Organisational form, Risk-taking, and Performance: An empirical study of UK unit trust companies

By Yoshikatsu SHINOZAWA

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Abstract

Following privatisations in the 1980's, the UK financial industry embarked on a series of demutualisations, which developed into a global trend in the late 1990's. This structural shift has generated numerous debates in academic circles concerning various managerial issues of mutual versus stock owned companies. Informed by agency theory, this thesis contributes to this debate by exploring the link between ultimate organisational form and the behaviour of companies in the U.K unit trust industry. The UK unit trust fund industry provides an excellent environment to explore this line of research because ultimate organisational form varies, and because the intra-industry variations are far smaller than those of other industries in term of regulations, income structure, and the use of information technology.

For the purpose of analysis, the thesis compares unit trust management companies belonging to mutual and stock owned groups along three dimensions: (i) risk-taking and (ii) efficiency at the corporate level, and (iii) quality of their products, e.g. risk and fee adjusted performance of unit trusts that the companies offer. To this end, a number of quantitative analyses are undertaken, including Tobit regression and Data Envelopment Analysis (DEA), using data from a sample of 130 unit trust management companies for the financial year 1999-2000.

The results support the agency theory hypothesis, revealing that at the corporate level, stock owned companies show higher managerial efficiency than the mutual counterparts whilst undertaking higher risk activities than the comparable mutual companies. Nonetheless, at the product level, no difference is found by ultimate ownership type with regard to risk-fee-adjusted performance of unit trusts. The latter indicates that competitive product markets remove the performance distinctions between mutuals and proprietary companies. Overall, these findings suggest that mutual organisations exhibit weaker cost control in conducting unit trust business via their affiliated companies.

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Chapter I: Introduction

1.1 Background to the research

1.1.1. Overview from financial literature

Research into collective investment schemes such as mutual funds in the U.S and unit trusts in the U.K (hereafter written as mutual funds) has been very popular subject in modern financial literature. The focus of early studies on mutual funds was whether these professionally managed funds yielded higher returns than market indices. Pioneered by Jensen (1968), scholars found that, on balance, mutual funds were unlikely to "beat" their target indices after the funds' risk was considered. The view of the poor investment skill led to another well-known debate concerning the efficient market hypothesis (EMH). Reviewed by Fama (1970) in his famous article, the hypothesis asserted that it is unlikely to achieve continuous superior returns from capital market investments because all market prices immediately reflect all the available information. Based on these lines of research, one can classify previous literature dealing with the issue of mutual funds into two research subjects: (i) how the performance of a fund should be evaluated, e.g. performance measurement, (ii) whether fund managers can generate superior returns, and if so, does their good performance persist e.g. performance persistence ?

As for the first topic, a simple return of a fund is not an adequate measure of performance. The reason is the simple return is dependent partly on the target risk level of the fund and partly on the return of market that the fund attempts to outperform. Overcoming the risk-return trade off and the market effect, Sharpe ratio and Jensen's alpha are classic examples for the risk-adjusted performance measures. Nevertheless, all these measures suffer from potential pitfalls such as mis-specification of the market index (Roll 1980 and Lehmann and Modest, 1987). As no perfect method for the performance evaluation is established yet, the development of accurate and reliable measure has been stimulating the financial literature for a long time[1]. A recent study by Dowd (2000) is an example to improve the traditional Sharpe ratio by considering the correlation element between the existing portfolio and the alternative portfolio (see Chapter V for details)

The second research topic has also been a central concern among academics and business practitioners. Some studies indicate that investment professionals do not have genuine superior skills that can beat the market consistently (for example, Jensen 1969 and Malkiel, 1995). Interestingly enough, poor performance seems to persist over time (Carhart, 1997, and Blake and Timmermann 2003). Other studies present the contradicting evidence that some fund managers can outperform the market and their superior risk-adjusted returns persist over time (for instance, see Goetzmann and Ibbotson, 1994). Hence, given the overall evidence, research has so far proved inconclusive with regard to the superior performance and its persistency.

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[1] An extensive bibliography on performance evaluation can be found in Knight and Satchell (2002)

As noted before, the two issues are critical to academic scholars because the importance of the two issues lies in the fact that they challenge the efficient market hypothesis. In a similar vein, it is worth pointing out that the two topics are essential parts of business for fund manages and their fund investors. Similarly, investors seek a method that could evaluate the service provided by the fund management company whilst justifying the fees that the investors are paying. The fund management company wants to emphasise the importance of their role, justifying why investors need to buy the company's actively managed funds as opposite to the passively managed funds, i.e. the index tracker funds.

More recently, there has been a renewal of interest in mutual funds from a slightly different angle. Namely, studies of the behaviour of fund managers and their retail investors are increasingly prevalent in academic finance literature. This recent rising popularity is mainly driven by the fact that (1) the performance related issue has been explored considerably although opinions remain divergent on these issues. (2) More importantly, as the fund industry has experienced spectacular growth in the last decade, the industry plays a more significant role in the economy. For example, at the end of the first quarter of 1998, mutual funds in the U.S were managing 3.3 trillion dollars in assets. The amount, in fact, exceeds all banks' saving deposits (Zheng, 1999). In the U.K, total funds under management have more than tripled over the last ten years from 36 billion pounds in 1987 to 269 billion pounds in 1996 (AUTIF 2000).

With the enormous growth of the assets under management in the industry, new studies express concern about the risk taking of fund managers, whose decisions are crucial determinants of their fund's returns. From various incentive viewpoints, a number of recent papers have analysed an individual fund manager as a unit of risk decision making. For example, different abstractive models such as utility maximisation models (e.g. Starks, 1987; Cohen and Starks, 1988) and option pricing models (Grinblatt and Titman 1989) were presented to show the connection between fees and risk taking of fund managers.

Implicit but more realistic incentives of fund managers have been elaborated on in more recent empirical studies; money flows into funds with superior returns (Chevalier and Ellison, 1997), a tournament mechanism in the industry (Brown et al 1996, Busse, 2001), career concerns (Chevalier and Ellison, 1999) and the job threat for the under performing managers (Khorana 1996). By and large, that research has revealed several implicit incentives as control devices of fund managers' risk taking.

However, until very recently, little has been documented regarding connections between risk taking decisions and the performance of fund management companies (rather than individual fund managers) and their organisational forms.

1.1.2. Overview from agency theory literature

The lack of studies on the effects of organisational form in the fund management literature is rather peculiar if one is aware of agency theory literature. An axiom of agency theoretic studies is that conflicts of interest among different property claimants are costly (the agency cost) in modern firms. This agency perspective has stimulated a great deal of research on the effects of ownership structures (Chen and Steiner 1999). Ratios such as shareholders versus debt-holders, (e.g. Agrawal and Knoeber 1996), and managerial ownership (see, in particular, Byrd et al, 1998) have become explanatory variables for the performance of a firm. Furthermore, several authors consider the proportion of insider ownership, equity versus debt as key determinants of the risk taking of firms in various industries: market listed companies (Wright, Ferris, Sarin and Awasthi, 1996; Chen and Steiner, 1999), banks (Saunders, et al, 1990) S&Ls (Knopf and Teall, 1996; Chen, Steiner and Whyte, 1998).

More importantly, the line of research is extended in Fama and Jensen (1983a, 1983b), Mayers and Smith (1988,1994) and Esty (1997a, 1997b) who consider organisation forms as explanatory variables of risk taking by mutual and stock financial companies. Previous works in this area also give weight to the performance differences (McNamara and Ghon, 1992; Mudambi and Nicosia, 1998; Genetay, 1999) and the different efficiencies (Cebenoyan et al, 1993; Cummins et al, 1999) between the two different organisational forms in the insurance industry. Lately, sparked by the large number of bankruptcies in the US saving and loans (S&L) industry, there has been renewal of interest in ownership effects on performance (Cole and Mehran, 1998), and risk taking (Barth, et al, 1995; Esty 1997a, b) of the S&L companies.

Nevertheless, most of the mutual versus stock company literature has limited itself to studying either insurance or the banking industry in the US. Consequently, the previous studies may not be applicable to different financial service industries in different countries. In brief, the link between organisational form and risk-taking, efficiency and product performance of the U.K unit trust companies has never been directly investigated neither from the investment literature nor from the agency literature. In this regard, this thesis makes important contribution to the existing literature.

1.2 Research topics

The central proposition addressed in this thesis is: *Does ultimate organisational form matter in the UK unit trust company?* Essentially, adopting the three-topic structure, this thesis attempts to examine the central research question from three dimensions. The first empirical study looks at the link between the risk taking of a unit trust company and the ultimate ownership of the company. The second empirical investigation addresses the linkage between organisational form and efficiency of the unit trust companies. The final empirical analysis concerns influences of the organisational form on the performance of their individual funds under the premise that the operations and monitoring of firms with different organisational structures should differ.

It is apparent that the three research topics can be divided into two groups. Consistent with a large number of studies on fund performance, the third research topic considers performance of individual unit trusts. By contrast, the first and second topics attempt to formulate risk-taking and efficiency measures viewed from the perspective of owners of the unit trust management company.

1.3 Value and contribution of this research

1.3.1 Overall significance

This thesis offers a useful contribution to the research on effects of ultimate ownership in the unit trust industry in three ways. Primarily, as previously noted, only a small number of attempts have so far been made at studying fund management companies whereas previous fund literature considers either individual funds or aggregated funds in the industry as a unit of analysis. The lack of research on this point is somewhat surprising given the growing presence of fund management companies in global capital markets. For example, Fidelity Investments, the largest mutual fund company in the US, has $1 trillion in assets under management in 290 funds[2] whilst the Vanguard Group, the second largest mutual fund company has 139 funds, 14 million individual and institutional shareholder accounts and $550 billion in assets under management[3]. In case of the UK fund managers, their domestic equity assets under management reached 90 billion pounds at the end of 1997[4]. As the top 30 unit trust companies manage

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[2] "Money Movers" *Forbes*; New York; Oct 9, 2000
[3] Palmer, George; Bina Brown (2000) "Vanguard sets sail for Europe" *Global Investor*; issue 133, p 13-16, London.
[4] Source: Walter, Ingo (1999) "The Global Asset Management Industry: Competitive Structure and Perfromance", Financial markets, Institutions & Instruments. Vol 8 No.1

more than 80 % of these assets (the FT fund directory, 1998), there is no doubt that the UK unit trusts play an important role in the equity market. Nonetheless, little is documented to date on the issue of fund management companies.

Secondly, from a corporate governance point of view the research problem is timely because the implications of this thesis increase the understanding with regard to recent demutualisations in the UK, where a number of financial mutual institutions are becoming quoted public companies owned by shareholders. Observing the demutualisation boom, a number of newspaper articles outline the pros and cons of the demutualisations[5]. However, little attention has been paid to the effects of the demutualisation on the financial products such as unit trusts, which the ex-mutual companies are managing and selling via their subsidiaries. The lack of such information is rather peculiar if one takes into account different stakeholders' perspectives: (a) In the UK, there are 18.89 million unit holders whose total assets reached to £195 billion at the end of 2002 (The Association of Unit Trust and Investment Funds, hereafter AUTIF, January, 2003). From the unit holders' perspective, what really matters are returns of their invested wealth, which depend on performance of the fund managers or of their management companies. (b) From the owners' standpoint, i.e. holding companies of unit trust managers, unit trust business via their subsidiaries must be a matter of great concern since the activities affect risk and the profitability of the holding companies (See, for example, Gallo, Apilado, and Kolari, 1996)

[5] See, for example, Brown-Humes, Christopher "Our ex-mutual friends", *Financial Times* 14 February 1998

This thesis therefore attempts to clarify some ramifications of the demutualisations through comparing unit trust companies ultimately owned by mutual institutions with those owned by shareholders.

Finally, from a methodological perspective, this thesis takes advantage of Data Envelopment Analysis (DEA) in researching the U.K unit trust industry. To the best of my knowledge this is the first study to employ the DEA for analysing both the relative efficiency of the unit trust management companies and performance of their managed unit trusts.

Data availability has been concern for the analysis with regard to performance of fund management companies (Siggelkow, 2003). In the case of the U.K unit trust management companies, some of accounting items required for conventional ratio computations are difficult to obtain from the financial statement or these are low levels of precision. Such limitations are mainly due to the parent- subsidiary accounting practice in the industry. This is where the DEA comes into play by estimating the relative efficiency score for the company with a few limited but critical accounting items. The accounting information used includes revenue, shareholder's fund and long-term debt e.g. capital employed in total, and administration expense. Specifically, the latter two financial statement components play critical roles for estimating the relative efficiency between the mutual and stock owned companies.

As for the capital employed, the ability of raising the capital employed is considered as the predominant motivation for the demutualisation decision (Cook et al , 2001; Cummins and Viswanathan, 2003) Stock owned companies, more precisely, market listed companies have flexibility in raising new capital through a variety of stock and debt offerings. By contrast, mutuals typically rely on their retained surplus for future expansion. As the capital is not easily replaced, hence, being precious to the mutuals, it is hypothesised that mutauls are lower risk organisations than the plc counterpart, inhibiting diversification into higher risk activities (Stephens, 2001). Furthermore, it is argued that if no profitable venture exists, mutuals face the risk of being over-capitalised, using their funds inefficiently (Cummins and Danzon, 1997).

The administration expense is also a key element under the agency theory paradigm that rather than maximising the value of a company, managers attempt to maximise their own utility via excessive perquisite spending or inefficient activities. Such managerial behaviour is originally defined as expense preference by Williamson (1963). The expense preference hypothesis predicts that compared with stock owned companies, mutuals are more likely to suffer from opportunistic behaviour by managers because of the lack of owners', e.g. policy or account holders' monitoring over their managers' activities.

For these grounds, the capital employed and administrative expenses are indispensable elements in analysing the relative efficiency between the mutual and stock owned companies. Although care needs to be taken due to the group accounting practices utilised by different company groups, these figure are at least in public domain and available from the U.K regulatory body, e.g. Companies House.

1.3.2 Justification for the study on the U.K unit trust industry

The setting of the U.K unit trust industry is particularly well suited for the purpose of this study. The following remarks highlight the way which the U.K unit trust industry is valuable in order to achieve the objectives of this thesis.

For the purpose of this study, the U.K unit trust industry offers a unique data set in terms of the number of companies, the type of ultimate ownership, and the degree of the market concentration. The U.K unit trust industry is comprised of more than 150 companies whose ultimate owners vary from mutual institutions to small private companies. Moreover, the top five companies account for 30% of the total industry asset. When one compares the UK unit trust industry with other European counterparts, it becomes evident that studying the UK industry with such distinctive characteristics has an advantage. For example, the ten largest French fund management companies held 65% of the industry asset (Pricewaterhouse Coopers, 2000-a). Similarly, the German fund industry is dominated by six financial groups, reflecting the structure of the German banking sector. Their assets under management account for 70% of all the assets in the industry (Pricewaterhouse Coopers, 2000-b). Hence, the U.K unit trust industry provides enough sample companies, allowing us to study the organisational effect in a meaningful way.

