variables: $(R_{pt} - R_{ft})$: risk- adjusted return of the portfolio, α_p : the intercept to measure the security selection skill of the fund manager, β_{p1}: coefficient of the market return, representing the systematic risk, $(R_{mt} - R_{ft})$: risk- adjusted return of the market (R_m-R_f), β_{p2}: coefficient that measures the market timing ability of the fund manager, and ε_{pt} : residual term.

is that fund mangers in general have no significant market timing skills as per the test statistics from the H-M model as well.

5.2.2 Results of Australian wholesale superannuation funds

The results relating to the wholesale funds from applying the T-M and H-M models are presented in Tables 5.3 and 5.4. These results provide slightly different conclusion, this time somewhat different from the results examined on the retail funds. T-M model, when applied to this sector, indicates that ten out of thirty-seven funds have

Table 5.3: Performance of Australian Wholesale Superannuation Funds during 1989-2002 using Treynor-Mazuy Method

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p (R_{mt} - R_{ft})^2 + \varepsilon_{pt}$$

Fund	α_1	t-values	β_1	t-values	β_2	t-values	$\bar{R}^2$
W1	0.058	(0.822)	0.3744	(24.858)*	-0.0026	-(0.907)	0.824
W2	0.125	(1.690)	0.49	(30.950)*	-0.004	-(1.370)	0.879
W3	0.0367	(0.632)	0.248	(20.063)*	0.0004	(0.169)	0.751
W4	0.136	(1.200)	0.659	(27.300)*	-0.008	-(1.770)	0.85
W5	0.161	(1.720)	0.481	(24.102)*	-0.005	-(1.420)	0.815
W6	-0.025	-(3.400)**	0.173	(10.840)*	0.005	(1.760)	0.464
W7	0.043	(0.397)	0.503	(21.360)*	0.001	(0.231)	0.774
W8	0.06	(0.571)	0.452	(20.150)*	-0.007	-(1.640)	0.756
W9	0.137	(1.550)	0.233	(12.310)*	-0.004	-(1.110)	0.533
W10	0.145	(0.100)	0.613	(2.001)**	-0.0154	-(0.258)	0.15
W11	0.148	(1.430)	0.249	(11.300)*	-0.002	-(0.619)	0.489
W12	0.044	(0.443)	0.535	(24.900)*	-0.002	-(0.522)	0.836
W13	0.033	(0.407)	0.229	(13.040)*	-0.003	-(0.105)	0.559
W14	0.085	(0.962)	0.491	(25.930)*	-0.004	-(1.250)	0.836
W15	0.091	(1.070)	0.243	(13.380)*	-0.001	-(0.350)	0.573
W16	0.112	(1.300)	0.378	(20.560)*	-0.003	-(1.050)	0.762
W17	0.139	(1.650)	0.425	(23.620)*	-0.002	-(0.588)	0.808
W18	0.102	(1.203)	0.492	(28.080)*	-0.0007	-(0.210)	0.846
W19	0.042	(0.734)	0.26	(20.970)*	-0.002	-(0.109)	0.768
W20	0.112	(1.083)	0.224	(10.140)*	-0.0005	-(0.110)	0.423
W21	0.212	(2.080)**	0.465	(21.360)*	-0.005	-(1.408)	0.776
W22	-0.042	-(0.608)	0.192	(12.907)*	0.002	(1.026)	0.553
W23	0.109	(1.010)	0.526	(22.870)*	-0.002	-(0.664)	0.798
W24	0.3055	(4.410)*	0.442	(29.950)*	-0.007	-(0.266)	0.871
W25	0.2001	(0.763)	0.359	(6.430)*	-0.016	-(1.490)	0.244
W26	0.071	(1.130)	0.23	(17.150)*	-0.001	-(0.630)	0.689
W27	0.254	(2.600)**	0.498	(24.001)*	-0.008	-(2.070)	0.815
W28	0.094	(0.901)	0.462	(20.640)*	-0.003	-(0.720)	0.763
W29	0.2077	(2.181)**	0.447	(22.009)*	-0.007	-(1.940)	0.787
W30	0.159	(1.750)	0.528	(27.200)*	-0.005	-(1.520)	0.849
W31	0.231	(2.201)**	0.475	(21.192)*	-0.007	-(1.608)	0.912
W32	0.177	(2.280)**	0.391	(23.670)*	-0.004	-(1.370)	0.81
W33	0.205	(2.153)**	0.495	(24.350)*	-0.006	-(1.620)	0.818
W34	0.158	(1.660)	0.236	(11.640)*	-0.002	-(0.563)	0.504
W35	-0.02	-(0.230)	0.455	(20.330)*	0.006	(1.520)	0.755
W36	0.254	(2.560)**	0.47	(22.150)*	-0.007	-(1.730)	0.79
W37	0.278	(2.590)**	0.439	(19.150)*	-0.007	-(1.720)	0.737

Note: t-values, based on heteroscedasticity consistent standard errors, are in parentheses beneath the parameter estimates; * significant at 1% level; ** significant at 5% level.

Variables: ($R_{pt} - R_{ft}$): risk- adjusted return of the portfolio, α_p: the intercept to measure the security selection skill of the fund manager, β_{p1}: coefficient of the market return, representing the systematic risk, ($R_{mt} - R_{ft}$): risk- adjusted return of the market (R_m-R_f), β_{p2}: coefficient that measures the market timing ability of the fund manager, and ε_{pt}: residual term.

Table 5.4: Performance of Australian Wholesale Superannuation Funds during 1989-2002 using Henriksson-Merton Method

$$(R_{pt} - R_{ft}) = \alpha_p + \beta_{p1}(R_{mt} - R_{ft}) + \beta_{p2}\max(0, R_{ft} - R_{mt}) + \varepsilon_{pt}$$

Fund	α_1	t-values	β_1	t-values	β_2	t-values	$\bar{R}^2$
W1	-0.09	-(0.864)	0.351	(14.130)	0.224	(1.190)	0.824
W2	-0.062	-(0.510)	0.466	(17.760)	0.24	(1.210)	0.878
W3	-0.005	-(0.005)	0.238	(11.660)	0.091	(0.585)	0.751
W4	-0.27	-(1.470)	0.604	(15.130)	0.543	(1.799)	0.85
W5	-0.002	-(0.014)	0.466	(14.020)	0.165	(0.636)	0.813
W6	-0.372	-(3.040)	0.132	(5.020)	0.367	(1.830)	0.463
W7	-0.201	-(1.130)	0.451	(11.680)	0.494	(1.690)	0.778
W8	-0.07	-(0.430)	0.449	(11.950)	0.059	(0.209)	0.751
W9	0.121	(0.844)	0.243	(7.720)	-0.082	-(0.340)	0.531
W10	-1.13	-(0.470)	0.411	(2.880)	1.956	(0.512)	0.17
W11	0.187	(1.070)	0.264	(7.230)	-0.134	-(0.487)	0.489
W12	-0.143	-(0.881)	0.504	(14.240)	0.296	(1.108)	0.83
W13	0.014	(0.106)	0.226	(7.780)	0.026	(0.121)	0.559
W14	-0.107	-(0.747)	0.467	(14.880)	0.239	(1.007)	0.835
W15	0.05	(0.364)	0.239	(7.940)	0.044	(0.196)	0.573
W16	-0.13	-(0.940)	0.34	(11.250)	0.36	(1.590)	0.76
W17	-0.0175	-(0.123)	0.4	(13.480)	0.242	(1.070)	0.809
W18	-0.121	-(0.890)	0.449	(15.130)	0.404	(1.800)	0.85
W19	-0.082	-(0.680)	0.236	(11.590)	0.234	(1.490)	0.771
W20	0.049	(0.292)	0.213	(5.830)	0.105	(0.381)	0.433
W21	0.021	(0.126)	0.446	(12.300)	0.2	(0.732)	0.774
W22	-0.05	-(0.440)	0.18	(7.320)	0.096	(0.515)	0.55
W23	-0.109	-(0.620)	0.492	(12.970)	0.333	(1.160)	0.799
W24	0.384	(3.440)	0.46	(18.900)	-0.171	-(0.920)	0.872
W25	-0.22	-(0.520)	0.326	(3.500)	0.362	(0.514)	0.23
W26	0.016	(0.158)	0.224	(10.090)	0.06	(0.357)	0.688
W27	0.061	(0.385)	0.487	(13.950)	0.135	(0.514)	0.809
W28	0.186	(1.090)	0.491	(13.260)	-0.26	-(0.929)	0.763
W29	0.119	(0.762)	0.454	(13.310)	-0.041	-(0.160)	0.781
W30	0.026	(0.177)	0.52	(16.050)	0.095	(0.388)	0.846
W31	0.145	(0.846)	0.48	(12.820)	-0.02	-(0.102)	0.769
W32	-0.08	-(0.676)	0.353	(12.981)	0.375	(1.820)	0.812
W33	0.001	(0.008)	0.475	(14.010)	0.211	(0.825)	0.816
W34	0.236	(1.530)	0.259	(7.710)	-0.207	-(0.810)	0.505

W35	-0.025	-(1.350)	0.384	(10.680)	0.556	(2.040)	0.759
W36	0.297	(1.830)	0.501	(14.410)	-0.277	-(1.030)	0.786
W37	0.311	(1.770)	0.471	(12.300)	-0.273	-(0.943)	0.733

Note: t-values, based on heteroscedasticity consistent standard errors, are in parentheses beneath the parameter estimates.
* significant at 1% level; ** significant at 5% level.
Variables: $(R_{pt} - R_{ft})$: risk- adjusted return of the portfolio, α_p: the intercept to measure the security selection skill of the fund manager, β_{p1}: coefficient of the market return, representing the systematic risk, $(R_{mt} - R_{ft})$: risk- adjusted return of the market $(R_m\text{-}R_f)$, β_{p2}: coefficient that measures the market timing ability of the fund manager, and ε_{pt}: residual term.

significant α values: these funds are W6, W21, W24, W27, W29, W31, W32, W33, W36 and W37.

Among these funds, except fund W6, all the other nine funds have positive values. This indicates that 25 percent of the fund managers in the wholesale funds sample have superior selection skills. However, in terms of market timing skill, none of these fund managers appear to test positive with superior market timing skills. There is only weak evidence of superior market timing skills for fund W6 but the same fund exhibits significant adverse security selection skill. The results based on H-M model also provide the same kind of results, except that the statistics are less significant: see Table 5.4 on page 110.

In summary, both retail and wholesale fund managers have no superior security selection, and market timing skills as revealed by the test statistics computed for recent fourteen years. Indeed some of the actions of the fund managers led to adverse selection, and worse timing skills. However, on a comparative basis, the wholesale funds performed better than the retail funds. The results are consistent with the test results reported in previous Australian studies.

5.3 Results based on Lee-Rahman (L-R) model

L-R model provides measures about the *quality* of fund manager's market timing skill and this has yet been tested on Australian data. The model compares the variance of fund returns introduced by market timing actions of the fund managers to the variance of the market returns. Hence it is a ratio of the two variances, which are presently accepted as superior measure of market timing skill. If the ratio equals one, it indicates that the fund managers did not induce additional variance due to their market timing and their portfolio variance is equal to the variance caused in the general market conditions. In other words, fund managers are able to predict the market variance and successfully adjust their portfolio variance accordingly. The ratio above one indicates that the fund managers' rebalancing strategies induce additional variance. In that case they should be able to out perform the market as they are taking additional risk. On the other hand, if the ratio is below one then it is interpreted as the fund managers' inability to predict market variance. As per L-R model a ratio of one indicates good quality of market timing.

Results for retail superannuation funds

The statistics in the tables provide somewhat more reliable findings on the quality of market timing of both retail and wholesale fund managers. Table 5.5 shows that around 35 percent of the retail superannuation funds (21 out of 59 funds) have the L-R ratio near to one (0.8 and above). The average L-R ratio is 0.625. Thus, the L-R model indicates that, on average, 65 percent of retail superannuation fund managers do not successfully forecast market conditions and 35 percent of them are able to successfully adjust their portfolio variance through their good quality of market timing.

Table 5.5: Quality of Market Timing of Australian Retail Superannuation Funds during 1989-2002 using Lee-Rahman Method

$$\rho = \{\sigma_\pi^2/(\sigma_\pi^2+\sigma_\varepsilon^2)\}^{1/2}$$

Funds	ρ	Funds	ρ
R1	0.322	R31	0.994
R2	0.440	R32	0.048
R3	0.943	R33	0.838
R4	0.146	R34	0.867
R5	0.307	R35	0.063
R6	0.307	R36	0.793
R7	0.167	R37	0.228
R8	0.382	R38	0.864
R9	0.065	R39	0.724
R10	0.425	R40	0.634
R11	0.977	R41	0.851
R12	0.029	R42	0.851
R13	0.104	R43	0.742
R14	0.667	R44	0.805
R15	0.757	R45	0.010
R16	0.467	R46	0.994
R17	0.630	R47	0.873
R18	0.874	R48	0.901
R19	0.939	R49	0.738
R20	0.473	R50	0.907
R21	0.619	R51	0.981
R22	0.555	R52	0.985
R23	0.567	R53	0.907
R24	0.939	R54	0.825
R25	0.323	R55	0.787
R26	0.034	R56	0.032
R27	0.769	R57	0.963
R28	0.871	R58	0.955
R29	0.902	R59	0.951
R30	0.747	Average	**0.625**

Note: ρ is the measure of quality of market timing. The nearer ρ is to 1 the better is the quality of market timing.

Variables: σ_π^2 :Variance of the mean-adjusted ($\pi = R_{mt} - E(R_m)$) market return obtained from Merton's (1980) definition: σ_π^2 : $\{\Sigma^n_{k=1}$ [$\ln(1+R_{mt})$]^2 }/n, and σ_ε^2 : Variance of the residual term, obtained through the following procedure Lee and Rahman's (1990) definition of portfolio return, R_{pt}.

Tables 5.5 and 5.6 provide L-R ratio for retail and wholesale funds respectively.

However, these results did not confirm whether such good quality results in superior performance. The results only indicate that how much of the total variance can be explained by the portfolio variance. As shown in T-M and H-M model-derived statistics, such good quality of market timing do not result in superior market-adjusted performance. This evidence suggests that timing activities to follow market movements successfully do not guarantee fund managers to achieve superior returns. The insignificant market timing coefficient for a majority of the funds using both models conveyed the same message.

Results of wholesale superannuation funds

The statistics in Table 5.6 indicates that around 60 percent of the wholesale superannuation funds (22 out of 37 funds) have the L-R ratio near one. This indicates that wholesale fund managers possess better quality of market timing compared to retail fund managers. This is a new and interesting finding for this sector. The average L-R ratio with value 0.75 supports this evidence. It is also evident from T-M and H-M models that wholesale fund managers are slightly better performers compared to retail fund managers. However, the overall results hold the same outcomes for both fund managers. Even the wholesale fund managers with their better quality of market timing are not able to outperform the market consistently as shown in T-M and H-M models.

Table 5.6: Quality of Market Timing of Australian Wholesale Superannuation Funds during 1989-2002 using Lee-Rahman Method

$$\rho = \{\sigma_\pi^2/(\sigma_\pi^2+\sigma_\varepsilon^2)\}^{1/2}$$

Fund	ρ
W1	0.820
W2	0.866
W3	0.442
W4	0.895
W5	0.901
W6	0.374
W7	0.942
W8	0.888
W9	0.660
W10	0.969
W11	0.745
W12	0.858
W13	0.096
W14	0.749
W15	0.375
W16	0.821
W17	0.896
W18	0.882
W19	0.862
W20	0.454
W21	0.520
W22	0.629
W23	0.851
W24	0.886
W25	0.522
W26	0.755
W27	0.884
W28	0.949
W29	0.893
W30	0.871
W31	0.860
W32	0.915
W33	0.764
W34	0.509
W35	0.802
W36	0.942
W37	0.935
Average	**0.756**

Note: ρ is the measure of quality of market timing. The nearer ρ is to 1 the better is the quality of market timing.

Variables: σ_π^2 :Variance of the mean-adjusted ($\pi = R_{mt}$- $E(R_m)$) market return obtained from Merton's (1980) definition: σ_π^2 : $\{\Sigma^n_{k=1}$ [$\ln(1+R_{mt})$]^2 }/n, and σ_ε^2: Variance of the residual term , obtained through the following procedure Lee and Rahman's (1990) definition of portfolio return, $R_{pt.}$

5.4 Results based on Logistic Smooth Transition (LSTM) model

5.4.1 Results based on rolling regressions

The rolling regressions as discussed in the methodology chapter are performed for two important reasons. These are (i) to show that beta varies with changes in market conditions and (ii) to prove that a dual beta model may not be a sufficient one to capture time-varying beta as it assumes only two extreme market conditions. The results are reported in Table 5.7, which is a summary of tests obtained from two regression equations.