For a slightly different reason, the study on the U.S mutual fund industry is also limited. Let us take a look at recent studies conducted by Massa (2003) and Siggelkow (2003). Their common research interest is whether a corporate strategy matters not only to the corporate performance, but also their funds' performance. However, their corporate performance measure, based on the cash inflows into the company, is incomplete to the extent that their measures exclude any cost components. The simple reason for the lack of the cost aspects is that "*a directly profitability measure for fund providers is unfortunately not available* (Siggelkow, p132)."

Using DEA to calculate the efficiency ratio, the study of the U.K unit trust industry can overcome the problem of the missing cost factors in the recent U.S studies. By law, the U.K companies have to submit their financial reports to the U.K authority, e.g. the Companies House where these annual reports are accessible. The reporting designs are not necessarily identical among the companies because the companies employ various accounting methods within the accepted accounting rules. Consequently, care is needed in formulating the corporate performance measures. Nonetheless, the key cost items are indispensable features in some ways and obtainable from these reports. Such financial data with a limitation allows for the efficiency score as an alternative to conventional performance ratios such as return of assets, return of capital employed. In this connection, the analysis of the U.K will be able to shed new light on the impact of the corporate strategy on their management efficiency.

There is a practical justification for studying unit trust companies in the U.K. By the Financial Service Act (1986), the unit trust management company must be a corporate body established in the U.K. Moreover, the company are not allowed to engage any type of business other than unit trusts management business. Such a legal criterion is likely to minimise regulatory and tax variations between the unit trust management companies owned by mutual institutions and those owned by proprietary companies. Controlling for such intra-industry heterogeneity across the companies, the comparison of the companies with different ownership becomes more valid.

In addition to the practical motive, there is a theoretical justification in light of the following Mayers and Smith's argument (1994). Mayers and Smith state that the control problem facing the mutual members is "*potentially more severe for stock companies owned by the mutual associations since they are not eligible to participate in a parent's proxy fight. Their major control mechanism is the withdrawal of patronage. Hence, in competing for business, a stock company owned by a mutual is more likely to rely on implicit contracts and reputational capital* (Mayers and Smith, 1994, p641)". For these reasons, this thesis focuses on the unit trust management companies in the U.K.

1.4 Overview of research method

The primary hypothesis to test is whether ultimate ownership of a fund management company relates not only to risk taking and efficiency of the company, but also to performance of unit trusts that the company offers.

1.4.1 Research Designs

In order to test the primary hypothesis, this thesis will employ non-experimental and cross-sectional research designs. The basic approach is a two-group comparative design where the proprietary companies are compared with the mutual owned companies in terms of risk-taking, and efficiency at the company level, and the performance of their unit trusts. More specifically, the empirical analyses employ a two-step approach with the cross-sectional study format, which is consistent with the 1993 study carried out by Cebenoyan et al (1993).

1.4.2 Research procedures

Variable specification

The first step is to develop several proxies for risk-taking decisions, managerial efficiency at the company level and performance at the unit trust level. The ways in which these variables are computed is vital because the relationship between organisational form and these proxies can be sensitive to the frameworks of the proxies (Regan and Tzeng, 1999).

In response to the issue of the proxy formation, the first empirical study develops risk-related measures in three ways; business specialisation, business concentration and proportion of risky unit trusts within the company. These risk measures are based on the company's product mix consisting of a number of unit trusts. As the company's fee revenues are generated from the unit trusts, these risk proxies reflect the nature of risk that the unit trust management company bears.

With regard to the efficiency measure for the unit trust management company, this thesis takes advantage of data envelopment analysis (DEA) where one output, e.g. the total revenue and two input variables, (e.g. administration costs and capital employed) are simultaneously compared and subsequently the efficiency score is generated. Two reasons for the use of the DEA are: (a) the unit trust management companies are non-market listed ones so that a stock price based measure is not available. (b) the standard financial ratios may not reflect the true picture of the companies. This is partly because a potential transfer pricing may exist between the unit trust management company and their affiliated group companies, and partly because the unit trust management company has a limited disclosure requirement as a subsidiary of the parent or holding company. Such practices are likely to reduce validity of the popular financial ratios. Under the data constraints, DEA can facilitate the efficiency score with multiple inputs and outputs whilst holding the basic ratio structure.

In a manner similar to the efficiency measure, the performance of individual unit trusts is evaluated by taking advantage of the DEA. As noted in section 1.3, the DEA allows for the potential interactions amongst the variables; return, risk and fees of an individual unit trust. This is the major advantage over the conventional risk-adjusted performance measures.

Before moving on to the second analysis, non-parametric independent tests are used to see whether these variables differ by ultimate ownership type.

Model specification

The second step attempts to relate these variables to ultimate organisational form whilst controlling for influential factors. The general reasons for using a regression model are; the regression can indicate whether the relationship exists between the explanatory variable of organisational form and the dependent variables such as the company's risk-taking, efficiency and their funds' performance. Moreover, the regression model can display the nature of the relationship amongst these variables. From a technical perspective, the Tobit model is more appropriate than the ordinary least square regression because the variables from the first step are limited within certain ranges.

1.5 Data and Sample

1.5.1 Data Collection

The sample data on the UK unit trusts and their management companies is mainly from the following resources; *The Financial Times Unit Trust & OEICs Year book 1999/2000, The UK Fund Industry Review and Directory 2000, Money Management, Financial Analysis Made Easy (FAME), Companies House Direct, and The Association of Unit Trust and Investment Funds' web-site.*

Based on the Financial Times Unit Trust & OEICs Year book and the UK Fund Industry Review and Directory, each company's ultimate ownership is identified. Companies House Direct's web site provides an annual financial statement of a unit trust management company with their original format. If it is necessary, a comparable document is also downloaded from the FAME web site for the cross-check purpose.

Concerning the unit trust information, the two directories also provide fund information that contains the sector classification, the size and the fee charges of individual unit trusts within a management company. Money Management provides returns of a unit trust for various investment periods, and the price volatility of the unit trust over 36 months.

Finally, in order to create the risk proxies based on the investment objective of a unit trust, the sector data is collected from the AUTIF web-site (for the money flow into each sector) and from Money Management (for the historical price volatility of each sector).

1.5.2 Sample Data

The sample period in this study is based on the financial year 1999-2000. The key reason for this period is that this is the most stabilised period as less frequent demutualisations occurred in the U.K financial industry after the mid-1990's demutualisation wave. The data used in this study includes all UK unit trust companies for which both sector data from Money Management and ownership data from the two industry directories are available. As a result, 12 unit trust companies are excluded from the sample because of their unknown ultimate ownership status. Furthermore, observations with pension sector funds are eliminated because the sector data were not available from Money Management.

This is not a major problem because the overall sample asset size is 253.442 million pounds, accounting for 99% of the industry assets at the end of 1999. The final sample consists 142 unit trust management companies and 1680 authorised unit trusts.

Based on the fact that unit trust management companies are usually subsidiaries of financial groups, the empirical analyses divide the ownership characteristics of the financial groups into the three forms; stock owned companies, i.e. market quoted companies, privately owned companies and mutual owned companies. Consequently, the sample data on the UK unit trust management companies includes 87 quoted company owned, 31 private company owned and 24 mutual owned.

1.6 Definitions

As definition adopted by academic literature are not uniform it is worth clarifying key terms used in this thesis.

1.6.1 Risk-taking

Risk-taking at the company level refers to as managerial decisions which incur discretionally risk related to the product mix affecting the company`s profitability. In this respect, this thesis is concerned only with financial risk as opposed to operational risk. The sources of risk addressed in this thesis is based on the company's product set, consisting of funds differentiated into the investment categories. Justifications for the choice are as follows. As recent papers (Massa 2003, and Siggelkow, 2003) reveal, the decision to set up a fund with a specific characteristic affects the company's cash flow. Cash flow is essential to an organisation because the organisation can pursue its objective with the cash. More theoretically, the cash flow is vital because the (net) cash determines the value of the organisation under the axiom of modern financial theory (Brealey and Myers, 1996). At the product level, e.g. individual unit trusts, the risk-taking is simply defined as the standard deviation of the unit trust's return (Haugen, 2001, p.57)

1.6.2 Performance and Efficiency

It is of use to understand the difference between performance and efficiency in this thesis despite the fact that some authors use efficiency and performance interchangeably. The term *efficiency* in this thesis is the measure of how well the company's resources expended are utilised in the ratio form of inputs (i.e. resources) over outputs (i.e. revenues). The inputs are the amount of capital employed and administration expenses whereas an output is the revenue, largely derived from the management and initial fees. The reason for this efficiency approach is that shares of the unit trust management companies are not traded in stock exchanges so that the stock-based performance measure is not available. Another reason is that the data is limited in terms of financial statement components because of the complexity of inter-group accounting practices. However, section 5.5 points out, the input items and the output items should serve as the key observation points for the hypothesis testing in this thesis.

Brockett et al (1998) and Cummins et al (1999) conduct similar studies on the U.S property–liability insurance industry by measuring the company's efficiency score.

According to popular theories of modern finance, *"differences in risk should be the principal determinant of differences in expected return from one investment to another"* (Haugen 1999, p.15). From the risk-expected return paradigm, one may raise a concern that the relationship between the efficiency measure and the risk-taking proxy is not clear. The justifications described in the preceding sections, 1.6.1 and 1.6.2 are primary responses to the inquiry about the risk and efficiency approach. Summarising the recent studies, section 1.6.1 addressed the product mix of the fund management company affects the company's profitability. Section 1.6.2 noted that it is practically difficult to employ standard performance measures because no stocks are listed, and group accounting practices are often complex.

There are a few additional reasons for the risk-efficiency approach employed in this thesis. First of all, the ultimate objective of this thesis is neither to estimate the risk-performance nor to solve the risk-efficiency relationship. Rather, the aim of the thesis is to examine the ultimate ownership effect on their operational characteristics and managerial efficiency. The risk-performance relationship at the company level within the unit trust industry would seem to be an interesting future research topic. This line of research is possible by studying several "listed" fund management companies whose share price information is much more easily obtainable.

Secondly and more importantly, it would be ideal if the distributions of the risk and expected return that a unit trust company is taking is known. Nonetheless, the data for the risk and expected return is limited because of frequent changes of product classifications. Specifically it is difficult to estimate the expected return. From the viewpoint of the company's profitability, returns of their unit trusts consist of not only investment returns from underlying assets that the unit trust hold, but also the positive money flow into the unit trusts. Specifically, the data of net money flow at any levels, e.g. individual unit trust, company and product category, is very difficult to obtain.

For these reasons, this thesis focuses on risk and efficiency separately and it is true that the efficiency score derived from DEA itself is not explicitly risk-adjusted. Hence, the present thesis attempts to isolate true efficiency from the risk factors by including the company's product mix that relates to market risk and business risk into the Tobit regression model.

1.6.3 Fund performance

The term, *performance* used in this thesis is used for evaluating individual unit trusts that the company offers. Performance is measured on the basis of the fund's risk-taking and its fee charges in accomplishing the investment return forwarded to their fund investors. How the performance measure in this thesis differs from the conventional measures is to include the fee factor. The main advantage to include the fees into the performance evaluation is that for the fund investors, the impact of fees can be substantial. Recently, Galagedera and

Silvapulle (2002) and others investigate the fund performance by incorporating the fee factors whilst utilising the DEA methodology (See Chapter VI). Moreover, the advantage of the performance measure used in this thesis is free of benchmark errors.

1.7 Delimitation

This thesis is narrowed with a few scopes: the data sample, the research issue and the control variables.

1.7.1 The data sample and observation period

At the corporate level, this thesis confines itself to examining the unit trust management companies in the U.K. Section 1.3.2 has addressed a few justifications for this point of selection. At the individual product level, this thesis only tracks unit trusts categorised into the All UK companies sector for the following reason. A key enquiry of the individual product analysis is whether ultimate organisational form of a unit trust company affects the performance of their managed unit trusts. To this end, as the most popular and the largest category, the U.K all companies sector provides the large number of the unit trusts managed by companies whose ultimate ownership vary. The year selected for the observation is 2000. After the heavy demutualisation activity in the past decade, this time period provides far more stable platform by which to analyse the available data.

1.7.2 The research issue

The primary objective of this thesis is to examine whether mutual and stock owned organisations (i) pursue different risk-taking strategies on the basis of their investment products and (ii) exhibit different efficiency. This thesis does not, however, address the effects of the demutualisation, by exploring the causality of the shift of efficiency if there is such a change after the demutualisation. Limited time-series data do not allow for the causality test. It should be also noted that such limited data availability does not allow for a test of performance persistency at the individual unit trust level, which has been a traditional research topic in financial literature.

1.7.3 Control variables

As with most empirical papers, this thesis may be limited in terms of variable selections. There are always possibilities for representing differently for some variables, adding more variables to the models. For example, it has been argued that the managerial ownership is a determinant of risk-taking and the performance of the company. However, this thesis does not investigate explicitly whether the degree of the managerial ownership explains any differences in terms of risk-taking and efficiency at the company level and the performance of unit trusts. The key reason for less attention being given to the managerial ownership effect is due to the fact that no directors or employees directly own the shares of the unit trust management company that they work for. Rather, they sometimes hold the shares of their parent or holding company, which owns the shares of its subsidiaries including the unit trust management company. In light of this, no empirical studies have specifically addressed the impact of the managerial ownership on the subsidiary company.

1.8 Conclusion

Given the agency theory paradigm, this thesis concerns ultimate ownership effects in the unit trust management industry within the U.K. To investigate the topic from various dimensions, the thesis consists of three empirical studies: (i) comparison of risk-taking activities of unit trust companies owned by mutual organisations with those owned by stock companies, (ii) comparison of management efficiency between the two ownership groups, and (iii) comparison of risk and return between unit trusts run by the two groups.

The key finding is that the degrees of risk-taking and efficiency differ between the two ultimate ownership groups, but no difference was found at their product level. These primary results have two implications. Firstly, at the company management level, the management control seems to fail in disciplining the management of mutual organisations, leading to inefficiency of their affiliated unit trust companies. The finding is in accordance with agency theory to the extent that proprietary companies are more effective in the owner-manager conflict.

Secondly, the market for the unit trust as a financial product is intense enough to eliminate any differences across the management companies. As such the finding suggest agency theory does not hold at the product level, as the research found no evidence that the mutual form is more effective in controlling the owner-policyholder or the owner-accountholder conflict as would be expected.

These implications from this thesis help resolve the on-going debate regarding the demutualisation effect whilst lending support to the pro-demutualisation argument.

1.9 Structure of this thesis

The remainder of this thesis is organised as follows. Chapter II presents the literature on which the hypotheses are based. The literature review is composed of three sections. Firstly, as the parent discipline, agency theory is briefly reviewed. Subsequently, expanding on the agency paradigm, the literature on the effects of organisational form is summarised. This can be considered as the immediate discipline. The second part of Chapter II addresses the existing literature on fund performance. Such a review is essential because the third empirical analysis deals with performance of unit trusts. The rest of Chapter II focuses on the principal-agent problem in the fund management industry. Specifically, several sections shed more light on incentive factors in terms of the risk-taking of individual fund managers. Finally, these reviews identify a number of research gaps within the existing literature. Note that in addition to the literature in Chapter II, the literature directly related to each empirical analysis is reviewed in a subsequent chapter.

Chapter III describes the UK unit trust industry. In addition to the general description of the industry, Chapter III analyses characteristics of the industry by following the industry economics framework such as barriers to entry. The analysis helps understand how the companies compete each other in the industry.

Chapters IV and V investigate whether differences of ultimate organisational form explain any differences in terms of risk-taking (Chapter IV) and efficiency (Chapter V) of the unit trust management company. The evidence in common with the two chapters is that there are differences between the mutual ownership group and the proprietary ownership group with regard to the risk-taking and efficiency measures.

Adopting a slightly different angle, Chapter VI develops a performance measure that computes return, risk and fees simultaneously by DEA. The results show no significant difference in the unit trust performance by ultimate organisational form.

It should be noted that chapters from IV to VI have similar structures. To begin with each chapter reviews the relevant literature, leading to the hypothesis development. Subsequently three empirical chapters address methods used to test the hypotheses. Each chapter summarises the results of the hypothesis tests in its analysis section, followed by the conclusion. Chapter VII outlines conclusions and implications.

Chapter II: Literature Review

2.1 Introduction

The fundamental objective of this thesis is to explore relationships between ultimate ownership and performance / risk-taking of affiliated companies. To carry out this task, the thesis looks at ultimate ownership effects in the UK unit trust industry. For purpose of the analysis, this industry is fertile ground because a number of subsidiaries of mutual and stock owned companies co-exist, competing with each other.

The main goal of this chapter is to review the financial literature, highlighting the main issues relevant to both the research filed and the research objective.
Further, in the course of the literature review, Chapter II identifies a few gaps in prior studies, leading us to the hypothesis development in subsequent empirical chapters.

To this end, Chapter II is comprised of three sections. As a starting point, the first part of the literature review grounds the present research in the prior literature, paying particular attention to agency theory and the application to modern corporations.

The second section deals with collective investment schemes. The collective investment schemes refer to mutual funds in the US and unit trusts in the UK. The traditional research enquiry on the investment schemes is whether or not fund performance persists. Reviewing this topic is relevant to the current thesis for the following reason. Chapter VI investigates whether or not performance persistence is attributable to certain organisational factors. Such an enquiry would be illogical if no persistence of fund performance exists, reflecting a perfectly efficient market. Hence, the second section seeks for empirical evidence for and against performance persistence whilst discussing some methodological issues.

Finally, by combining agency theory with characteristics of fund management business, the third section summarises early studies on agency problems in the fund management industry. The review is of help in two ways. First, the review establishes theoretical rationales so as to explain potential agency problems in the fund management business. Second, the review ensures that the current thesis can make a contribution to the existing literature, rather than repeat it. The third section reveals that most of the prior literature in this research area is concerned with the individual fund as a unit of analysis. In contrast, until very recently, little interest has been shown in agency problems at the company level. To fill the void in the literature, the subsequent empirical chapters analyse the company's risk-taking (Chapter IV) and efficiency (Chapter V).

2.2 The agency literature

2.2.1 Introduction

Since the writings of Berle and Means (1932), a great deal of research has gone into the issue of ownership and control of modern corporations. The dominant paradigm among the prior studies is agency theory, helping explain why ownership matters in term of performance and risk-taking of a company. The current thesis is no exception, building on the agency paradigm in an attempt to explore the ownership effect in the unit trust industry.

In this regard, the first review section consists of background, relevant and very relevant literature groups. Section 2.1.2 starts with an outline of the basic idea of the agency theory. Then, in section 2.1.3, a few early studies are presented as applications of the agency theory in business studies. Further, as a few scholars have extended the agency paradigm to the study of organisational forms and their characteristics, section 2.1.4 outlines their basic arguments, which are also reviewed in detail in subsequent empirical chapters. To this end, the final section, 2.1.5, shows the theoretical linkage between the present thesis and prior agency literature.

2.2.2 Background: basic agency framework

In general, the agency theory used for the legal literature is associated with the term, respondeat superior. The basic idea is that the principal is responsible for the acts of his agent when the agent is acting within the scope of his employment. (Crockett and Gilmere, 1999)

However, agency theory in the economics literature differs from that of the legal literature. More precisely, the term of 'principal agent relationship' used in the economics literature refers to a situation in which *one individual (the agent) acts on behalf of another (the principal) and is supposed to advance the principal's goals.* (Milgrom and Roberts, 1992. p 170). However, *there is good reason to believe that the agent will not always act in the best interests of the principals.* (Jensen 1998, p 54). More specifically, problems can be observed when the principal cannot easily recognise whether the agent's actions are for the principal's goal or for the agent's own interest. Hence, such principal-agent problems are attributable to asymmetric information that one party has some information that the other party does not. Typical examples that arise in this type of world are moral hazard and adverse selection.

By and large, there are three conditions when an agency problem arises. There must be (1) some divergence of interests between people; (2) some basis for gainful ex-ante exchange between individuals, and (3) difficulties to see whether the individual follows terms of the contract between the individuals, in a sense that monitoring activities are costly (Milgrom and Roberts 1992).

In order to control the agency problem, several remedies are suggested. First, it is of help to increase monitoring activities despite the fact extra monitoring makes for additional costs. Second, designing effective incentive schemes is also useful to mitigate the moral hazard problem. The third way to eliminate the agency problem is to penalise the agent if the agent would engage in self-interest activity at the expense of the principal's welfare.

2.2.3 The principal-agency perspective on modern corporations

A starting point

Berle and Means (1932) were the first to draw the attention to the relationship between corporate ownership and performance. It can be seen that their line of reasoning had much in common with the principal-agent perspective. Focusing on more diffused ownership in modern firms, Berle and Means predicted managerial problems as a consequence of the dispersed equity ownership structure, which leads to property without power for the equity shareholders to power without property for the incumbent executive management. Their intuitive argument relied on the idea that the managers will not always place the owners' interest above their own if "*the desire for personal profit is the prime force in motivating control* (Berle and Means, p 123)[1] ". Anchored by their logic, agency based studies have been developed as described in the subsequent sub-sections.

Theory of the firm

In a similar vein, Jensen and Meckling (1976) advanced the agency theory from the following three standpoints: (a) a clear explanation of agency problems in

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[1] Berle A.A and Means G.C. (1932), "*The modern corporation and private property*". Macmillan. This quotation is taken out from T.J. Gough's *the economics of building societies*. (1982. p5). the Macmillan Press Limited.

firm, (b) ownership as an incentive, and (c) asset substitution problem between shareholders and debt-holders.

(a) Explanation: To begin with, the authors demonstrated that whenever managers have less than 100% stake in the firm, it is inevitable to see conflicts of interest between shareholders and non-owner managers. To take a simple example, the managers take excess consumption of perquisites for their own benefit. Jensen and Meckling's illustration in this point is summarised as follows: Consider that the manager owns only 5 percent of the company's shares. Each pound of unnecessary expenditures which the manager personally obtained benefits from, costs the manager only 5 pence whereas other shareholders incur the other 95 pence (Grinblatt and Titman, 1998).

Defined as agency problems, such conflicts of interest can be seen to the extent that the managers, as decision-makers of the firm, can affect any business functions, and ultimately corporate value, whilst their decisions may not be the optimal ones for owners.

(b) Ownership as an incentive: Under the circumstance presented above, Jensen and Meckling suggested that to provide the managers with shares of the firm is one of the devices to mitigate the problem. In this way, the managers become "inside" or "managerial" owners of firm. To put it another way, the agency problems are reduced by establishing linkages between the managers' rewards and firm performance.

Viewed from this perspective, a great deal of attention has been paid to the design of incentive contracts with optimal risk sharing properties on the theory side, and to the connection between ownership and firm performance on the empirical side. For a detail discussion of the manager-owner conflict, see Byrd, Parrino, and Pritsch (1998), who provide an excellent review of the literature concerning manager-owner agency problems.

(c) Shareholder versus debt-holder: Moreover, Jensen and Meckling (1976) also revealed the risk-shifting effect of debt due to different residual claims between shareholders and debt-holders. Shareholders have incentives to maximise the value of their shares by investing riskier projects at the expense of debt-holders' interest. On the other hand, debt-holders are only entitled to claim their original lending and the interest[2]. To avoid risk shifting by shareholders, the debt-holders need to set up a monitoring or bonding mechanism. In other words, one can consider monitoring by the debt holders as a device to reduce the agency problems.

Defined as costs of debt or equity, this line of thinking provided considerable importance to financial researchers because the notion of cost of debt/equity contradicts the Modigliani and Miller proposition (1958) that the actual capital structure is irrelevant to the value of a firm in a perfect capital market. The debates on capital structure (which is often called debt policy) appear in standard corporate finance textbooks (See, for example, Brealey and Myers, 1996).

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[2] Brealey and Myers (1996) described such different residual claims as saying that when a firm gets into trouble, limited liability allows stockholders simply walk away from it, leaving all its troubles to its creditors. (p 485)

Nonetheless, to argue this point would carry us too far away from the purpose of this thesis. It is enough to summarise that because the capital markets are not 100 percent perfect, capital structure does matter. Conflicts of interest, and incentive problems between shareholders and debt-holders are costly, leading to financial distress.

In essence, stimulating a substantial body of financial economic researches, the preceding scholars' contributions to the agency literature are twofold: The first point is that ownership matters. The second is that the principal-agent relationship can be seen in a variety of setting in a modern corporation. From the scope of the present thesis, the two strands are preludes to theory of organisational form, which are directly connected with the present topic.

2.2.4 Analysis of organisational forms

Carrying Jensen and Meckling's paradigm one step further, Fama and Jensen (1983a, and 1983b) stated that the controlling agency problems is a key factor in explaining the survival of various organisational forms. Their discussion has an explicit linkage to the present research. In this respect, the following Fama and Jensen's argument serves as the immediate discipline whereas the preceding agency literature refers to the parent discipline. It is essential for the purpose of the present thesis to enter into Fama and Jensen's discussion.

There are three concepts grounded in Fama and Jensen's seminal papers. First, an organisation is the nexus of contracts that specify the rights of each agent in the organisation, performance criteria on which the agents are evaluated and the payoff function they face. However, agency problems arise because such contracts are imperfect in a way that the *contracts are not costlessly written and enforced* (Fama and Jensen, 1983a:p153[3]). In other words, it is costly to draw a set of contracts that specify course of action for each stakeholder in all conceivable future circumstances (Drake and Llywellyn, 2001).

Second, residual claims are important. The residual claim refers to the right to net cash flows generating the difference between stochastic inflows of resources and promised payments to agents (Jensen, 1998, p176). Focusing on different type of the residual claim, Fama and Jensen classified various organisation forms. For example, a mutual institution is characterised by the fact that the customers are themselves the residual owners. In contrast, customers and residual claimers, i.e. shareholders are separated in stock owned companies.

Lastly, given the viewpoints above, Fama and Jensen built up an important hypothesis that different organisational forms have their own mechanisms to control agency problems. Such control mechanisms reflect the unique organisational characteristics defined by a set of various contracts among stakeholders. Thus, organisational form is a key factor, helping explain the survival of organisational forms in specific activities.

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[3] This quotation is taken out from Michael Jensen (1998) "*Foundations of Organisational Strategy*" Harvard University press.

Table 2.1 summarises their hypothesised relationship between organisational archetypes and their business activities where a particular organisation archetype is likely to survive.

Table 2.1: Fama and Jensen's organisation analysis (Fama and Jensen,1983 a)

Organisation Form	Circumstances in which they are more likely to survive	Key implications
Listed Company	• The greater the benefits of unrestricted risk sharing. • The greater the benefits of specialised management. • The greater the amount of organisation-specific assets to be purchased. • The greater the wealth required to bond contractual payoffs • The lower the costs of separating decision management from decision control.	Economies of scale are essential
Private Company / Partnership	• The costs of separating decision management from decision control are high	Economies of scale are not important.
Mutual	• The lower costs of expanding and contracting assets. • The lower costs of obtaining accurate indices of assets' values.	Financial organisations where assets are primarily the securities of other organisations.

Mutual has a control mechanism against agency problems by liquidating residual claims on demand at a price set out by their rules. To take advantage of such a device, the mutual association is likely to survive in business that deals with other companies' securities, which prices are easily obtainable.

In the case of an exchange-listed company, nature of residual claimants such as limited liability and free transferability of shares allows the quoted company to raise a large amount of capital. Moreover, from the shareholders' view, they diversify their own wealth by their investments in various companies whilst letting their invested companies to engage in uncertain business projects. Arguably, these conditions are critical in pursuing economies of scale.

Further, to a private company, what distinguishes the private company from the quoted counterpart is that the residual claimants in the private company are largely restricted to important decision makers. For this reason, the privately held company is likely to survive in business activities where the benefit from restriction of residual claimants is larger than that from separation of decision makers and risk-bearers. Typical business activities are law, accounting, medicine and business consulting. Such business fields do not require economies of scales, which work well with separation and specialisation between decision making and risk-bearing functions (Fama and Jensen, 1983). Obviously, the prediction noted above will provide foundations for a number of testable hypotheses in the subsequent empirical analyses in the present thesis.

One final point is worth commenting on with regard to Fama and Jensen's discussion. Their line of reasoning suggested that in examining organisational form, there is need to consider the circumstances in which companies are doing business. Nonetheless, as discussed later, early empirical studies of stock versus mutual companies failed to account for the nature of the industry where companies with the two different organisational forms coexist. In this light, Chapter III is intended to provide the brief industry analysis concerning the unit trust industry in the U.K.

2.2.5 Section summary

This section briefly reviewed the basic notion of agency theory and its application to modern companies. In particular, two issues are more applicable to the objective of the present thesis: Ownership matters and organisational form also matters. The former topic is of use when considering the difference between private owned and public owned stock company. The latter issue is indispensable for the stock versus mutual debate in this thesis. In an attempt to develop testable hypotheses from these two points of view, the current thesis will turn back to the issues made as the introductory remarks in subsequent empirical chapters.

2.3 Literature on fund performance

A task of the current thesis is to explore the linkage between performance/risk-taking of fund managers (or management companies) and their incentives, associated with their ultimate ownership form. As the review of background literature, the first section addressed potential effects of ownership and organisational form on performance.

Now the second section goes through the literature of collective investment schemes. As described in the next chapter, the schemes are usually referred to as mutual funds in the U.S. and unit trusts and investment trusts in the U.K. Thus, the review in this section is around mutual fund / unit trust literature.