Table 5.7: Rolling Regression Composite Results of Retail and Whole Sale Superannuation Funds

	No of funds with significant α_1	
Rolling regressions	**Retail**	**Wholesale**
No.1 $\beta_t = \alpha_0 + \alpha_1 R^*_{mt} + \varepsilon_t$	28	18
No.2 $\beta_t = \alpha_0 + \alpha_1 D_t + \varepsilon_t$	3	2

Note: In Equation 1, β_t represents each fund's rolling beta and R^*_{mt} is rolling excess market return. The model tries to measure whether β_t varies significantly with the changing market conditions. In Equation 2, D_t is a dummy variable with value 1 for positive R^*_{mt} and 0 for negative value. It measures whether dual beta model captures changing R^*_{mt}.

Regression results in the above table are aimed at testing whether beta is significant, and positive with several states of changing market conditions. A significant beta value implies that beta changes with market returns. Equation No.1 tests whether beta changes with changing market return. Regression equation No. 2 is more important for our analysis as we aim to improve the existing dual beta model used hitherto. The dummy variable in the regression equation takes a value 0 and a value of 1 based on the sign of the risk premium. The regression equation tests whether time-varying betas capture only the signs of market conditions. If the dummy variable is significant then it indicates that dual beta model like H-M is a good test for measuring timing skills of the fund managers.

We found significant α_1 values for 28 out of 59 retail superannuation funds: the corresponding number is 18 out of 37 wholesale funds. Thus, the findings relating to 28 retail and 18 wholesale funds indicate that beta is a time-varying variable unlike the assumption in the traditional models (used in earlier parts of this chapter). This result is expected given the reliable literature on time-varying beta (see Ferson and Schadt, 1996). Although the method of testing is not robust and there are friction problems due to changing only one beta at a time for every 30 observations, the results from the model convey one strong conclusion. That is, that the majority of betas vary with changes in market conditions.

The results show that only 3 out of 59 retail superannuation funds and 2 out of 37 wholesale funds have significant dummy variable. This indicates that dual beta model is *not* a good choice; hence the usefulness of earlier models (H-M, T-R and L-R models) is very limited. The statistics on a majority of the funds indicate that dual beta model is insufficient to capture the time-varying beta. This is a clear evidence to-date to argue that dual beta model does not provide a good representation of data generation process. Hence the model developed in this thesis on a continuous basis provides a better measure of the market timing skill.

5.4.2 Linearity test results

We begin our model selection process by testing for nonlinearity using the Luukonen and Tsay test statistics. If nonlinearity is detected, then we estimate the nonlinear LSTM model using nonlinear least squares (NLLS). Although not reported in this section, the statistics and their p-values were based on White's (1980) heteroscedasticity consistent standard error estimates. The results are presented in Tables 5.8 and 5.9 for retail and wholesale funds respectively.

We reject the null hypothesis which assumes a constant risk model if at least one of the Luukonen and Tsay test statistics was significant at the 10% level. Eighteen of the 37 sampled wholesale and 28 of the 59 retail funds were found to be nonlinear. Therefore only these funds with nonlinear results were modeled using the LSTM form. Although the rolling regressions indicate a relationship between beta and our transition variable R^* for almost all funds, we chose to use the linearity tests to only these selected funds to be modeled using the LSTM formulation because this method has been shown to have good power properties against both the DBM (dual beta model: with up and down market betas) and LSTM forms and because the rolling regression results are sensitive to the length of the window used in the rolling regressions.

Table 5.8: Linearity Test Results for Australian Retail Superannuation Funds

RETAIL FUNDS	S_1	S_1^*	S_3	*Tsay*	*Tsay**
R4	1.199 (0.276)	0.082 (0.775)	0.625 (0.537)	3.072 (0.063)	0.568 (0.568)
R5	1.509 (0.221)	0.006 (0.938)	0.903 (0.408)	2.731 (0.072)	0.991 (0.374)
R6	2.623 (0.108)	2.781 (0.098)	1.848 (0.162)	3.136 (0.047)	1.866 (0.159)
R14	5.663 (0.019)	0.204 (0.653)	4.453 (0.013)	3.355 (0.039)	4.474 (0.014)
R15	0.521 (0.472)	5.732 (0.018)	2.935 (0.057)	2.810 (0.064)	1.095 (0.338)
R16	0.296 (0.587)	1.517 (0.220)	1.558 (0.214)	2.434 (0.092)	0.695 (0.501)
R18	0.952 (0.331)	5.822 (0.017)	2.898 (0.059)	4.760 (0.010)	1.846 (0.163)
R20	3.667 (0.058)	2.748 (0.099)	2.214 (0.113)	3.668 (0.029)	0.771 (0.465)
R27	3.300 (0.072)	0.246 (0.621)	2.822 (0.063)	2.933 (0.057)	2.474 (0.089)
R28	0.000 (0.983)	2.644 (0.106)	1.658 (0.195)	2.810 (0.064)	2.556 (0.082)
R29	2.739 (0.100)	1.684 (0.197)	1.546 (0.217)	2.751 (0.068)	1.322 (0.271)
R30	1.199 (0.276)	1.441 (0.232)	2.502 (0.089)	1.829 (0.165)	2.330 (0.102)
R32	2.947 (0.088)	0.033 (0.857)	1.704 (0.186)	2.089 (0.129)	2.438 (0.092)
R33	2.884 (0.092)	0.382 (0.538)	1.448 (0.239)	1.638 (0.199)	1.639 (0.199)
R37	3.033 (0.084)	0.257 (0.613)	1.560 (0.214)	1.668 (0.193)	1.517 (0.224)
R38	4.417 (0.038)	0.125 (0.724)	3.368 (0.037)	2.462 (0.090)	4.441 (0.014)
R40	7.609 (0.007)	2.377 (0.126)	3.834 (0.024)	3.743 (0.027)	2.484 (0.088)
R41	3.262 (0.073)	0.671 (0.414)	3.455 (0.035)	1.882 (0.157)	4.332 (0.015)
R42	3.805 (0.053)	2.268 (0.134)	2.133 (0.123)	2.035 (0.136)	1.208 (0.303)
R44	2.357 (0.127)	0.042 (0.839)	1.713 (0.184)	1.427 (0.244)	3.415 (0.036)
R49	2.948 (0.088)	0.912 (0.341)	1.481 (0.231)	1.343 (0.265)	1.583 (0.210)
R50	0.093 (0.760)	0.978 (0.325)	0.858 (0.426)	1.677 (0.192)	2.497 (0.087)
R53	4.055 (0.046)	0.010 (0.919)	2.716 (0.070)	2.736 (0.069)	2.397 (0.096)
R54	5.153 (0.025)	0.060 (0.807)	2.980 (0.054)	2.723 (0.070)	2.943 (0.057)
R55	0.301 (0.579)	3.963 (0.049)	2.049 (0.133)	0.886 (0.415)	0.142 (0.868)
R56	1.210 (0.273)	2.801 (0.097)	1.461 (0.236)	2.407 (0.095)	0.385 (0.681)
R58	4.362 (0.039)	1.843 (0.177)	2.271 (0.107)	2.047 (0.134)	1.544 (0.218)

Note: S1, S*1, S3 are respectively the Luukkonen first order, augmented first order and third order F-versions of the Lagrange Multiplier type tests of nonlinearity.TSAY and TSAY* are the Tsay F-statisticsfor the data sorted in ascending and descending order respectively. P-values are in parentheses next to the calculated values of the statistics