One of the research strands within the fund management literature is performance persistence. This topic is key in analysing performance of individual fund products. If there is no performance consistency among funds, the effort in Chapter VI that connects a fund's performance with its company's ultimate ownership form would be flawed.

The above enquiry is based on the efficient market hypothesis (EMH)[4] and there are many of mutual fund studies on the topic of performance persistence. Because of its relevance and the controversy, a review of previous literature on performance persistence must not be dismissed.

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[4] See the next section for details.

2.3.1. Performance Persistence

This subsection provides several indications of the research findings with regard to fund performance in the U.S and the U.K. The focuses of existing studies on mutual funds are twofold: Whether or not these professionally managed funds yield higher returns and, if this is the case, whether or not such performance persists. In plain English, the former can be thought of as "beat the market" whilst the latter means "can winners repeat?" Note that based on recent empirical studies (Carhart, 1997 and Blake and Timmermann, 2003), the latter question can be rephrased as "why losers persist?"

Background

There are two motives for such performance studies. The first and foremost is to test out the EMH as noted above. Basically, what the EMH asserts is that security prices reflect all available information (Fama 1970). If the EMH holds, it is of no use to analyse information in order to achieve excess returns[5] because numerous rational investors react quickly to the just-released information (Reilly and Brown, 2000).

The next motive to study performance persistence in mutual funds is that an implication from findings of such studies has a large economic impact on investors' strategy. If there is performance consistency, investors should benefit from investing in the constantly superior funds whilst avoiding the continuously poorly performing funds. Undoubtedly, the notion above results in the on-going

[5] Excess return refers to excess from the equilibrium or required rate of return.

debate about active versus passive investment strategy in the investment community.

Besides the two motives, examining mutual funds offers more realistic and widely applicable merits in testing the EMH. The first advantage is that mutual funds are managed by a group of investors who are considered as highly trained professionals working full time at investment management. At the same time, however, the fund managers as well as ordinary investors are usually not in the position to have exclusive access to critical new information[6]. The motives described above can be best summarised in the following quote: "*Studies of money managers' performance are the bottom line test of market efficiency*" (Quigley and Sinquefield, 2000, p 72).

The second favourable condition is that in conducting empirical tests for the EMH, obtaining reliable data is a fundamental requirement. In this respect, historical records of mutual funds are more easily obtainable than those of other investment schemes such as pension funds. Clearly there is a practical advantage in studying mutual funds[7].

Given the motives above, numerous studies have been made as to whether or not performance persistence of mutual funds exists. Notably, a great deal of the most advanced work has been completed in the U.S. (reviewed in the next

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[6] Insider dealing is a criminal offence defined by the Company Act 1980. According to the FSA (www.fsa.gov.uk), "*It is a process where individuals use, or encourage others to use, information regarding a company which is not generally available, to deal for their own financial advantage (other than in the proper performance of their job).*"

section). More recently, there are also studies of funds in Europe including the UK (Otten and Bams, 2002) and in Asian countries such as Hong Kong (Cheng et al 1999) and Japan (Cai et al, 1997; Brown et al 2001). However, these non-US studies are limited in comparison to those of U.S mutual funds.

In spite of Herculean efforts, history of these studies shows that empirical evidence is mixed. It is argued that a few methodological problems such as choice of performance measures and the possibility of survivorship bias can partially explain why evidence is divergent on the persistence (Elton et al, 1996; Allen and Tan,1999). As these two issues will be addressed again in the subsequent chapter that investigates individual unit trusts, for the moment, let us concentrate on the main findings of widely referred studies of this research issue. To begin with, the following subsection goes through several prominent papers in the U.S mutual fund literature.

U.S Studies

Evidence from early U.S. works (Sharpe, 1966; Jensen,1968; and Treynor 1966) indicated that there was little information in the historical performance record of mutual funds. For example, Jensen (1968) examined 114 mutual funds over the 1945-1964 period, finding that the majority of funds (72 out of 114 funds) in his sample showed negative risk-adjusted returns after controlling for various fees. Hence, he drew the conclusion that there is no persistence of superior performance in mutual funds.

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[7] Examples are Standard & Poor's (*www.funds-sp.com)* FT Fund Ratings (*www.funds.ft.com)* and Morningstar (*www.morningstar.co.uk*)..

In more recent studies that directly investigate consistency of mutual fund performance, some controversy still remains. Studies that presented some evidence for the persistence include those by Grinblatt and Titman (1992), Hendricks, Patel and Zechhauser (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), Elton, Gruber, and Blake (1996) and Gruber (1996).

By contrast, researches that reported no or conditional evidence for persistence include those by Malkiel (1995), Carhart(1997), Daniel, Grinblatt, Titman, and Wermers (1997), Phelps and Detzel (1998), Jain and Wu (2000), and Droms and Walker (2001).

Evidence for persistency

The impetus for the renewed interest in performance persistence can be traced largely to the findings of Hendricks et al (1993). Their paper was able to show positive but short-term persistence in mutual fund returns. Such positive performance persistence is referred to as "hot-hands" in the literature. Using quarterly returns of 165 growth equity funds over the period 1974-1988, the authors conducted cross-sectional regression analyses where the dependent variable was fund i's residual from the market equilibrium[8], e.g. the expected return in the quarter. The independent variable consisted of lags of one to eight of the dependent variables (See Equation 2.2.a in Table 2.2).

[8] Horst and Verbeek (2000) emphasised that a choice of the market equilibrium is crucial because results from persistence studies highly depend on the estimation of the market equilibrium.

The results from the regressions showed that the coefficients for the first four lags were all positive and statistically significant whereas those from five to eight lags were less clearly significant. The degree of the positive performance relative to conventional measures was 3-4% per year with a four-quarter evaluation period when the impact of the hot hands' effect reaches a maximum. Therefore, their conclusion was that there was performance persistence of mutual funds from one quarter to the next. Nonetheless, such persistence fades away beyond a year.

By using two-way contingency tables, Goetzmann and Ibbotson (1994) also found evidence for performance persistence, which is referred to as the repeat winner hypothesis (Goetzmann and Ibbotson, 1994). As their methodology becomes a dominant model in studies of performance persistence, it is worth describing not only their findings but also their methodology. Their method consisted of three stages. The starting point was to compute each fund's return over time. The next step was to classify each fund as winners or losers based on whether or not the fund's return was above (winners) or below (losers) the median return in each period. The final stage was to create a 2x2 table to which each fund was assigned, following the winners/losers of the previous period t and those of the subsequent period t+1, then to count the number of funds in each cell. If more funds are found in the diagonal cells than in the off-diagonal cells and the distribution is statistically significant, then persistence exists (Hallahan and Faff, 2001).

In terms of the sample size, Goetzmann and Ibbotson used a relatively large sample with monthly total returns of 728 funds for the period of 1976 through 1988. Further, there were two performance measures used in their work; a raw return and a Jensen's alpha. The results with both measures indicated that by using the previous performance, the ratio of selecting a winner fund over a loser fund was about 60/40, and significant at the 5% confidence level. Hence, they concluded that the repeat winner pattern is present.

Whilst stating strongly that past performance is of use for predicting future performance in mutual funds, Elton, Gruber and Blake (1996) extended the line of research in two ways: by creating a data set with no survivorship bias and by taking into account the performance of growth versus value stocks. By tracking funds individually, the authors created the sample set including 188 funds that survived over the 1977-1993 period. The authors used the four-factor model where the intercept α is defined as a risk-adjusted performance (See Equation 2.2.b in Table 2.2). Note that the authors used this intercept to compute both a one year alpha and a three year alpha subject to the period they examined . Grouping the funds into 10 deciles on the basis of the alphas, Elton et al studied how the ranking in year (*t*) has a relationship to their subsequent rankings, i.e. year (*t+1*), (*t+3*). Results form the rank correlation showed that there were significant correlations.

Moreover, as an additional test, the authors created two portfolios; (a) the top portfolio that consisted of funds taken from the top deciles group and optimally weighted, (b) the bottom portfolio created in a similar manner but with funds taken from the bottom deciles. The performance comparison between the two portfolios in the subsequent period was significant. For example, when the two portfolios were constructed on the basis of a three-year alpha, the difference between the two portfolios' alphas in the subsequent three year period was 0.446% per month or 5.4% per annum. These results led them to conclude that "*there is definite information about future performance conveyed by past performance*" (Elton, Gruber and Blake, 1996; p.156). From a slightly different research interest, Gruber (1996), who studied the survival of poor performing funds, presented similar evidence for the persistence of mutual funds during the 1985-1994 period.

Evidence against persistence

By contrast, there are some studies that challenge the preceding evidence of persistence. Malkiel (1995) is a good illustration of a paper showing performance persistence with some reservations. His main point is that performance persistence reported in prior literature depends on the year and duration of the performance measured. Using equity mutual funds over a twenty-year period between 1971 and 1991, Malkiel constructed contingency tables similar to those in the Goetzmann and Ibbotson's (1994) work. Based on quarterly total returns of funds, the tables showed funds with successful performance in year *t* over the successive period, i.e. year *(t+1)*. His key results were as follows: The persistence appeared to be present in the 1970's when winners, e.g. funds with high return than the average, were likely to repeat almost two third of the time. However, in contrast to the 1970's, winners tended to repeat just over half of the time over the whole period of the 1980's. Hence, Malkiel concluded that considerable performance persistence existed during the 1970's, but such a pattern disappeared during the 1980s[9].

In a similar vein, Phelps and Detzel (1998) supported Malkiel (1995), by presenting additional evidence that performance persistence was a temporal phenomenon. The basic method of Phelps and Detzel's work was the same as that of Goetzman and Ibbotson (1994). However, the point to observe is that Phelps and Detzel's data, covering the period of 1975-1996, was much longer and more recent than that used in Goetzman and Ibbtoson's work, i.e. the period of 1976-1988. Their analysis indicated that there was positive and statistically significant persistence pattern during the period of 1985-1988. The finding is consistent with that of prior studies (Hendricks et al, 1993 and Goetzman and Ibbotson, 1994). Nevertheless, such positive persistence patterns were not observed in the later period, e.g. from 1989 to 1994. Given the findings, Phelps and Detzel had taken a position against performance persistence.

In reviewing the recent performance literature, Carhart's study (1997) deserves emphasis because his factor model approach explained considerable variation in funds' returns, eliminating almost all patterns in performance persistence. Whilst developing a 31-year data sample without survivorship biases, Carhart estimated funds' performance by using a single (CAPM), three, and four factor alpha models (Equation 2.2.c in Table 2.2.). For each alpha model, he created 10 portfolios that were formed from the ranking of funds' alphas in year t and observed the alpha of the 10 portfolios in the successive year, t+1. His primary

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[9] Rhodes (2000) presented a similar phenomenon in U.K. unit trusts.

result indicated that the difference between the top and bottom portfolios was significant, showing 0.67% per month or 8% per annum. The results supported the short run persistence of performance.

However, a close inspection of the coefficients in the four-factor model revealed that the difference was explained by size and momentum effects (4.6% out of the 8% difference) of stocks held in the portfolios, by expense ratios (0.7%) and by transaction costs (1%). The observation led him to conclude that most of the persistence is explained by common factor sensitivities, expenses, and transaction costs, leaving less room for superior skill or information of fund managers.

Furthermore, there is one interesting finding. When focusing on the subsequent return of the bottom portfolio that consisted of funds with the previous year's worst return, the four-factor model had a lower explanatory power. In other words, the four-factor model alone could not explain the subsequent poor performance of the bottom portfolio.

Finally, from a slightly different research angle, Jain and Wu (2000) were interested in fund advertisements that often took advantage of their records with superior performance. In terms of the performance persistence, their enquiry concerned whether or not advertised funds exhibiting above-normal performance can maintain their superior performance after the advertisement. Focusing on funds advertised in Barrons' or Money Magazine between 1994 and 1996. Jain and Wu evaluated performance of the funds' with four different models[10]. Their overall finding was that on average, advertised funds had higher returns than their peer fund groups in the pre-advertising year(s). However, returns of the advertised funds in the following years were not as good as before the funds were advertised. Therefore, Jain and Wu concluded that there is no performance persistence.

Evidence from the UK unit trusts

Many of the results from the US mutual fund studies show that a clear-cut answer to performance persistence is proving elusive. In order to cross-check the U.S findings, the next task is to review the U.K. literature comparable to that of the U.S. mutual funds. As the third research issue in the current thesis is to do with individual unit trusts, the review of these studies is the most direct relevant to the thesis. However, in comparison with the U.S. studies on this research topic, less attention has been paid to the U.K unit trusts. Among the few recent studies are those by Blake and Timmerman (1998 and 2003), Quigley and Sinquefield (2000), Rhodes (2000), and more recently, Fletcher and Forbes (2002).

Blake and Timmerman (1998) presented evidence of performance persistence by using 1402 unit trusts that were in existence between 1972 and 1995. Their first step was to form the top and bottom quartile portfolios on the basis of a three factor model over the previous 24 months. In a manner similar to Fama and

[10] The first measure is the average return on all the mutual funds. The second benchmark is the S&P 500 index. The third measure is the one factor alpha computed from the standard CAPM:$R_{it} - R_{ft} = \alpha_{It} + \beta_i (R_{mt} - R_{ft}) + error_{it}$ The forth measure is the four factor alpha (See Equation 2.2-c in Table 2.2)

French (1993)' model (See 2.2-d in Table 2.2), their three factor model design was a regression of the trust's excess returns on (i) a constant, e.g. an abnormal return, (ii) excess returns on the stock market index, (iii) excess returns on small-cap stocks over the market index, and (iv) excess returns on a five year UK government bonds. The comparison of time-series of returns between the two portfolio was their second step. The key results were that: the top quartile portfolio generated significantly positive abnormal returns whereas the bottom quarter portfolio showed significant negative abnormal returns. Hence, they concluded that there is persistence in abnormal returns.

Similar to Blake and Timmermann (1998), Quigley and Sinquefield (2000) created the top and bottom portfolios on the basis of non-risk adjusted returns of U.K unit trusts in time t during the period from 1978 to 1997, then compared the performance between the two portfolios in time t+1. The result revealed that the difference was 3.54% on average from 1981 to 1997, suggesting performance persistence.

An additional test was conducted in a similar way to the first test, but this time, the top and bottom portfolios were created on the basis of risk-adjusted return, i.e. alpha derived from Fama and French' three factor model. Results of the regression analyses showed that: For the top portfolio that consisted of unit trusts with the highest alpha in time t, the alpha in the subsequent period (t+1) was positive but not statistically significant. In contrast to the top portfolio, the comparable alpha in the bottom portfolio was negative and statistically significant at the 5% level. Therefore, Quigley and Sinquefield concluded by saying "*does performance persist? Yes, but only poor performance does* (p.72)." This conclusion is consistent with one of Carhart (1997)' findings.