Table 5.9: Linearity Test Results for Australian Wholesale Superannuation Funds

WHOLESALE FUNDS	S_1	S_1^*	S_3	$Tsay$	$Tsay^*$
W1	0.823 (0.366)	1.666 (0.199)	2.312 (0.103)	2.324 (0.103)	1.833 (0.165)
W2	1.878 (0.173)	1.241 (0.267)	2.945 (0.056)	2.019 (0.138)	2.681 (0.073)
W4	3.164 (0.078)	0.094 (0.760)	2.410 (0.094)	1.384 (0.255)	3.022 (0.053)
W7	3.109 (0.080)	5.882 (0.017)	3.207 (0.044)	2.584 (0.080)	3.166 (0.046)
W9	2.694 (0.103)	0.917 (0.340)	1.364 (0.259)	1.368 (0.259)	1.427 (0.244)
W10	1.235 (0.269)	3.118 (0.085)	0.631 (0.534)	1.064 (0.348)	1.278 (0.283)
W15	2.697 (0.102)	0.112 (0.739)	1.338 (0.266)	0.898 (0.410)	1.646 (0.198)
W19	1.119 (0.292)	3.310 (0.071)	4.084 (0.019)	2.466 (0.089)	5.341 (0.006)
W27	0.442 (0.507)	2.120 (0.148)	2.228 (0.112)	0.578 (0.563)	3.509 (0.033)
W29	2.225 (0.138)	0.034 (0.853)	1.267 (0.285)	1.080 (0.343)	9.789 (0.000)
W31	4.302 (0.040)	0.127 (0.722)	2.368 (0.098)	1.877 (0.158)	2.385 (0.097)
W33	3.773 (0.054)	2.215 (0.139)	2.106 (0.126)	3.067 (0.051)	2.751 (0.068)
W35	2.694 (0.103)	0.239 (0.626)	1.324 (0.270)	1.594 (0.208)	1.789 (0.172)
W36	1.902 (0.170)	1.178 (0.280)	2.908 (0.058)	2.525 (0.085)	3.500 (0.034)
W37	2.695 (0.102)	0.696 (0.406)	1.309 (0.274)	1.254 (0.289)	1.972 (0.144)

Note: S1, S*1, S3 are respectively the Luukkonen first order, augmented first order and third order F-versions of the Lagrange Multiplier type tests of nonlinearity.TSAY and TSAY* are the Tsay F-statisticsfor the data sorted in ascending and descending order respectively. P-values are in parentheses next to the calculated values of the statistics

5.4.3 Results on information structure of fund managers

As discussed in Section 3.3.5 yield spread has been used as the information variable to model the information structure of fund manager. The LSTM results using the duration dependent yield spread are presented in Tables 5.10 and 5.11 for wholesale and retail superannuation funds respectively.

Both tables indicate that our spread based LSTM model fits the data well. A good fit is indicated by the fact that all estimated β_2 coefficients are positive for the retail funds and all but one are positive for the wholesale funds.

Table 5.10: Australian Retail Superannuation Fund Performance During 1989-2002 using Logistic Smooth Transition Model: Parameter estimated using Duration Dependent Spread as Transitional Variable

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \beta_p^U \cdot F(R_t^*) \cdot R_{mt} + \varepsilon_{pt}$$

RETAIL FUNDS	α_1	β_1	β_2	γ	$\overline{R}^2$
R2	-0.230 (0.996)	0.157 (0.000)	0.114 (0.002)	.110	0.7532
R6	0.076 (0.290)	0.130 (0.002)	0.121 (0.010)	3.495	0.5320
R7	-0.051 (0.492)	0.043 (0.336)	0.219 (0.000)	0.302	0.5258
R8	0.096 (0.292)	0.020 (0.756)	0.189 (0.008)	5.442	0.3181
R9	-0.007 (0.928)	0.166 (0.000)	0.085 (0.012)	25.062	0.4981
R10	-0.031 (0.624)	0.166 (0.000)	0.101 (0.094)	.489	0.6157
R11	-0.078 (0.124)	0.027 (0.600)	0.202 (0.000)	.050	0.5748
R13	0.049 (0.532)	0.149 (0.000)	0.116 (0.004)	26.521	0.5163
R17	-0.040 (0.558)	0.139 (0.000)	0.119 (0.012)	20.633	0.5620
R19	0.076 (0.264)	0.016 (0.000)	0.097 (0.002)	54.198	0.4785
R20	-0.001 (0.986)	0.109 (0.000)	0.122 (0.000)	84.509	0.5163
R21	0.036 (0.456)	0.104 (0.000)	0.083 (0.006)	6.134	0.5652
R22	0.027 (0.622)	0.084 (0.046)	0.186 (0.002)	.664	0.6517
R23	-0.021 (0.788)	0.152 (0.000)	0.068 (0.054)	53.782	0.4447
R24	0.085 (0.266)	0.084 (0.024)	0.157 (0.000)	1.982	0.4576
R25	-0.065 (0.282)	0.164 (0.000)	0.073 (0.060)	29.969	0.6029
R26	0.068 (0.216)	0.140 (0.000)	0.129 (0.000)	63.080	0.6882
R27	0.194 (0.216)	0.282 (0.000)	0.130 (0.016)	.855	0.8454
R28	0.053 (0.388)	0.247 (0.000)	0.132(0.002)	5.134	0.7652
R32	-0.152 (0.170)	0.998 (0.000)	0.276 (0.000)	5.738	0.3214
R33	-0.444 (0.036)	0.294 (0.000)	0.197 (0.002)	9.510	0.7564
R35	-0.264 (0.092)	0.392 (0.000)	0.090 (0.044)	239.67	0.7699
R36	-0.262 (0.096)	0.360 (0.000)	0.148 (0.000)	08.933	0.8175
R38	-0.016 (0.798)	0.317 (0.000)	0.107 (0.002)	0.418	0.8091
R39	-0.007 (0.932)	0.278 (0.000)	0.185 (0.018)	7.803	0.7432
R41	-0.302 (0.154)	0.392 (0.000)	0.169 (0.002)	588.60	0.7868
R42	-0.264 (0.122)	0.314 (0.000)	0.146 (0.036)	0.876	0.7343
R43	-0.174 (0.264)	0.414 (0.000)	0.097 (0.024)	05.730	0.8415
R44	0.040 (0.600)	0.379 (0.000)	0.074 (0.206)	24.051	0.7771
R45	-0.493 (0.046)	0.285 (0.006)	0.182 (0.055)	7.415	0.6156
R47	-0.028 (0.660)	0.345 (0.000)	0.151 (0.000)	427.92	0.8492
R49	-0.302 (0.070)	0.183 (0.000)	0.323 (0.000)	1.002	0.7399
R50	0.057 (0.468)	0.356 (0.000)	0.117 (0.032)	1.713	0.7644
R52	0.175 (0.220)	-0.057 (0.730)	0.761 (0.000)	.614	0.4821
R53	-0.040 (0.606)	0.456 (0.000)	0.081 (0.090)	1.586	0.8212
R54	-0.273 (0.016)	0.371 (0.000)	0.103 (0.010)	6.375	0.8584

R55	0.066 (0.334)	0.383 (0.000)	0.108 (0.032)	2.623	0.8369
R56	-0.056 (0.540)	0.194 (0.019)	0.270 (0.002)	.420	0.669
R57	0.091 (0.390)	0.287 (0.000)	0.288 (0.000)	5.844	0.7038
R58	0.093 (0.260)	0.266 (0.000)	0.232 (0.000)	0.859	0.7500

Note: p-values are in parentheses, based on heteroscedasticity consistent standard errors, are in parentheses beneath the parameter estimates.

Variables: $F(R_t^*) = (1 + \exp[-\gamma R_t^*])^{-1}, \gamma > 0$. *Rt* in the above equation is duration dependent lagged yield spread. γ is the slope of the F (.). It measures the rate of change in beta with a given change in the R*.

This is what is expected from rational fund managers. Also indicative of a good fit is the fact that for most funds the adjusted $\overline{R}^2$ was larger for the spread based estimates than for the $(R_m - R_f)$ based estimates which are in Tables 5.12 and 5.13.

We conducted a small-scale simulation study. We generated 1,000 observations from the spread based LSTM model with $\beta_2 > 0$, for a range of values on the other parameters and found 61% of the follow-up threshold DBM β_2 estimates were negative and that only 3.8% of them were significant. This lends further support to our hypothesis that the spread based LSTM model is a good representation of the behavior of fund managers and further that such behavior leads to adverse timing. Although not reported we also estimated the LSTM model with rolling 30 month one-step ahead AR (1) forecasts of $(R_m - R_f)$ as transition variable, R_t^*. The spread based LSTM model gave a far better fit for almost all funds as determined by linearity tests in conjunction with the adjusted R^2 criterion.

Table 5.11: Australian Wholesale Superannuation Fund Performance During 1989-2002 using Logistic Smooth Transition Model: Parameter estimated using Duration Dependent Spread as Transitional Variable

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \beta_p^U \cdot F(R_t^*) \cdot R_{mt} + \varepsilon_{pt}$$

WHOLESALE FUND	α_1	β_1	β_2	γ	$\overline{R}^2$
W1	0.522 (0.000)	0.254 (0.000)	0.160 (0.002)	.530	.8356
W3	0.544 (0.000)	0.132 (0.000)	0.155 (0.000)	.892	.7570
W7	0.030 (0.788)	0.072 (0.136)	0.128 (0.026)	.395	.51[illegible]
W9	0.150 (0.472)	0.314 (0.000)	0.182 (0.008)	9.763	.7694
W10	0.593 (0.000)	0.115 (0.082)	0.150 (0.036)	0.581	.5300
W12	0.614 (0.000)	0.057 (0.364)	0.255 (0.002)	.498	.4916
W15	0.538 (0.000)	0.350 (0.000)	0.178 (0.000)	27.838	.8437
W21	0.595 (0.000)	0.415 (0.000)	0.099 (0.028)	2.772	.8499
W22	0.539 (0.000)	0.211 (0.000)	0.063 (0.098)	.470	.7687
W24	0.639 (0.000)	0.153(0.000)	0.089 (0.094)	44.000	.4192
W26	0.504 (0.000)	0.039 (0.480)	0.196 (0.001)	.354	.5758
W30	0.552 (0.000)	0.143 (0.000)	0.111 (0.002)	3.401	.6887
W32	0.554 (0.000)	0.291 (0.000)	0.224 (0.000)	.061	.7687
W33	0.608 (0.000)	0.300 (0.000)	0.192 (0.000)	1537	.8056
W35	0.667 (0.000)	0.215 (0.006)	0.327 (0.000)	47.044	.8211
W39	0.630 (0.000)	0.108 (0.016)	0.167 (0.004)	.347	.5026
W42	0.661 (0.000)	0.242 (0.000)	0.294 (0.000)	.740	.8024
W43	0.676 (0.000)	0.279 (0.000)	0.208 (0.004)	0.755	.7393

Note: p-values are in parentheses, based on heteroscedasticity consistent standard errors, are in parentheses beneath the parameter estimates.

Variables: $F(R_t^*) = (1+\exp[-\gamma R_t^*])^{-1}, \gamma > 0.$ *Rt* in the above equation is duration dependent lagged yield spread. γ is the slope of the F (.). It measures the rate of change in beta with a given change in the R*.

The positive β_2 empirical spread based LSTM estimates are consistent with Resnick and Shoesmith (2002). Thus our results indicate that there is a significant positive relationship between fund returns and past yield spread. In other words, there is evidence to suggest that fund managers behave as if they use spread as part of their information structure used to determine the risk of their portfolios. However, a positive

β_2 in this model does not mean that fund managers are good market timers. The real test of their market timing skills must be made against the benchmark excess market return.

5.4.4 *LSTM based market timing results*

The parameter estimates for the duration dependent LSTM model are in tables 5.12 and 5.13 for the wholesale and retail funds respectively. Even though fund managers' information structure is well characterised by the yield spread, their real test for performance should be against the risk premium. Risk premium (Rm-Rf) is the conventional benchmark to measure the performance of the portfolios LSTM model was estimated using the duration dependent risk premium $(R_m - R_f)$ as the transition variable. If it can be assumed that the choice between the duration dependent version and the non-duration dependent version of the model using the MSE criterion is a Bernoulli process and that the choice of model is independent across funds, then the p-values are for the two binomial random experiments of 0.048 and 0.044 for the wholesale and retail funds respectively. In other words, for the two binomial experiments, the p-values are obtained as $\Pr(X \geq 11|n = 18, \pi = 0.5) = 0.048$ and $\Pr(X \geq 11 | n = 18, \pi = 0.5) = 0.044$ for the wholesale and retail funds respectively. This is a significant evidence of duration dependence in superannuation fund betas, which suggests that fund managers do use same estimates of their duration of market conditions in their rebalancing decisions.

The LSTM results are presented in Tables 5.12 and 5.13.

Table 5.12: Australian Retail Superannuation Fund Performance During 1989-2002 using Logistic Smooth Transition Model: Parameter Estimated using (Rm-Rf) as Transitional Variable

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \beta_p^U \cdot F(R_t^*) \cdot R_{mt} + \varepsilon_{pt}$$

RETAIL FUNDS	α_1	t-values	β_1	t-values	β_2	t-values	γ	$\beta_2 \cdot \gamma/4$	$\bar{R}^2$
R4	0.161	-(1.621)	0.266	(8.030)*	-0.076	-(1.416)	5.671	-0.11	0.5202
R5	0.047	-(0.509)	-0.267	(7.790)*	-0.094	-(1.678)	5.297	-0.12	0.4802
R6	0.497	-(1.856)	0.275	(5.230)*	-0.1	-(1.652)	8.446	-0.21	0.2882
R14	-0.03	-(0.106)	0.176	(3.400)**	-0.163	-(2.584)**	4.859	-0.2	0.2285
R15	0.043	-(0.485)	0.173	(3.230)**	0.037	(0.450)	1.317	0.01	0.4599
R16	0.08	(0.790)	0.241	(6.670)*	-0.068	(1.220)	8.239	-0.14	0.4954
R18	-0.047	-(0.665)	0.148	(3.390)**	0.145	(1.700)	0.746	0.03	0.6335
R20	-0.23	-(2.683)**	0.021	(3.930)**	-0.058	-(1.205)	11.632	-0.17	0.2917
R27	0.006	(0.070)	0.313	(7.120)*	0.072	(0.810)	0.884	0.02	0.756
R28	0.171	(1.120)	0.424	(6.600)*	-0.093	-(0.790)	95.442	-2.22	0.5836
R29	0.086	(0.860)	0.536	(19.160)*	-0.08	-(1.674)	39.443	-0.79	0.8825
R30	0.182	(1.000)	0.455	(9.670)*	-0.107	-(1.186)	40.296	-1.08	0.5955
R32	0.131	(0.940)	0.519	(15.760)*	-0.141	-(2.059)**	112.237	-3.96	0.7385
R33	0.105	(0.860)	0.56	(12.580)*	-0.063	-(0.895)	130.037	-2.05	0.8734
R37	0.114	(1.150)	0.243	(10.690)*	-0.108	-(2.116)**	6.383	-0.17	0.8076
R38	0.086	(0.670)	0.479	(9.170)*	-0.152	-(2.536)**	1.003	-0.04	0.8086
R40	0.19	(1.370)	0.599	(12.750)*	-0.148	-(1.762)	6.968	-0.26	0.7712
R41	0.23	(2.050)**	0.495	(13.550)*	-0.127	-(1.811)***	4.377	-0.14	0.7273
R42	0.268	(2.020)**	0.563	(11.510)*	-0.143	-(1.849)***	87.097	-3.11	0.8385
R44	-0.029	-(0.117)	0.44	(6.720)*	-0.109	-(1.127)	2130.5	-58.06	0.5883
R49	-0.267	-(2.074)**	0.39	(7.990)*	-0.011	-(0.181)	21.199	-0.06	0.7621
R50	0.051	(0.350)	0.392	(11.250)*	-0.058	-(0.843)	113.585	-1.65	0.6511
R53	0.124	(1.470)	0.512	(17.770)*	-0.118	-(2.375)**	9.586	-0.28	0.8549
R54	0.096	(1.440)	0.518	(3.770)**	-0.132	-(2.985)**	1.615	-0.05	0.8557
R55	0.98	(2.590)**	0.528	(7.940)*	-0.027	-(0.260)	1.56	-0.01	0.6531
R56	-2.316	-(1.986)***	0.435	(2.710)**	0.107	(0.330)	0.586	0.02	0.5186
R58	0.23	(1.630)	0.5	(12.950)*	-0.099	-(1.338)	120.77	-2.99	0.7359

Note: t-statistics, based on heteroscedasticity consistent standard errors, are in parentheses adjacent to the parameter estimates. Variables: $\beta_2 \cdot \gamma/4$ measures market timing skills of fund managers when (Rm-Rf) = 0. $F(R_t^*) = (1 + \exp[-\gamma R_t^*])^{-1}, \gamma > 0$. Rt in the above equation is duration dependent (Rm-Rf). γ is the slope of the F (.). It measures the rate of change in beta with a given change in the R*.