From a practical point of view, however, Quigley and Sinquefield discovered that an investment strategy using this method did not work in reality because the strategy requires high turnover[11] in order to re-form the portfolios each year. Resulting in return reduction, the high cost of portfolio rearrangement arises from the bid-offer spread practice (see Chapter III for more details), which should be incurred as the transaction cost. This remark calls into the question of Blake and Timmerman's finding (1998) from the viewpoint of practical relevance.

From a regulatory viewpoint, a member of staff of the Financial Services Authority (FSA), Rhodes (2000) published an occasional paper on performance persistence. Rhodes created five portfolios consisting of UK equity unit trusts that were grouped on the basis of quartile rankings of monthly returns over the years 1980 to 1998. Then, by using 5x5 contingency tables, he studied how the five portfolios in an initial period performed in the subsequent period.

The point he examined was whether or not the distribution of the numbers in each cell is normal. If there is no pattern in performance, the number will be

[11] According to the authors, every year, on average, 80% of the underlying unit trusts in the top portfolio is replaced with unit trusts with higher return in the subsequent period.

normally distributed[12]. His results indicated that the distribution pattern was not significantly different from the normal one. Thus, he drew the conclusion that there was a lack of evidence to support the claim that past performance information is of use to retail investors. Instead, from the regulatory standpoint, his conclusion implies that marketing activities relied on past performance of unit trusts are potentially misleading to retail investors. In fact, subsequent to Rhodes' paper, the FSA proposed that use of past performance in marketing materials be restricted (the FSA, 2001).

As a response to Rhodes' paper (2000), a report from Charles River Associates (hereafter, CRA), which was sponsored by Association of Unit Trust and Investment Funds (AUTIF), was immediately published (CRA, 2002). By way of contrast, this counter-attack from the industry is worth a mention in passing. Taking the form of a literature review, CRA's main criticism was that Rhodes failed to represent prior studies' full conclusions whilst omitting a significant amount of the existing research. For instance, Rhodes quoted a following passage from Carhart (1997). "The mundane explanations of strategy and investment costs account for almost all the predictability in mutual fund returns." Nonetheless, CRA pointed out that the passage is followed by "important rules of thumb for wealth maximizing mutual fund investors: (1) Avoid funds with persistently poor performance; (2) Funds with higher returns have higher than expected returns next year, but not in years thereafter." Hence, it seemed to

[12] As he emphasised investors' interests, the numbers in the cells were weighted to allow for investors' utilities that were characterised by risk aversion, and a diminishing return toward higher performance. To illustrate this, suppose that Fund X has a ranking giving a constant performance of 4 across each of two periods (t and t+1). This gives a unit holder utility of 80 in each period. By contrast, assume that Fund Y that has a ranking with a performance of 6 in time t and a ranking with a performance of 2 in time t+1. The average performance of is 4 on average, but the average utility is lower. e.g. 73.

CRA that Rhodes ignored the latter paragraph that suggested performance persistence.

A recent report prepared for the FSA by Blake and Timmermann (2003) attempts to clarify and condense the debate between the FSA and Charles River Associates (hereafter the CRA) on persistence of fund performance. Whilst the CRA report (2002) found evidence of performance persistence in raw return data, Blake and Timmermann (2003) raised doubts about the methodologies that the CRA employed. The main methodological problems that Blake and Timmermann highlighted are the use of non-risk adjusted return, lack of robustness of the statistical analysis, the exclusion of fee charge effects and the exclusion of index tracker funds.

Blake and Timmermann's summary is more noteworthy. After reviewing previous empirical literature including the CRA, Blake and Timmermann summarised that losers generally repeat whilst winners do not necessarily repeat. As an important policy implication, Blake and Timmermann emphasised the importance of the performance league table that includes not only superior performing funds but also poorly performing funds over several investment horizons.

More recently, Fletcher and Forbes (2002) used 2x2 contingency tables (Goetzman and Ibbotson, 1994; Brown and Goetzman,1995) and Carhart's four factor model (1997) in order to test the U.K unit trusts' performance persistence between 1982 and 1996. What distinguishes one approach from the other is that the contingency table approach is based on relative rankings whilst the Carhart model is formed on the basis of excess return compared to stock market benchmarks.

The results from the contingency table approach were consistent with those of the prior studied in the U.S, suggesting that there is a significant persistence in repeated winners and losers for 8 out of 14 evaluation periods. Of particular to note is that the repeated losers mainly accounted for the persistence. The number of repeated losers is over the three times higher than that of repeated winners in 11 out of 14 evaluation periods.

The results from the Carhart' model contrasted with those of the contingency table approach. The performance persistence disappeared when unit trust performance was evaluated with the Carhart model. The observations were generally consistent with those of Carhart's original work (1997).

Based on these findings, the implications from Fletcher and Forbes (2002) are worth summarising: Performance persistence is subject to a relative measurement. Further, if there is persistence of a unit trust's return, such performance can be explained by factor models such as Fama and French (1993) and Carhart (1997).

2.3.2 Section Summary

From the viewpoint of performance persistence, this subsection provides a brief mention of some recent studies on the U.S mutual funds as well as the U.K. unit trust. Overall, early literature is indecisive as to whether fund performance persists period after period. Nonetheless, recent studies reported an interesting observation that inferior performance of a fund is more likely to persist than superior performance of a fund. (Carhart, 1997, and Blake and Timmermann 2003). The number of issues emerged from the literature review on the persistence of fund return and these issues are likely to account for the inconclusive evidence presented in this sub section.

The first point is that various measurement criteria tend to have impact on performance persistence. For example, performance can be clustered in time for U.S mutual funds (Malkiel, 1995), and in the early 1980's for the U.K. unit trusts (Rhodes, 2000). Further, performance persistence can be sensitive to survivorship bias (Elton et al, 1996). Moreover, performance persistence often depends on whether the performance is evaluated by a peer comparison or by a market index comparison (Fletcher and Forbes, 2002).

The second point to note is that if performance persistence holds, then factor model approaches can explain why certain fund performance persisted, leaving little room for fund managers' unique skills (Carhart, 1997).

Finally, in addition to the investment factors, a fund's costs and charges should be considered as parts of the fund's net performance. This is an important issue, and specifically relevant to funds with poor performance records because *"under-performing funds are exactly those funds that do not have any fund manager ability, but do have higher charges and costs* (Blake and Timmermann, 2003, p.40)"

Given the mixed picture on persistence and the methodological issues, it is still worthwhile to blend the line of fund performance research with the rhetoric of agency theory. The enquiry is whether or not a company's ultimate ownership form is linked to better (or worse) performance of unit trusts that the company offers. Specifically, as risk and charges are important determinants of a unit trust's net performance, the two elements can be good proxies for the degree of agency problems. This is the main goal of Chapter VI where the relationship between performance of individual unit trusts and their management company's ownership is empirically investigated.

Table 2.2 Models in the previous literature (using the authors' notations)

Hendricks et al (1993)	$R_{it} = k_t + \sum_{J=1}^{J} a_{jt} r_{it-j} + u_{it}; i = 1,....,N_t$ (2.2-a) where R_{it} = a measure of the "residual" performance of fund i in the quarter. R_{it-j} = lags of j (1 to 8) quarter of the dependent variables
Elton, Gruber and Blake (1996)	$R_{it} = a_i + \beta_{iSP} R_{SPt} + \beta_{iSL} R_{SLt} + \beta_{iGV} R_{GVt} \beta_{iB} R_{Bt} + \varepsilon_{it}$ (2.2-b) where: R_{it} = the excess return on fund i in month t (the return on the fund minus the 30 day Treasury-bill rate) R_{SPt} = the excess return on the S&P 500 index in month t R_{SLt} = the difference in return between a small-cap and a large cap stock portfolio based on Prudential Bache indexes in month t. R_{GVt} = the difference in return between a growth and a value stock portfolio based on Prudential Bache indexes in month t. R_{Bt} = the excess return on a bond index in month t measured by combination of the Lehman Brothers Aggregate Bond Index and the Blumer/Keim High-Yield Bond Index. β_{ik}= the sensitivity of excesss return on fund I to excess return on index k (k = SP, SL, GV, B) ε_{it} = the random error in month t
Carhart (1997) and Jain and Wu (2000)	$R_{it}-R_{ft} = \alpha_{4i} + \beta_{1i} (R_{mt}-R_{ft}) + \beta_{2I}\, SMB_t + \beta_{3I}\, HML_t + \beta_{4I}\, momentum_{\ t} + error_{\ it}$ (2.2-c) where R_{it} = the return on fund i in month t R_{ft} = the risk-free rate in month t R_{mt} = the return on a market portfolio in month t SMB_t= the return on portfolios of small minus large firms in month t HML_t = the return on portfolios of high minus low book-to-market stocks in month t *momentum* $_t$= the rate of return on portfolios of high minus low momentum (prior one year return) in month t Note: a momentum factor is constructed as follows: Beginning in the sample period, all securities are ranked on the basis of their cumulative return over the past 11 months and grouped into the top and bottom third of companies. Over the next month, a portfolio is formed which is the difference between the mean return of the top 1/3 and the mean return of the bottom 1/3. This is repeated each month to generate a time-series of return observations.
Fama and French (1993)	$R_{it}-R_{ft} = \alpha_i + \beta_{1i} (R_{mt}-R_{ft}) + \beta_{2I}\, SMB_t + \beta_{3I}\, HML_t + error_{\ it}$ (2.2-d) where R_{it} = the return on asset i in month t R_{ft} = the risk-free rate in month t R_{mt} = the return on a market portfolio in month t SMB_t= the return on the mimiking portfolio for the size factor in month t HML_t = the return on the mimiking portfolio for the book-to-market stocks in month t

2.4 Agency problems in the fund management industry.

The basic objective of the current thesis is to examine UK unit trust management companies and their products from an agency theory perspective. As the initial work for the objective, the prior literature review dealt with two bodies of "parent" disciplines. The first discipline is concerned with agency theory applied to modern corporations. The second discipline is about studies of fund performance, which provide key foundations for mutual fund analysis. Combining the two "parent" disciplines together, the next review section concentrates on agency literature applied to the UK unit trust industry and by extension, the fund management industry.

There are three strands of agency-based literature that are related to the fund management industry: the first relevant literature is on incentive fee arrangements, using the normative models; next and even more relevant is the recent empirical literature on implicit / explicit incentive effects on a fund manager' s behaviour; and finally most relevant of all is the latest literature on the relationship between ownership and fund performance in the mutual fund industry.

However, before moving on to the review of the literature that serves as the immediate discipline, there is a quick inquiry to ponder: It is whether or not the setting of the fund management industry meets certain circumstances from which agency problems arise. This "reality-check" is important because papers in this section are commonly built on the view that the conflict of interests between fund investors and mutual fund managers/companies can be interpreted as an agency problem. Hence, a good starting point for this section is to describe the relationship between fund investors and their fund managers within the scope of agency theory. In addition to the description, recent business episodes are presented so as to enhance the notion that agency problems exist in the industry.

2.4.1 Three conditions

Viewed from the perspective of agency theory addressed in the preceding literature review section 2.1, three essential elements are found in the fund management industry. These viewpoints are often addressed in literature on fund managers' behaviour.

The principal and its agent

First of all, it is evident that the investor as the principal hires the investment manager as the principal's agent who is expected to maximise welfare of the principal by managing the principal's wealth (Golec, 1992).

Unobservable skills or costly to monitor their effort

Next, arguably, the agent is a professional who has superior investment skill or information. Yet, their skills and luck are hard to distinguish due to the random nature of capital markets (Starks, 1987).

For example, according to Kritzman(1986), it requires quite long historical records to evaluate fund managers' investment skills by using statistical confidence measures[13].

Further, "*it is prohibitively costly for the investor* (Golec, 1992, p.82)" to monitor the agent's ex-ante activities. Moreover, in an attempt to reduce agency problems, the threat of ex-post settling is costly too, because it may require some kind of legal action (Starks, 1987; Cohen and Starks, 1988). In reality, the number of lawsuits against fund management firms both in the Unites States and the U.K has increased[14]. The following cases support this point of view. In the U.S, one financial professional went to court, claiming that the legendary fund manager, Mark Mobius, failed to invest his Vietnam Opportunities fund's assets in Vietnamese/ Vietnam oriented companies by October 1997[15]. In the U.K, there was a negligence lawsuit of 130 million pounds between one of the leading British fund management companies, Merrill Lynch Investment Managers, trading as Mercury Asset Management, and the Unilever Pension Fund. The heart of the allegation against Merrill Lynch Investment Managers is that Merrill Lynch took inappropriate risks with the Unilever pension holders' savings[16].

Self-interested agent

The final and foremost element to note is that investors appoint investment managers to optimise the investors' assets subject to a predetermined investment

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[13] If active return is 1% whilst its risk is 2%, 15 years of evidence are needed in order to have 95% confidence that the active return was causally achieved.

[14] For instance, lawsuits against mutual funds jump 25% in the U.S, *Financial Times weekly review of the investment industry*, 2 June, 2003

[15] "Franklin Resources to settle holder suit." Wall Street Journal, 21 November.2001, page,C19

policy. On the other hand, the investment managers are self-interested agents who aim to maximise their own profits. Although the income structure in the industry will be taken up a little more fully in subsequent chapters, the point to remember concerning income structure is that management fees are based on assets under management, accounting for a major income source to fund management firms.

Further, their profits are also generated from the front-end fees when the fund managers receive new money inflow. An article, "A mutual fund morality tale" from *The Economist* [17] illustrated this point of view. During 1994, a number of money market funds were using risky derivatives, attempting to boost their returns. The article pointed out that in an attempt to attract new money from investors, the money markets funds took unnecessary higher risk at the expense of their existing unit holders' interests.

The following recent study provides another example to show how fund managers pursue their profit. Khorana and Servaes (1999) examined when mutual fund companies in the U.S launched their new funds. By analysing a sample of more than one thousand fund openings over the 1979-1992 period, the authors found that when the potential size of the underlying investment (such as the latest high tech funds) was large, more funds were launched. Likewise, when large fund companies established a new fund with a particular investment objective, other fund companies were likely to follow suite. The following

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[16] "Unilever pension holders take on Mercury in court," *The Guardian*, 15 October 2001, page22
[17] "A mutual fund morality tale" *The Economist*, 21 October 1995, page 76

comment from the industry expert reflected the principal findings of the Khorana and Servaes study. Namely, "the industry will keep introducing whatever has been working well lately.[18]"

Arguably, such a practice in the industry is not without problems, accelerating booms and busts in the stock market. Take recent sharp declines of high tech shares for example. In May 2000, UK technology funds fell by an average of about 40% since early March 2000, wiping out more than one billion pounds off small investors' savings. In particular, funds launched in March so as not to miss the "dot-com" euphoria were victims due to the current sharp declines of high tech stocks. Prices of funds like *Gartmore UK Tectornado* and *Framlington Netnet* have halved since they received large cash inflows from investors.[19]

These two recent incidents illustrate how the fund managers' risk decisions hurt their fund holders' interests, whereas the fund managers purse their own interests. Evidently, under the conditions described above, financial researchers have justified their notion that a fundamental conflict of interest exits between fund investors and fund managers so that the agency theory can be applicable to the fund management industry.