The results reported are for 18 wholesale funds and 28 retail nonlinear superannuation funds based on linearity test results shown in Tables 5.8 and 5.9. For the rest of the funds, since these are linear, it is alright to assume a dual-beta model (such as

H-M model) as being sufficient. The results are therefore compared with those of the H-M model in Tables 5.2 and 5.4 for most of the funds.

The LSTM parameter estimates differ from those in the H-M model for retail funds. Funds R20, R41, R42, R49, R55 and R56 exhibit significant α values where as the same funds are insignificant using H-M model. LSTM estimates some evidence superior selection skills for R41, R42 and R55 funds. However, no funds have significant market timing skills. For some funds with weak superior market timing ability as indicated by the H-M model, the LSTM estimates indicate inferior market timing skills. These contradictory results may be due to the inability of the H-M model to measure the market timing of the fund managers at various degrees of market conditions. Fund managers with superior market timing skills as per the H-M model seem to perform well when their market timing is measured in the binary sense. However, when their market timing is measured realistically against a magnitude of sensitivity and duration-dependent version of market conditions, they appear to have inferior market timing skills.

Statistics in Tables 5.12 and 5.13 also exhibit speeds of adjustment as represented by the γ estimates, in relation to the market indicator R^*, of the portfolio beta for each fund manager. Fund managers with large γ values are abruptly switching their portfolio betas in response to small perturbations of the transition variable around the threshold value of zero. The behaviour in this case indicates the sort of information structure assumed in the Merton (1981) and H-M models. In other words, these fund managers use the sign of the market condition alone in making their portfolio rebalancing decisions.

Small γ funds on the other hand utilise the information content on the magnitude, duration and also the sign of the excess market returns in making their decisions. The results indicate that both the wholesale and the retail funds exhibit a wide range on the transition parameter γ .

Table 5.13: Australian Retail Superannuation fund performance during 1989-2002 using Logistic Smooth Transition Model: Parameter Estimated using (Rm-Rf) as transitional variable

$$R_{pt} = \alpha_p + \beta_p R_{mt} + \beta_p^U \cdot F(R_t^*) \cdot R_{mt} + \varepsilon_{pt}$$

WHOLE SALE FUNDS	α_1	t-values	β_1	t-values	β_2	t-values	γ	$\beta_2 \cdot \gamma/4$	$\bar{R}^2$
W1	-0.041	-(0.237)	0.37	(9.800)*	-0.071	-(1.470)	34.735	-0.616	0.8261
W2	-0.017	-(0.102)	0.49	(14.430)*	-0.091	-(1.951)***	19.74	-0.449	0.8813
W4	-0.194	-(0.763)	0.65	(12.180)*	-0.142	-(1.993)***	18.343	-0.651	0.8535
W7	-0.613	-(3.736)**	0.06	(1.870)***	0.093	(1.770)	9.955	0.231	0.4754
W9	0.136	(1.190)	0.52	(16.990)*	-0.125	-(1.974)***	10.597	-0.331	0.7552
W10	0.181	(1.960)	0.27	(8.960)*	-0.077	-(1.400)	6.143	-0.118	0.5335
W15	0.131	(1.190)	0.53	(14.450)*	-0.08	-(1.311)	8.61	-0.172	0.8354
W19	-0.03	-(0.176)	0.37	(7.600)*	-0.068	-(1.003)	600.692	-10.21	0.7636
W27	-0.124	-(0.516)	0.5	(9.150)*	-0.043	-(0.596)	21.802	-0.234	0.7979
W29	0.318	(1.990)***	0.50	(11.700)*	-0.269	-(1.340)	5.636	-0.379	0.2391
W31	0.265	(2.810)**	0.61	(16.020)*	-0.225	-(3.297)**	0.673	-0.037	0.8142
W33	0.313	(2.600)**	0.52	(9.420)*	-0.143	-(1.744)	118.172	-4.22	0.7875
W35	0.313	(2.480)**	0.54	(17.000)*	-0.131	-(1.663)	8.316	-0.272	0.774
W36	0.005	(0.040)	0.39	(10.690)*	-0.085	-(1.644)	22.314	-0.474	0.8127
W37	0.251	(2.630)**	0.6	(14.600)*	-0.191	-(2.131)**	1.354	-0.064	0.8207

Note: t-statistics, based on heteroscedasticity consistent standard errors, are in parentheses adjacent to the parameter estimates.
Variables: $\beta_2 \cdot \gamma/4$ measures market timing skills of fund managers when (Rm-Rf) = 0. $F(R_t^*) = (1+\exp[-\gamma R_t^*])^{-1}, \gamma > 0$. *Rt* in the above equation is duration dependent (Rm-Rf). γ is the slope of the F (.). It measures the rate of change in beta with a given change in the R*.

The arithmetic average of the returns for the wholesale/retail groups were calculated each month in order to obtain a composite wholesale/retail fund series. The results are reported in Tables 5.14 and 5.15. Table 5.14, provides composite estimates for all the retail superannuation funds. These results can be interpreted as the results of average retail superannuation funds. The results show that the average β2, which represents the market timing skills of the fund managers, is negative and significant. This evidence confirms the adverse timing skills of the retail funds managers. The small γ value of 1.401 indicates that retail fund managers rebalance their portfolio weights on a continuous basis with changing market conditions.

Table 5.14: Composite results of LSTM for Australian Retail Superannuation Funds using (Rm-Rf) as the Transition Variable

Parameters	Values	Std.Error	p-value
α	0.047	0.064	0.228
β_1	0.373	0.018	0.000
β_2	-0.069	0.034	0.020
γ	1.401	0.901	0.060

Note: SSE: 48.0092 and Adjusted R-Square: 0.84.

Table 5.15: Composite results of LSTM for Australian Wholesale Superannuation Funds using (Rm-Rf) as the Transition Variable

Parameters	Values	Std.Error	p-value
α	0.693	0.097	0.000
β_1	0.421	0.023	0.000
β_2	-0.094	0.043	0.015
γ	32.635	32.648	0.159

Note: SSE: 48.0092 and Adjusted R-Square: 0.84.

The composite LSTM results of wholesale funds are reported in the above table 5.15. Similar to retail fund managers, wholesale fund managers also exhibit negative timing skills on average basis. However, the rebalancing decision of wholesale fund managers is more abrupt (large γ value) and discontinuous compared to retail fund managers. The composite γ value for wholesale fund managers is 32.65.

Although it is difficult to draw direct inferences from the shapes, it clearly indicates that retail funds, on average, rebalance portfolios more frequently than wholesale funds. In other words, retail fund managers are more active than wholesale fund managers on market timing. We feel that the higher expenses[8] incurred by investors in retail funds encourages them to scrutinise the funds thereby pressuring the fund manager to be more active. However, their active rebalancing does not seem to translate into superior performance skills. Instead it appears that active rebalancing proves costly to them as they have negative β_2 and small γ values. Thus, LSTM results also support the evidence that wholesale funds comparatively perform better than retail funds by being less active.

Tables 5.12 and 5.13 also provided results on the impact of market timing decisions of the fund managers when market conditions are indecisive. The impact is measured through $\beta 2^* \gamma/4$ measure. As most of the $\beta 2$ values are negative, fund managers' decisions during market indecisiveness prove to be negative. The real test of the skill is actually the skill of timing when market conditions precipitating a rebalancing decision are elusive. The magnitude of the negative impact comes with the γ value of the fund managers. In other words fund manager's speed of adjustment measures the magnitude of their loss or gain due to their decision during market indecisiveness. The larger the γ value the higher will be the magnitude of this effect.

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[8] As per Australian superannuation funds association reports, the average MER of wholesale funds is around 1percent. Whereas for retail funds it is 1.9 percent. Unlike wholesale funds retail funds charge loading fees. Retail funds, due to investors' direct contributions, are more performance savvy compared to wholesale funds.

As seen in the earlier discussion, larger γ values occur due to abrupt switching. Thus abrupt switching is more appropriate if the fund manager's $\beta 2$ is positive. In contrast, as found in this study, where the $\beta 2$ for many fund managers is negative, abrupt switching proves to be a highly risky strategy. The results also appear to suggest that retail fund managers performed better when market conditions are indecisive than wholesale fund managers. This may be due to their continuous rebalancing which makes them adapt with changing market conditions.