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[18] Money Magazine, July 1996, p.96
[19] Hunter, Teresa (2000) "Have you dotcom investments gone down to the drain ?" The Sunday Telegraph, London 28 May 2000

2.4.2. The normative models

Sketching out the principal-agent setting in the fund management industry, the section overviews a few normative models. The common rational behind the normative approach is that designing incentive arrangements is one of the key mechanisms to mitigate agency problems, as the previous literature on agency theory suggests. As a result, traditionally, a great deal of the normative agency literature has gone into the subject of explicit incentive contracts between the principal and the agent (Beatty and Zajac, 1994). Early normative literature on the relationship between investor and fund manager relationship are no exception[20]. Hence, the common feature among the conceptual models was to explore the connection between the risk decisions of fund mangers and various fee settings.

Two broad approaches can be found among early normative models from the standpoint of model specifications: To deal with the agency problem, the first group employed the expected utility approach (Starks, 1987; Cohen and Starks, 1988; and Golec,1992) The second group used an option pricing framework to tackle the problem (Glinblatt and Titman,1989; Ferguson and Leistikow,1997; and Elton, Gruber, and Blake;2003). To follow the classification, several theoretical models are described briefly in the following sub-section.

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[20] For the latest arguments for normative models, see Sciubba Emanuela, "Relative performance and herding in financial markets" in *Performance Measurement in Finance*, ed. John Knight and Stephen Satchell, Butterworth-Heinemann, Oxford (2002), p.290-292

However, note that there seems to be no need to go into the minor details of the models for the main scope of the current thesis, because the ability of abstract models to analyse real world situations of the UK unit trust industry is limited. The limitations of the normative approach are elaborated at the end of this sub-section.

Expected utility model

Starks' first model

Starks (1987) is among those who developed abstract analysis concerning incentive contracts and their effects on the risk taking of fund managers. The intention of her study was to evaluate the following two incentive contracts so that her work helped clarify the policy debate regarding the fee charging practices in the U.S asset management industry during the late 1980's. The two incentive arrangements are: the incentive fee with symmetric performance (SP) where fund managers receive a fixed management fee plus a variable fee depending on the difference between return of the managed fund and that of a market index.

On the other hand, the incentive fee with bonus performance (BP) where a fund manager receives not only a fixed fee but also a bonus fee if the rerun exceeds the corresponding benchmark. Her models were developed under a few assumptions that the model is on a single-period basis; the investor (the principal) and the fund manager (the agent) are supposed to maximise their own expected utility of wealth and both parties are strictly risk averse; CAPM is applied in terms of asset pricing[21].

Investigating fund managers' risk taking behaviour under the two different incentive schemes, Starks developed theorems that the SP scheme equates the manager's optimal risk level and the investor's optimal risk whereas the BP allows the manager to take higher risk than the investor requires. Thus, Starks concluded that from the manager's risk taking viewpoint, the SP is preferable to the BP.

Manager's effort

In a subsequent study, Cohen and Starks (1988) carried the Starks' model one step further by taking into account nature of the portfolio beta. They argued that it is impossible to estimate and manipulate the portfolio beta, which was defined as the portfolio risk in the Starks' paper. Instead, by making effort, fund managers can minimise the residual between the estimated beta and the true beta of the portfolio. Considering the manager's effort for the beta estimation, and building on the specific assumptions similar to the Starks work, Cohen and Starks' work suggested a different implication from the Starks work; Regardless of whether a bonus fee is provided or not, agency problems exist in a way that the fund manager provide less effort and /or taking higher risk that the investor prefers.

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[21] The Capital Asset Pricing Model refers to $E(R_i) = R_f + \beta_i [E(R_m) - R_f]$ where $\beta_i = \rho_{im}\sigma_i/\sigma_m$,

Supply of superior information

A further complex model was presented by Golec (1992). Golec put forward the prior conceptual models by assuming that there are two different factors that affect fund returns: The first factor is a fund beta in the manner which the preceding articles assumed (Starks,1987; Cohen and Starks, 1989). The second factor is associated with superior information with which the fund manager is provided. In this regard, it is possible to say that the notion of the superior information is similar to Jensen's alpha in terms of performance measures.

One of the important suggestions from Golec's approach is that the incentive fee portion is positively related to a fund beta, and supply of superior information whereas the base fee is negatively associated with the beta. Hence, Golec's work implied that one could reduce the agency problem by providing fund managers with a carefully-designed fee scheme that balances well between the base fee and the incentive fee.

Option pricing approach

By the same token, Grinblatt and Titman (1989) and Ferguson and Leistikow (1997) also investigated the agency problems in the investor-fund manager relationship. Nonetheless, the investigations by Grinblatt and Titman (1989) and Ferguson and Leistikow (1997) differed from the prior literature to the extent that these four scholars applied option pricing methodology.

Single period approach

Using a performance based contract similar to the bonus incentive scheme used in Starks' paper (1987), Grinblatt and Titman (1989) considered the bonus fee portion as a call option that gives the fund manager rewards if his/her return exceeds the corresponding benchmark, i.e. the stock market index such as the S&P 500. Whilst applying Black-Scholes option pricing in order to evaluate the manager's fee, the authors presented the following interesting propositions. First, the value of the performance-based fee is increasing if there is no maximum limitation for the fee along with the increasing beta of the managed fund. Second, establishing the cap point and the threshold point seems to deter the excess risk taking of the manager. Note that this type of fee structure is referred to as the Bull-Spread Performance Fee in the following article by Ferguson and Leistikow (1997).

Multi-period fee schemes

More recently, Ferguson and Leistikow (1997) contributed to the research field by extending Grinblatt and Titman's one period call option contract to the multiple-period option contract. It is of use to describe implications from Ferguson and Leistikow's model because their long run fee schedules appeared more realistic than the preceding study by Grinblatt and Titman.

In their model, performance volatility was referred to as risk of the managed portfolio, and the threshold level for the performance fee became two crucial parameters in considering the incentive effect of fund managers. In practice, focusing on combinations of the two parameters, Ferguson and Leistikow elaborated three different incentive fee schemes: The Call Performance Fee that is paid when the portfolio performance is above the threshold level, e.g. the excess performance. The Bull-Spread Performance Fee is a variant of the Call Performance Fee in the sense that the Bull Spread Performance Fee has the upper limit of the payment when the performance is over a certain target level. The Flat Performance Fee gives the fund manager a fixed percentage of the asset under management of the portfolio, regardless of the portfolio performance.

The authors' main points are summarised as follows: Regarding the Call Performance Fees, there is a positive association between the value of the call performance fees and performance volatility. Therefore, fund managers attempt to increase values of their fees by raising the volatility of their fund performance. Naturally, such a higher volatility is hardly acceptable to investors. In contrast, if certain conditions are met[22], the Bull Spread Performance fees discipline the fund managers to control the performance volatility. In the same way, if the threshold performance is sufficiently restricted, the Flat fees also provide the fund managers with incentives to take reasonable risk, i.e. the volatility of performance.

Concluding comment and some caveats

The mathematical models in this section demonstrated how incentive fees can influence fund managers' investment decisions. Of particular relevance for the present thesis is that most of the conceptual models above predict that there is room for moral hazard, regardless of their theoretical frameworks, e.g. the maximising-utility function or the option pricing theory. That is, fund managers are apt to "game" the incentive fees by the changing the portfolio risk. Nonetheless, some models indicated that it is possible to mitigate such a principal-agent problem if the fee contracts are carefully designed with certain conditions.

However, there are a number of limitations when the theoretical models are put into practice, especially in the context of the current thesis. First and most obviously, individual fund investors are not in the position to negotiate for fund fees in the real world. At most, U.S retail fund investors can select mutual funds with performance incentive fees (See Golec, 1988, and Elton et al, 2003 in the next sub-section). In contrast to the US mutual funds with incentive fees, no unit trust with such incentive fees is not allowed under the current FSA rules[23].

For this reason, conceptual incentive models seem to be more applicable to the situation between fund management companies and institutional investors such as pension funds that have bargaining power over fee setting. This is not surprising on the grounds that the underlying motive of several papers is to provide foundations for policy debate for the U.S pension fund industry and the U.S government (Starks, 1987). Alternatively, one can find the normative approach valuable in analysing the employment relationship between a fund management company (as an employer and principal) and an individual portfolio manager (as an employee and agent).

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[22] For instance, the threshold performance to renew the contract should be sufficiently negative.
[23] See the FSA Handbook, Collective Investment Schemes Sourcebook September 2002. See also "*Unit Trust: the Law and Practice*" release 8, Longman 1998, p.A4.2330. It is also reported that the FSA will lift its ban on authorised unit trusts charging performance fee ("New regime to broaden choice for investors", Financial Times, 24/25 May 2003).

A second and somewhat more serious limitation is that most of the models cannot account for the full spectrum of variables that determine fund managers` incentives, and consequently, their risk-taking behaviour. For example, Brown, Harlow, and Starks (1996) pointed out that fund managers are incentivised by the industry's tournament mechanism. The tournament mechanism refers to the industry practice that rewards the managers for their annual performance rankings in the format of a peer-group league table. Their analysis presented evidence that fund managers below (above) the average peers' return at the half year evaluation period are apt to alter their portfolio risk so as to make up (lock in) their interim inferior (superior) fund return. The study illustrated how fund managers react to the implicit incentive mechanism and pursue their own interest whilst putting aside their clients' risk-tolerance or investment objectives.

The final limitation is related to the definition of risk that the fund manager manipulates. Most of the models assumed that beta and return variance of the portfolio are the ways that fund managers play the game. However, as Khorana's study (1996) demonstrated, there is a case that fund managers manipulate their portfolios by increasing stock-turnovers held in the portfolios. Similar to Brown et al (1996), Khorana stated that as a consequence of the tournament mechanism in the industry, the job security of a fund manager is often at stake. Hence, threat of dismissal serves as an implicit but strong incentive in reality. He presented evidence that fund managers with poor performance records are more likely to trade equities very often, incurring trading fees to their portfolios, than those with superior performance records.

Overall, despite the fact that the normative models provide some guidance as to the effect of incentive fees in the fund management industry, reflection on the limitations makes it clear that the real world is not simple as the models assume. This point directs our attention to the empirical agency literature concerning incentive effects on a fund manager's behaviour.

2.4.3 Empirical studies

Reviewing the immediate disciplines, this sub-section starts with two empirical research initiatives. Golec (1988) and Elton, Gruber and Blake (2003) explicitly analysed the incentive fee effect on performance in the U.S mutual fund industry, where a number of mutual funds with incentive fees existed. Note that their main interest was not in the excess risk-taking but in fund performance. But, in the context of the present thesis, results from both studies are informative, implying the possibility of agency problems in the industry, as predicted by normative models. Therefore, the following brief review of the two studies is noteworthy.

Golec (1988) was an early researcher examining the incentive fee effect on fund performance. His data set covered 387 equity mutual funds including 27 funds with incentive fees for the period 1982 –1987. Employing a CAPM approach in order to measure fund performance, Golec analysed the differences between incentive funds and non-incentive funds. His main findings are that alpha, beta and standard deviation of monthly return of funds with incentive fees are higher[24] than those without incentive fees. Hence, his evidence suggested that mutual funds with incentive fees showed not only better performance but also higher risk than those without incentive fees.

In a similar study, Elton, Gruber and Blake (2003) examined mutual funds with incentive fees for the period 1990-1999. They employed the average of their multi index model alpha[25] as fund performance. Their observation generally supported Golec's findings. On average, the fee-adjusted performance of funds with incentive fees was higher than that without incentive fees. However, the magnitude of the excess performance was close to zero. As a result, fund managers using incentive fees receive only marginal bonuses in reality.

More importantly results are that funds with incentive fees showed higher risk propensity. There are two risk measures that the authors used. The first risk measure is a deviation from the fund's benchmark, i.e. R^2 derived from the regression of a fund return against the fund's benchmark return. Under the risk measurement, the higher R^2 a fund shows, the less risky the fund is, because the fund tracks their benchmark more closely. In this light, the authors' finding is that R^2 (= 0.79) for incentive funds is lower than that of the total fund sample documented in previous studies with the similar multiple factor index[26].

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[24] The differences are 1.62, 0.11 and 0.64 respectively.

[25] The multi-index model uses (1) the excess return on the S&P 500, (2) a bond index, (3) a small-cap minus large-cap index, and (4) a growth minus value index (Elton, Gruber and Blake,1999,p.57)

[26] For instance, Brown, and Goetzmann (1995) showed that R^2's are 0.90, and 0.92 for a single index model and a three index model, respectively.

The second risk refers to standard deviation of monthly fund return. Often referred to as total risk in fund management literature, this is a conventional risk measure so that only the authors' finding is mentioned. That is, the standard deviation of monthly return for incentive funds is 4.63, which is higher than that of their comparable index, i.e. 4.22.

In sum, given the findings of the two empirical studies, incentive fees seem to attract skilful fund managers or encourage fund managers to make more effort, resulting in better fund performance. Nevertheless, such better performance does not occur without costs. Consistent with the CAPM's notion of the risk-return payoff, funds with better performance carry a high level of risk-taking. Hence, it should be the case that high risk investments, which may or may not lead to a superior fund return, are not always optimal for certain investors. In this regard, the possibility of agency problems is present.

2.5 Other determinants of agency problems in the industry.

The preceding empirical research stated that agency problems are partly attributable to the industry's tournament practice. More recently, several scholars have extended the tournament effect to the individual stock selection level (Lakonishok, Shliefer and Vishny, 1992; Grinblatt, Titman, and Wermers, 1995; Falkenstein, 1996; and Wermers, 1999). Their common argument is that the tournament mechanism or the relative performance evaluation practice leads fund managers to flock together in trading securities for their portfolios

(Wermers, 1999). The rationale behind such herding behaviour is that fund managers want to retain their position in the peer comparison league table (Devenow and Welch, 1996) or to share the blame when their investments turned out to be disastrous (Khorana, 1996).

Notwithstanding the principal-agent relationship grounded in these herding studies, to inquire further into these studies is not the point in question. The main reason for no further inquiry is that studies on herding behaviour of fund managers often shift their emphasis away from the incentive effect on fund managers. Instead, herding studies focus on the investment preferences of fund managers. Such a point of view would bring us back the issue of investment style, e.g. one of the branches in fund performance literature.

Apart from the tournament mechanism, there are two significant factors that lead to agency problems in the fund industry. Those include the year-end evaluation practice, leading to window dressing (Lakonishok, Shleifer, Thaler, and Vishny, 1991) and asset-based fees, that are the norm in the fund management industry (Chevalier and Ellison, 1997; Sirri and Tufano, 1998).

The former element refers to selling poor performing shares toward the end of the year when the fund manager discloses his/her portfolio holdings. It is said that in an attempt to maintain his/her client account or ultimately his/her own job, the manager has to get rid of "embarrassments" from the portfolio, impressing the clients with superior stock holdings. However, the empirical results were inconclusive. Analysing quarterly trading patterns of 769 pension funds during the period 1985-1989, Lakonishok et al (1991) reported that the sales of large loss-making shares become evident. But they found no clear tendency with regard to purchasing stocks toward the end of the year.

The latter incentive element is more important, contributing to the research topic of this thesis on the following grounds. First of all, the asset-based fee is the norm within the fund management industry. By and large, the fee is based on the amount of assets under management. Under the fee scheme, fund management companies deduct the fee from their managed portfolio at a small percentage rate. Often defined as the annual management fee, the fee become a major earning source for fund management companies (Pozen, 1998 and Walter 1999). Hence, the analysis together with the current fee scheme, provides us with a more accurate picture of the fund management industry.

Next, under present industry practice, the asset-based fee can be said to be an effective incentive. The explanations are twofold. At the outset, higher returns on the managed fund and subsequent asset growth under management generate higher fee revenues to the fund managers.

In addition to the asset growth by investment, another route to increase the asset-based fee is available for fund management companies. That is by attracting new money from investors. If a fund and its management company are successful in raising more money, the amount received by the fund management company will increase. Likewise, if investors of the fund redeem their holdings for a variety of reasons, then the size of the fund shrinks, generating less fee revenues.

In this respect, there is a conventional view among practitioners that funds with good performance records attract more money from investors than those with poor performance records. Therefore, given the two paths to increase the asset-based fee, it is possible to say the current scheme already works as an incentive fee.

Finally, the incentive effect stemming from the present asset-based fee should provide empirical foundations for the first and second analysis in the present thesis. The subsequent empirical chapters develop performance / risk-taking measures, by focusing on the impact of existing asset based fees. Hence, the subject deserves more than a passing glance.

2.5.1 Managers' response to the performance-money flow relationship

As the next chapter describes in detail, the assets under management is a key revenue factor for fund management companies. Building on this point, many scholars have enquired into whether or not funds with good performance are accountable for increases in the assets under management by attracting new money from investors. In other words, a number of papers have investigated the performance-money flow linkage as a potential determinant of a fund manager's revenue.

However, only a few researchers have evaluated the implications of the performance-money flow linkage from an agency perspective. One of the often-referred-to studies is Chevalier and Ellison` work (1997), addressing the agency problem between the fund manager and their investors. Chevalier and Ellison demonstrated the way fund managers manipulated their portfolio risk at the expense of their investors' interests, as a response to the performance-money flow pattern. Certainly, if there is no connection between performance and money flow of a fund, it is worthless to explain the fund manager's behaviour as a reaction to the performance-money flow connection. For this reason, the following section devotes some space to the issue of the relationship between performance and money flow. Then, findings from Chevalier and Ellison' study are presented.

2.5.2. The relationship between performance and money flow

A starting point

As one of the early researchers, Ippolito (1992) stimulated a great deal of research on the relationship between performance and subsequent money flow a fund. He defined the excess return from the CAPM formula as the fund performance and used 143 mutual funds over the period 1965-1984. Ippolito regressed the growth rate of a fund in time (t) on the fund performance in time (t-1), (t-2) and (t-3). His model showed that the coefficients of the fund performance were positive and statistically significant; 0.003, 0.023, and 0.002 for the performance coefficient of (t-1), (t-2,) and (t-3) respectively. The results above illustrated the positive relationship between performance and money flow of a fund.

In a similar manner to Ippolito's single determinant model, some scholars expanded the performance-flow study by adding a few extra explanatory variables: Patel, Zeckhauser, and Hendricks (1994) included prior money flow and fund size in their model; Sirri and Tufano (1998) used fund size, and fund fee; Chevalier and Ellison (1997) considered the fund age as a potential effect on the relationship.

Size effect

Patel, Zeckhauser, and Hendricks (1994) justified the use of prior money flow as a determinant of the subsequent money flow, by stating *that "investors tend to stick with strategies because of a fondness for the status quo"* (Patel et al 1994; page 55). Further, the authors took a view that elements such as advertising level and marketing effort should be linked with fund size. Hence, the fund size could have a potential impact on the performance-flow relationship. This view is consistent with Sirri and Tufano's work (1998) that focused on media influence on investors' choice of mutual fund .

Whilst prior money flow, and size of fund were added to the explanatory variables, the main explanatory variable, fund performance was computed on the basis of the fund return ranking in Patel, Zeckhauser, and Hendricks' model. The result of their regression model revealed that all of the three explanatory variables had positive and statistically significant effects on subsequent money flows of the fund. The coefficients of past performance, prior money flow and fund size were 0.75, 0.20,and 0.05 accordingly. Certainly their finding serves as another piece of supporting evidence for the positive relationship between performance and money flow of a fund.

Non-linear relationship

More recent studies advanced the study on the performance-money flow relationship not only by adding extra explanatory variables, but also by finding a non-linear relationship between performance and money flow of a fund. Gruber (1996) employed an alpha of his four-index model as a basis for forming 10 deciles' portfolios, e.g. from the worst fund group portfolio to the best fund group portfolio. Then, he examined the correlation between the ranked portfolios and their subsequent money movements in the following year.

His findings were that significant rank correlations were reported across the one and three year periods. Further, all the differences between these deciles' portfolios were significant at the 1 percent level. More importantly the magnitude of change of money flow differed between the worst decile's portfolio and the best decile's portfolio. In the subsequent year, on average, the portfolio consisting of worst performing funds lost 15 percent of the asset as the investors' redemption. On the other hand, that of best performing funds increased assets by 29% because of new money inflow.

Fund age

In a related study, Chevalier and Ellison (1997) employed a sophisticated semi-parametric model so as to measure the performance-flow relationship. In their model, the dependent variable refers to money flow of fund i in time t+1 whereas the independent variables include the fund i's performance in the prior time periods, the industry growth, the fund age, and the fund asset size. The reason for including the fund age variable is that the degree of attracting money may differ by age of fund.

Their overall finding was in accordance with prior studies on the performance-flow relationship: As an excess return of a fund increases (decreases) money flow into the fund is likely to increase (decrease) in the following period. More noticeably, by drawing a non-linear relationship, their graphs showed that funds with significantly poor returns, e.g. 15 or more points below the benchmark, experienced substantial large redemption. In contrast to the funds with the worst return, funds with modestly poor returns, e.g. 8 to 15 pints below the benchmark, had marginal redemption. In the case of the top ranked funds, they received a considerably large money flow. This asymmetric pattern between performance and money flow agrees with that of Gruber's work.

Furthermore, it is interesting to note that there was a difference between new and old funds in terms of sensitivity to prior period performance. New funds had higher coefficients of prior performance, e.g. 1.86 for one-year lag performance, 0.73 for two-year lag performance, than those of old funds, 1.00 and 0.29 respectively.

Media coverage

Finally, Sirri and Tufano (1998) provided a comprehensive study on determinants of new investment into mutual funds in the United States. The researchers referred to past performance, risk and fees as determinants of new money flow into mutual funds. In particular, Sirri and Tufano's contribution to this research area was that: fund size, marketing expenses and media coverage were expected to influence on the performance-flow relationship.

With regard to the performance-money flow connection, Sirri and Tufano's finding was largely consistent with those of previous papers (Gruber 1996; Chevalier and Ellison 1997), showing such a non-linear pattern between returns of funds and subsequent new money flow into funds. When the performance variables were sorted into three groups on the basis of relative return ranking; low, middle and high rank groups, the coefficients of the subsequent money flow differed across the three groups. The coefficient of the low performance group was –0.035 with an insignificant p-value, suggesting no clear relationship between the past ranking and subsequent money flow. On the other hand, the coefficients of the middle and top ranking groups are 0.17, and 1.633 respectively and both had significant p-values at 1% level. Sirri and Tufano interpreted these results as showing the asymmetric relationship between performance and flow.

There are additional findings derived from Sirri and Tufano's model where money flow of a fund was regressed on various factors including the fund's size, fees, risk, marketing expenses and media coverage work. For example, the coefficients of fees and risk variables were negative, suggesting that investors prefer lower fees and lower risk. The next interesting finding was that an individual fund's flow was significantly related to flows into the sector to which the fund belongs. The sector refers to the investment objective group such as the international equity growth sector. This observation is in line with Khorana and Servaes (1999) who studied determinants of mutual fund starts. More importantly, this point of view becomes an empirical foundation when creating risk measures for unit trust management companies in the present thesis. Finally, Sirri and Tufano reported mixed evidence of the size and media coverage effects on the performance-flow relationship[27].

2.5.3. Summary and other issues

In essence, a number of empirical studies in this section documented some degree of support for the conventional view that funds with good performance attract new money. Some scholars extended the line of research by adding several determinant factors of the performance-flow relationship. These determinants include the fund size, age, risk and the sector into which the fund is categorised.

The most noteworthy finding is that an asymmetric flow pattern exists in the mutual fund industry, i.e. fund investors put their money into winning funds more rapidly than they take their money out from their losing funds. In fact, the latest industry data from *The Financial Times*[28] reports a similar money flow pattern: In the U.S, some 97 per cent of net new money has been channelled into funds ranked in the top third by *Morningstar*, according to Cerulli Associates, the

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[27] More recently, Jain and Wu (2000) examined the advertising effect of mutual funds on new money flows into the funds, reporting that money flows to the advertised fund group were larger than those to the non-advertised i fund group.

US consultancy. In the UK, 65 per cent of net new money has been channelled into funds rated in the top third – up from 60 per cent last year. In Germany, the figure is 60 per cent – up from 50 per cent last year.

Two interesting issues may be raised about the asymmetric pattern. The first issue is why investors invest a disproportionately large amount of their money into over-performing funds whereas relatively slowly cashing in their investment from under-performing funds. The second issue is the effect of the asymmetric flow pattern on risk-taking of fund managers. Possible explanations are (1) behavioural finance (Tversky and Kahneman, 1991), (2) investors' naïve knowledge (Capon et al 1996), and (3) advertising practices (Blake and Timmermann, 2003)

(1) Behavioural finance

A branch of behavioural finance has posited several explanations for the first issue. Prospect theory (Tversky and Kahneman, 1991) predicts people fear losses more than they value gains. As a consequence, investors are apt to hold their loss-making shares too long. In related research, Odean (1998) explained the investors' disposition or behaviour by a rational or irrational belief in mean reversion that today's losers will soon outperform today's winners.

(2) Investors' naïve knowledge

Similarly, according to a random telephone survey, the tendency to hold loss-making shares too long can be attributable to investor's indifferent attitude

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[28] FT Fund Management 12 August 2000, p1

toward their fund investment (Capon et al 1996). Capon et al revealed that 72 per cent of mutual fund investors do not know whether their funds are investing in domestic or international shares. Equally, 75 percent of the investors do not know whether their funds are investing in stocks or bonds.

(3) Advertising practices

A recent report by Blake and Timmermann (2003) pointed out that there is an asymmetric pattern in current advertising practice with regard to unit trust performance. Unit trusts with superior performance records are heavily advertised, whilst poorly performing trusts are not actively publicised. This asymmetric advertising practice does not increase awareness that investors` unit trusts are poorly performing, preventing the investors from the withdrawing their money from the poorly performing trusts. These arguments are interesting, but to discuss this issue will carry us too far way from the purpose of this thesis.

Inducing agency problems

Critical to the objective of the present thesis, the second topic provides some insights in addressing agency problems in the mutual fund industry. As the following chapter of industry description outlines, a fund management fee is a fixed percentage of the fund asset under management. Hence, in ignoring the asset growth by new money flow, the current management fee can be viewed as a symmetric or linear fee scheme. In this regard, it is interesting to recall Starks' (1987) conceptual model, illustrating the way a symmetric performance fee equates a fund manager`s optimal risk level to that of his/her investors.

However, when taking into account the asymmetric pattern of money flow, the reward for the fund manager roughly resemble a call option on the expected money flow. A simple description of this point is that the fund manager receives his/her bonus fee automatically when her fund performance is either mediocre or superior but does not pay any penalties when her fund under-perform against the benchmark. Arguably, the preceding normative models suggest that agency problems in the fund management industry are attributable to such a quasi–call option scheme (See for example Grinblatt and Titman, 1989 in section 2.4.2).

Building on the non-linear relationship between performance and money flow, Chevalier and Ellison (1997) conjectured that such an asymmetric pattern leads fund managers to take excess or little risk. Their argument is as follows: Imagine a fund that is ranked above the peer average but just below the top group. Given the asymmetric relationship, a slight improvement in performance raises the fund rank, resulting in a large amount of money. If the fund's investment does not work, ending up at the mediocre rank, the fund will not suffer from a substantial redemption. Thus, the fund manager will tend to "gamble" with her fund by taking excess risk. By the same token, the bottom ranked fund manager is also inclined to take excess risk so as to avoid a substantial money outflow. Further assume a fund that is ranked as the best fund. In order to keep the top position, the fund manager is likely to invest conservatively until the end of the evaluation period. Such fund managers behaviour does not match up with the fund investors' best interests.

To test whether fund managers alter their portfolio holdings as a response to the money flow pattern, Chevalier and Ellison regressed fund risk on the expected flow incentive. The result of the regression supports their notion on the ground that the coefficient of the expected money flow is positive (=0.87) and significant at the 1% level.

2.6 The organisational factor on fund managers' behaviour.

The prior studies are concerned with the implicit incentive effect of the performance-money flow relationship on fund managers' behaviour. Recent papers by Frey (2001) and Berkowitz and Qiu (2003) illustrate the value in examining the organisational effect on fund managers' behaviour. Frey (2001) compares bank-managed mutual funds with non-bank-managed ones. Berkowitz and Qiu (2003) investigate differences between Canadian mutual funds run by private companies and those run by quoted companies. As the two studies attempt to relate fund managers' behaviour to an organisational factor, their approaches are closest to that of the current thesis.

2.6.1 Mutual funds provided by banks

Frey (2001) and Berkowitz and Qiu (2003) have different emphases on why organisation elements matter in terms of the individual funds that they offer. Frey proposed a few explanations for the potential difference between bank-managed funds and non-bank-managed funds. Her first explanation is that banks may attract investors who are different from those attracted to non-bank mutual funds because it is convenient for many retail investors who have already had accounts with a bank to invest money in the bank funds. In a similar way, it is said that novice investors are attracted to bank mutual funds because they believe banks are trustworthy. From the bank's viewpoint, banks are afraid of losing their fund investors as banking customers on the grounds that many investors in the banks' proprietary funds also buy other financial services from the banks.