5.5 Chapter summary

In this chapter we reported and discussed results on fund manager skills of Australian superannuation funds that may be attributed to fund performance. The results were based on Treynor-Mazuay (T-M), Henriksson-Merton (H-M), Lee-Rahman (L-R) and Logistic Smooth Transition (LSTM) models for both retail and wholesale superannuation funds. Results based on T-M and H-M, which are traditional models, indicate that both retail and wholesale fund managers do not have superior performance skills to beat the market. Testing for the quality of market timing, majority of the fund managers appear to exhibit good quality of market timing.

When funds are tested for linearity and suitability of H-M model, the results indicate that LSTM is superior compared to T-M and H-M for modeling fund managers information process. The results based on LSTM model indicate findings similar to H-M model. However, LSTM model shows more fund managers exhibited adverse market timing skills compared what was revealed by the H-M and T-M models. Retail fund managers rebalance their portfolios more frequently than wholesale fund managers. However, such frequent rebalancing did not result in better performance for the retail fund managers.

CHAPTER SIX

CHAPTER SIX

CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

6.1 Summary of findings

6.1.1 Performance of Australian superannuation funds using traditional methods

The first set of results came from using conventional methods of performance measurement widely reported in professional circles and in analysts' reports. These are Sharpe ratio, Treynor ratio, Jensen's alpha and M-square value. We found that both retail and wholesale funds, on average, performed below market benchmark. However, these measures provide no consistent conclusion on the ranking of superannuation funds. We also found that measuring fund performance using one-period measures is more informative and consistent if the measure is both market and risk-adjusted.

Market-adjusted and risk-adjusted measures suffer from inconsistency of ranking The good thing about this conclusion is that the Australian finding is not anomalous to those reported elsewhere in the world when we used these same measures. M-square, which is a more refined measure among the four measures, indicates that none out of the 139 funds performed better than the market benchmark. Thus, the overall performance of superannuation funds in the test period is not satisfactory.

6.1.2 Role of fund characteristics on fund performance

Performance evaluation of funds using traditional measures gives somewhat conflicting ranking on performance. The strong assumptions, which are violated in practice, means that there is a need for evaluation from a different perspective other than fund returns adjusted for risk and benchmark used in conventional - though industry popular - measures. Fund expenses, which have emerged as a performance indicator, are also utilised to assess performance in this study. We investigated how fund characteristics in reducing (increasing) the fund expense items. The new findings arising from this analysis suggest a number of interesting implications.

The second set of findings therefore relate to the investigation as to whether specific characteristics of the funds are related to performance. We found no significant relationship between fund size and fund expenses in the cases of retail and wholesale funds. Retail fund returns appear to be significantly negatively related to fund's age in the case of retail funds whereas there is no relation found for age in wholesale funds. If a fund is a member of a large fund, being a member of such a large and complex fund management company should help to reduce expenses: but this is not the case. Positive relation ship was found between fund objectives and fund expenses. Finally, no significant relation exists between fund returns and fund expenses.

These findings are far more revealing of the complexity of assessment measures for performance using other than the widely-used traditional measures which often indicate, as it did in this study, results of doubtful accuracy. An analysis of fund characteristics suggests findings that vary to some extent between wholesale and retail funds. However, the characteristics did not provide clear-cut results except to suggest some low-level priors.

The third set of results relate to whether economies of scale are present. These suggest, that on average, retail superannuation funds do not have economies of scale. However, when funds were divided on fund size there is some evidence that funds with more than $A 30 million in assets exhibited significant economics of scale. Domestic debt funds and international debt and equity funds show variations in cost elasticity with domestic fund cost elasticity being less than one: the international debt and equity cost elasticity are at values greater than one. The former indicates efficiency. Thus, superannuation funds exhibit limited economies of scale and the economies vary with fund objectives.

These results have important implications for the management of superannuation funds. Both fund expense analysis and economies of scale analysis reveal that funds with international investment objectives experience significantly higher expenses. However, there is no evidence that international funds experience higher risk-adjusted performance than domestic funds. An analysis of Australian unit trusts (only those with international investments) by Benson and Faff (2003) found that these unit trusts do not exhibit superior risk- adjusted returns compared to the market benchmark.

6.1.3 Fund performance using robust measures

6.1.3 (a) Results based on T-M, H-M and L-R models

Skills attribution to fund performance needed the use of Treynor-Mazuy, Henriksson-Merton, and Lee-Rahman models. Results based on Treynor-Mazuy and Henriksson-Merton, which are considered conevtional models, would have us believe that neither the retail nor the wholesale fund managers possess superior skills, on average, to outperform the market benchmark. On security selection skills and market timing skills, tests revealed few fund managers have superior security selection skills though none of them possess superior market timing skills. *Ex post* measures would have us believe that returns generated from applying timing skills actually led to negative returns.

On the quality of market timing decisions, which can be done using Lee-Rahman model, it is found that a majority of fund managers appears to have market timing skills although the size of that parameter is not very large. Superannuation funds, both retail and wholesale funds, exhibited less variance, showing that they are able closely follow the market. However, fund managers' effort to reduce the return variance from the market benchmark and thus hoping to exhibit good quality of market timing did not result in superior performance compared to market benchmark.

6.1.3 (b) Results based on LSTM model

The logistic smooth transition function has been adapted from the business cycles literature and extended as tests to represent a better measure on fund managers' information structure. The model provides an appealing representation of the information process used by managers. As noted in the relevant section of the thesis, these estimates assist one to extend Henriksson-Merton mod· by incorporating the dichotomous market conditions used in the Henriksson-Merton model to the real-world continuous changes in the market conditions. Incorporating *continuous* change in market condition is a more realistic representation of how the managers are likely to respond to changing conditions than to assume that there are only down- and up-market conditions. It also includes the simpler threshold values and constant risk assumption as special cases while also incorporating the known prior that beta is time-varying (which has strong empirical support in finance literature).

We found significant evidence that fund betas are duration dependent; duration meaning the duration or period over which the market conditions change continuously. The new measure of fund performance that emerged from this is a measure of the speed of adjustment of managers in the portfolio rebalancing process. When the contemporaneous excess market return was used as transition variable, the parameter estimates indicated perverse market timing. However, when yield spread was used, in place of the excess market return as the transition variable to time forthcoming market conditions, we found a drastic improvement in the fit and parameter estimates much more in line with what is expected from good market timers.

The results based on this model indicate similar results to those from Henriksson-Merton model. However, logistic smooth transition model shows more fund managers exhibited adverse market timing skills than the number resulting from Henriksson-

Merton and Treynor-Mazuy models. The results also indicate that retail superannuation fund managers, on average, rebalance their portfolios more frequently than wholesale fund managers and that more frequent rebalancing did not result in higher performance. More of the retail managers perform worse than wholesale fund managers. Interestingly, using the new model, in periods when market conditions cannot be determined either way - when market can be described as being indecisive - retail funds performed better than wholesale funds due to their higher frequency of rebalancing. These are new findings to explain why the perverse timing skill is likely to account for the worse results of retail managers and the slightly better results of wholesale fund managers.

6.2 Limitations of the thesis

This thesis made a number of contributions, which are also subject to a list of limitations. First, the major limitation relates to data. The findings obtained from the test period using no-doubt a large sample cannot be generalised to all superannuation funds. The sample is smaller than the population of the superannuation market, which has been around for a long time: our tests cover 1989-2002. This study covers only the latest period of 14 years. This limitation is despite the fact that the sample and the test period covered are the largest to-date compared to the samples and test periods of other published reports.

Survivorship bias, which afflicts almost all studies on this subject, also introduces a likely bias in favour of conclusions about the funds that survived, and included in the sample. The historical data, over longer period in this study is likely to increase this limitation in this and other ongoing studies on this subject.

Difficulty in accessing the data as well as the private nature of self-managed fund data not included in this study would also limit the findings to only the superannuation funds covered in this study. Self-managed funds account for 20.7 percent of the total amount in investment while investments in the retail and wholesale funds constitute 58 percent of the investment. The more formally organised markets are covered in this study while the less organised self-managed funds are excluded.

The effect of taxes on superannuation fund returns is not addressed in this study. Australian tax system provides some tax rebates for investing in superannuation funds. The changes in tax treatment of the contribution as well as the investment returns would have some definable impact on performance. Due to the complexity of tax policy changes, and the unavailability of access to information needed to segregate the cash flows relating to tax treatment, it was difficult to study these effects. Besides, such an effort will by itself be large enough to justify a separate study.

6.3 Future research directions

This thesis provides some pointers for future research on the Australian superannuation funds. One critical area of further research is to subject the data relating to earlier periods included in prior studies to be re-examined in terms of the newer tests introduced in this thesis. That is likely to reveal that the timing skill may be similar or different in different periods. Such re-direction of research may also target the non-superannuation funds, on which there are several studies with results that do not incorporate the continuously changing market conditions.

It may well be that the private funds, given the intense competition, are more likely to have evolved in ways different from the super funds. It is potentially justifiable that private funds – because of their need to produce immediate performance that can be demonstrated to be superior to avoid client dissatisfaction and exists from funds – may have superior performance as the litmus tests for managers. In that case, such funds may exhibit superior timing skills, which is likely to be picked up precisely using the LSTM process developed in this thesis.

One possible extension of this study is to develop a methodology to integrate fund characteristics in performance evaluation of all types of funds, not just the super funds. This study has produced somewhat strong evidence to attribute fund performance to fund characteristics. A more comprehensive methodology to integrate both fund characteristics and fund manager skills may provide better insights on the correct process of attribution to fund performance. An approach similar to a factor model may be more appropriate to attribute persistence in fund performance given recent evidence that supports momentum strategies. If such studies applied a panel data design, the present study and any extension of this study to include private funds may help to reveal newer and reliable findings of value for comparison across different types of funds as well as to provide research information of relevance for policy changes.

The existing studies measured superannuation fund performance on the same lines as unit trusts or mutual funds. The measurement commonly used is against the same market-adjusted measure as that used in unit trusts. There is a need for distinguishing superannuation fund measurement from that of unit trusts. The utility goals of super funds differ from those of unit trusts due to the variation in the investment objectives. Defined future benefit is a better benchmark to measure performance than market return. This is an important future research direction as many investors expect superannuation funds to perform like unit trusts. This will also help in investor education on the expectations ofsuperannuation fund performance.

In this study, it was assumed that the yield spread represents changing market conditions (following Rosenick and Shoesmith, 2002) and the fund managers apply yield spread to time market for rebalancing their portfolios. However, the definitions of market conditions are defined differently by different researchers, and there is no consensus in the literature on this important topic on market information structure. There is potential for future research to resolve this issue by finding out the best variable to represent market conditions. There is also scope in that line of research for understanding the information structure used by fund managers.

Appendix 1: Choice of fund issue:

Choice of fund – Australian Superannuation Funds Association's position:
(Source: ASFA)

ASFA supports the objective that all Australians should be members in superannuation funds which are appropriate to their needs for retirement savings.

Following the rejection of the Choice of Fund Bill in the Senate, ASFA believes that funds, employers, industry associations, and the government should now cooperate in ensuring protection for members and helping them understand the choice options they already have, for example, by:

- Providing members with information and education to enable informed member investment choice.
- Ensuring that the superannuation arrangements provide for appropriate and effective disclosure of benefit characteristics, investment returns, fees and charges at entry, exit and on an ongoing basis.
- Ensuring that members have access to appropriate insurance coverage with adequate continuance arrangements in the event of switching.
- Ensuring strong prudential and other protections are maintained, including: an effective, independent and accessible complaints mechanism with enforcement powers.
- amending the Superannuation Guarantee legislation to ensure monthly, or at least quarterly, payment of employer SG contributions into the member's (superannuation) account.
- maintaining an effective avenue for resolving disputes between the employer and employee. The award system currently provides that mechanism.

Appendix 2: Superannuation membership flow

	Member Entrants	Member Exits: Death and Disability	Member Exits: Transfers and Rollovers	Member Exits: Other	Member Exits: Total	Net Entrants
1994/95						
Jun	896	8	236	269	513	383
1995/96						
Sep	937	7	500	286	793	144
Dec	847	7	268	296	570	277
Mar	834	7	307	234	548	286
Jun	908	7	375	315	696	212
1996/97						
Sep	936	5	366	310	685	251
Dec	898	6	382	349	738	160
Mar	820	6	299	296	601	219
Jun	1,821	7	1,403	255	1,664	157
1997/98						
Sep	1,588	7	870	217	1,093	495
Dec	716	7	321	196	524	192
Mar[a]	703	6	346	238	590	113
Jun	838	7	341	230	578	260
1998/99						
Sep	1,037	7	231	233	471	566
Dec	809	8	256	213	477	332
Mar	1,069	9	342	331	682	387
Jun	1,123	9	469	443	921	202
1999/00						
Sep[b]	2,251	6	1,389	187	1,582	669
Dec	1,203	10	801	212	1,023	180
Mar	1,369	12	405	238	655	714
Jun	1,146	14	443	297	755	391
2000/01						
Sep	1,178	15	268	365	614	565
Dec	896	10	452	320	782	114
Mar	912	9	442	270	721	191
Jun	1,059	7	457	204	668	391
2001/02						
Sep	1,077	12	402	465	879	198
Dec	1,062	8	328	193	530	532
Mar	1,058	10	379	328	718	340
Jun	1,058	9	454	229	692	366
2002/03						
Sep	1,280	11	380	324	716	564
Dec	917	11	330	313	655	262
Mar	987	12	368	332	712	275

Notes: This table reflects the members of all funds covered in the quarterly survey.
[a] From the March 1998 quarter the number of survey funds has been reduced by 603 compared to previous quarters.
[b] From the September 1999 quarter the number of survey funds has increased by 18 compared to previous quarters.

Appendix3: Superannuation Benefit Structure (Assets A$ million)

	Public Sector			Private Sector			
	Accumulation	Defined Benefit	Hybrid	Accumulation	Defined Benefit	Hybrid	Total
1994/95							
Jun	1,605	15,668	34,376	70,334	16,396	24,110	162,488
1995/96							
Sep	1,813	16,294	35,283	77,406	16,595	25,698	173,088
Dec	1,977	16,968	36,361	81,006	17,060	26,541	179,913
Mar	2,124	17,616	36,909	83,685	17,050	26,736	184,120
Jun	2,282	18,100	38,290	88,680	18,226	26,798	192,377
1996/97							
Sep	2,298	18,715	39,483	93,990	17,061	27,874	199,422
Dec	2,461	13,095	47,547	98,383	16,898	29,661	208,045
Mar	2,586	13,585	47,964	101,321	16,713	29,797	211,965
Jun	2,407	31,542	37,064	109,930	17,774	32,471	231,186
1997/98							
Sep	2,555	32,828	38,529	114,351	18,550	34,947	241,759
Dec	2,743	33,075	37,806	118,005	18,939	34,176	244,743
Mar	2,942	15,786	58,836	123,236	17,305	35,054	253,158
Jun	3,274	16,075	60,395	128,024	16,980	36,052	260,799
1998/99							
Sep	3,363	9,174	65,805	132,824	15,132	37,337	263,635
Dec	3,810	9,289	70,432	140,201	15,483	39,118	278,334
Mar	3,758	8,496	73,851	147,186	12,832	43,013	289,135
Jun*	3,862	8,674	82,720	153,209	12,953	43,938	305,357
1999/00							
Sep	3,978	8,610	83,438	160,444	12,390	45,360	314,220
Dec	4,310	9,639	89,568	172,448	12,171	48,468	326,604
Mar	4,476	10,072	91,562	179,807	12,148	49,670	347,735
Jun	4,947	10,567	95,341	188,812	12,350	51,345	363,362
2000/01							
Sep	5,030	10,523	93,037	190,648	10,368	54,192	363,797
Dec	5,169	10,480	92,712	192,143	11,989	52,574	365,067
Mar	5,275	5,643	96,922	196,871	10,876	52,566	368,152
Jun	5,725	10,489	97,774	208,682	11,175	54,774	388,619
2001/02							
Sep	5,474	8,683	89,045	207,038	9,770	51,100	371,110
Dec	6,328	9,343	93,964	225,056	10,351	54,402	399,444
Mar	6,493	9,508	94,061	230,525	9,855	54,620	405,062
Jun	6,507	9,149	89,697	229,450	9,244	52,071	396,119
2002/03							
Sep	6,409	8,684	84,543	222,646	8,504	52,480	383,266
Dec	6,777	8,520	86,795	229,920	8,958	53,745	394,715
Mar	6,896	8,519	85,283	225,418	8,511	55,941	390,569

Notes: Small Funds (those with less than 5 members), not included in this table, are assumed to be accumulation funds
* During the June 1999 quarter, three public sector funds received $8.4 billion in exceptional employer contributions.

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