2.6.2 Effect of ownership structure on fund performance

A latest paper by Berkowitz and Qiu (2003) has taken the agency rhetoric approach. Building on the agency perspective, their ultimate enquiry is how diffusion of ownership affects the performance of funds the company manages. The sample companies consist of the six largest publicly traded management companies and the six largest privately owned management companies whose asset sizes match their quoted company counterparts in Canada. As a result of the selection criteria, the sample includes 446 Canadian equity mutual funds run by the 12 management companies. The total assets of these funds account for more than 60% of the Canadian mutual fund industry.

As their agency perspective is the central concern in the current thesis, it is worth summarising their work as follows.

For the purpose of evaluating the performance across funds with different ownership companies, both a single index model and a three index model are used (Equations 2.3-a and 2.3-b respectively in Table 2.3)

Table 2.3 Models in the recent literature (using the authors' notations)

Berkowitz and Qiu (2003)	The single index model is: $R_{it} - R_f = \alpha + \beta_i (R_{mt} - R_f) + \varepsilon_{it}$ (2.3-a) The three index model is: $R_{it} - R_f = \alpha_i + \beta_{im} (R_{mt} - R_f) + \beta_{is} SMB_t + \beta_{ih} HML_t + \varepsilon_{it}$ (2.3-b) where $R_{it} - R_f$ is the excess return on the fund $(R_{mt} - R_f)$ is the market risk premium SMB_t = return on the small minus large stocks in terms of stock size. HML_t = return on the small minus large stocks in terms of book-to market ratio. The regression for return comparison $R_t^{QUO} - R_t^{PRI} = a_j + \beta_m (R_{m,t} - R_{f,t}) + \beta_s SMB_t + \beta_h HML_t + \varepsilon_t$ (2.3-c) where $R_t^{QUO} - R_t^{PRI}$ = the difference in returns of the equity funds run by the quoted company group and those by the privately owned company group

Further, in an effort to identify any performance difference between funds managed by quoted companies and those by privately owed companies, the authors created equally weighted portfolios of the Canadian mutual funds for each type of management company.

Their main findings were: excess returns of funds run by quoted companies are lower than those managed by privately owned companies[29]. As for the SMB and HML variables, there are similar investment styles between the quoted company group and the privately owned group.

Ensuring the difference in returns of the equity funds run by the quoted company group and those by the privately owned company group, the authors conduct the regression analysis described in Equation 2.3-c in Table 2.3

Berkowitz and Qiu reported that the regression coefficient for the size factor (SMB) was positive and statistically significant at the 5% level whereas other factor loadings were not significant. In essence, compared with funds run by privately owned companies, equity funds managed by listed companies had lower risk-adjusted returns and tend to invest in risky assets in terms of stock size.

Berkowitz and Qiu concluded that compared with mutual funds run by privately owned companies, mutual funds managed by their quoted rivals tend to invest in riskier securities, generating lower risk-adjusted returns. Such higher risk-taking tendency of the funds run by the quoted companies can be explained by the following risk-reduction argument. Berkowitz and Qiu argued that the major shareholders in a typical private company tend to have undiversified personal wealth, because their shareholdings account for a significant proportion of their

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[29] Alphas from CAPM model were –0.0028 (t = -3.40) for the quoted company group, and –0.0012 (t = -1.19) for the private company group. Alphas from the three factor model were –0.0032 (t = -4.17) for the quoted company group, and –0.0015 (t= -2.02) for the private company group.

personal wealth. Such undiversified wealth portfolios of the large shareholders may result in a lower risk-taking strategy for their company. On the other hand. it is argued that shareholders in a listed company such as individual and institutional investors can pursue optimal diversification of their own wealth portfolios by encouraging greater risk-taking of their invested companies. The underlying assumption of the view is that as the shareholders` wealth portfolios are well-diversified by investing in a number of companies, they are willing to promote risk-taking activities via each of their invested companies. Such risk-taking activities across their invested companies result in the diversification effect that maximises their total investment wealth whilst reducing the total risk of their wealth portfolio.

2.7 The effect of the company strategy on fund performance.

2.7.1 Two recent studies closely related to this thesis

Until very recently, little research has been conducted addressing the effect of the corporate strategy not only on the company performance but also on their managed fund performance. Massa (2003) and Sigglekow (2003) are recent examples. Massa emphasises the corporate strategy as a response of the competitive market structure. Sigglekow focuses on the relationship between the degree of the diversification and the performance of the company from the industrial economics perspective. As for the theoretical motivation, there are some disparities between the recent works and this thesis that concerns the agency problem in the fund management industry.

Nonetheless, the review of the two recent papers provides a valuable addition to the literature review in three respects. Firstly, Massa and Siggelkow elaborate the performance of the fund management companies, drawing a line between the performances of the company and of their fund products. Despite the fact that the two latest papers do not explicitly address the potential agency problem in the fund management industry, the notion to establish the company performance corresponds that of this thesis.

Secondly, in practice, taking a similar view that the cash inflows into the company is a key profit driver, the two authors consider the cash inflow as the performance proxy for the company. In this light, the efficiency measure used in this thesis is supported by the latest literature.

Finally, other valuable specifications in Massa and Siggelkow papers can also serve as useful references for this thesis. For example, a useful variable that the two researchers employ is the company's product comprised of a set of funds with various categories. The logic is that funds are distinguishable according to the type of underlying equities in the funds. Such common characteristics among the underlying investments are often referred to as the fund categories or sectors. Massa and Siggelkow consider the product set as the company's strategy, arguing that *each company's choice consists of the decision to set up a fund with specific characteristic* (Massa, p.252). In this point, this thesis shares the view with the two recent papers, regarding the product mix as the reflection managerial decisions.

2.7.2 The differentiation strategy

Massa's intuition is that the degree of differentiation in the industry affects the company's incentive to generate better fund performance. The reason for his argument is that fund investors differ in terms of their investment needs. For example, their needs vary with regard to their investment time horizon and their plans to switch one type of fund to another. This is where the fund heterogeneity, i.e. fees and investment objectives, or the company's heterogeneity, i.e. the numbers of funds and the numbers of fund categories can capture the investors' unique needs. Accordingly, the investors select the fund that best suits their needs. Such a line of reasoning invokes his proposition that maximization of fund performance is not necessarily to the optimal strategy.

Collecting the U.S mutual fund data in the period between 1992 and 2000, Massa investigates whether the company's category coverage and their funds' fees affect the volatility of the money flow into the funds. The money flow is referred to as the proxy of the company's performance. To test this inquiry, he estimates the following the models in Table 2.4

The key results are that the coefficients of the average initial fee are negative (= -3.20 for 2.4-a and –2.03 for 2.4-b) and significant (t = -15.52, and t = -9.18 respectively), suggesting that funds belonging to the companies with high initial fees are likely to have more stable investors. Another important observation in Model 2.4-a is that the coefficient of the number of funds is positive (0.02) and significant ($t = 4.63$). Likewise, in Model 2.4-b, the coefficient of the company's market coverage is positive (0.29) and significant ($t = 2.05$). These results suggest that investors with more volatile investment prospect prefer the fund management companies offering a large number of funds with various investment objectives.

These findings also imply the effective fees for an investor will rebalance his or her fund portfolio. That is, the more funds the company offers, the greater likelihood of switching from one fund to other funds at no cost because moving money in and out funds within the same fund management company costs little or no switching fees (Massa, 2003, p.251). In essence, after controlling for the fund performance, the company strategy affects the key determinant of the company profitability, i.e. the cash flow into the funds.

Table 2.4 Massa's (2003) models

Massa (2003)	Model for the impact of the total number of funds the company provides, $Flow_{,m,i,t} = \alpha + \beta(Fee_{i,t}) + \gamma(Fund_{i,t}) + \delta(Controls_{,m,i,t}) + e_{m,i,t}$ (2.4-a) Model for the impact of the number of fund categories the company offers. $Flow_{,m,i,t} = \alpha + \beta(Fee_{i,t}) + \gamma(Category_{i,t}) + \delta(Controls_{,m,i,t}) + e_{m,i,t}$ (2.4-b) where he subscripts, m, i and t, refer, respectively to the *m* th fund, belonging to the *i*th company at time t. $Flow_{,m,i,t}$ = the standard deviation of the flows in the fund over the 12 months in the respective year. $Fee_{i,t}$ =the total load fees charged by the *i*th company at time t $Fund_{i,t}$ = the number of funds that the company I manages $Category_{i,t}$= the number of fund categories that the company I offers $Controls_{,m,i,t}$ = a vector of control variables such as net assets of the company i, the average performance, risk and expense ratio of all the funds run by the company I $e_{m,i,t}$ = Error term Model for the impact of product differentiation $Return_{i,t} = \alpha + \beta(Dispersion_{i,t}) + \gamma(Control_{i,t}) + \delta(Return\ Lag_{,i,t-1}) + e_{i,t}$ (2.4-c) Where the subscripts, i and t, refer, respectively to the I th company at time t. Returni,t = the average performance of all the funds the company i manages at time t Dispersioni,t = the index that proxies for the average degree of product dispersion of all the categories the company has funds in at time t. Controls,i,t = a vector of control variables such as net assets of the company i, the average performance, risk and expense ratio of all the funds run by the company I Return Lag,i,t-1 = the (lag) average performance of all the funds the company i manages at time t-1 em,i,t = Error term

Sifting from the corporate performance to the fund performance, Massa's second focus is on the relationship between the funds' returns and the company's differentiation strategy. Massa tests for the relationship by regressing the average performance of the company's all funds on the index of the company's differentiation strategy, plus several control variables. The differentiation strategy is based on all the categories where the company has funds and defined in three ways: (i) the non-performance factor, i.e. the fees across the categories to which the company's funds belong, (ii) the performance factor, i.e. the returns of across the categories to which the company's funds belong, and (iii) the mixture of (i) and (ii), plus the distribution income factor. Massa runs a regression model for each differentiation index. His basic model is summarised in Equation 2.4-c in Table 2.4.

The results of the three regression models show that the coefficient of the differentiation index in all the models is negative and significant (-0.31, t=-2.73; -0.02, t=-2.21 and –0.19 t = -2.70 for the index i, ii, iii, respectively). Hence, Massa concludes that the differentiation strategy of the company affects the level of their managed funds.

2.7.3 The focus strategy

Viewed from the industrial economics perspective, Siggelkow (2003) considers the way which corporate focus is advantageous, exploring the relationship between the company's product set and performance of (i) the company and (ii) the product in the fund management industry.

Siggelkow' recent work consists of two research topics: at the performance levels of (i) the company and (ii) the their managed funds. At the corporate level, Siggelkow investigates the effect of the company's diversification or focus on money inflows into the company. At the product level, he question is whether a mutual fund run by a company with limited products, i.e. the "focus" company. exhibits a higher return than similar funds run by a company with a broader product range. Clearly, these research issues are not primary research objectives of this thesis, focusing on the effect of the organisational form on (i) the risk-taking activities of the company (Chapter IV), (ii) the management efficiency of the company (Chapter V), and performance of unit trusts the company manages (Chapter VI). Nevertheless, Siggelkow's inquiries are still valuable because the empirical analyses in the subsequent chapters employ variables similar to those in Siggelkow's paper. For example, Siggelkow refers to a set of funds that the company offers as the diversification index. In a similar vain, models in Chapter IV of this thesis use such a set of unit trusts as the dependent variable of the company's risk-taking decision. Chapters V and VI of this thesis also employ the product mix as an important control variable.

As his first analysis, Siggelkow tests the effect of the product diversity on the company's cash inflow, which largely determines the company profitability. To this end, his basic regression model includes the company's aggregated cash flow as the dependent variable and the number of the fund categories the company offers at time t-1 as the explanatory variable. His interpretation is that the larger the number of the fund categories, the boarder product mix the company manages. In addition to these key variables, several control variables are included. They are the company's averaged fund return at time t-1 as the quality of their product, the total size of the company's managed funds at time t, the average age of the funds within the company's product set at time t, and the growth of the money flow into each category. Based on the sample consisting of the U.S mutual funds in the period from 1986 to 1996, the key result is that the product diversity has a positive effect on the cash inflows. It is noteworthy that with and without the variable for the average performance of their funds, the coefficient of the diversification index remains positive and largely unchanged. In sum, by increasing the diversity of the product set, the fund management company can boost the money inflows into the company, improving the higher profitability.

Sigglekow's second analysis has uncovered a vital role of the corporate focus on performance of their managed funds. The regression framework is similar to that in his first analysis. He estimates three regressions because there is no perfect performance measure. Hence, each model has a different performance measure used as the key independent variable. The first focus proxy is the difference between the fee-adjusted return of the company's funds and averaged return of funds within the corresponding category. The second measure incorporates the risk factor in a manner that: the difference between a fund's return and the averaged return of all funds in the category is divided by the standard deviation of the averaged return of all funds within the fund category. The third measure is a fund's gross return divided by the standard deviation of the averaged gross return of funds in the category.

An index of the overall company focus is defined as

$$\text{Focus}_{k\,t} = \sum_j \left(\frac{assets\_of\_company_k\_in\_category_j\_at\_time_t}{total\_assets\_of\_company_k\_at\_time_t} \right)^2 \quad (4.5)$$

where the sum is taken over all categories j of company k at time t.

In addition to the focus proxy, the regression models include a range of control variables for the fund characteristics such as the portfolio turnover, expense ratio, initial fees and size of each fund. As for the company's characteristics, the size of the total managed asset and the invested asset in each category are included.

The most important observation is that the coefficients of the (lagged) focus variable in the three models are positive and significant (0.969, t = 2.53; 0.123, t = 2.69; and 0.112, t = 2.49, for the first, second, and third performance measures respectively). Given the findings, Siggelkow concludes that the company focus has a positive impact on their managed fund performance. This finding is consistent with Massa's (2003) main result to the extent that a company with a large number of funds can differentiate itself in terms of its product set whilst reducing the competitive pressure for better fund performance. Such a product diversification strategy provides the company with less incentive to achieve superior fund returns.

The next sub-section attempts to identify gaps in the literature by summarising the prior studies with the immediate discipline of the current thesis.

2.8 Gaps in literature

Starting with an inquiry of whether or not conflict of interests exists in the fund management industry, this section explored the literature addressing the agency problem in the fund management industry. It is found that there is the common view that a conflict of interests is present between fund managers and their fund investors. Derived from this view, three strands in the literature are reviewed; (i) an incentive fee issue including normative models and empirical findings, (ii) the performance-money flow connection and its effect as an implicit incentive, and (iii) organisational effects on fund management. Going through the literature above, one can spot unexploited issues as follows.

2.8.1 Gap (1)

It is evident that the preceding studies focused on individual funds. As an extension from the classic fund management literature that examines risk and performance of funds, the research motive among the prior researches can be understood. Nonetheless, the growing presence of fund management companies is too big to ignore in the global capital market. Furthermore, practitioners have been more interested in winning formulae from their company's managerial perspectives (See for instance, the Association for Investment Management and Research, 1991[30]). Notwithstanding these growing phenomena, there has been little research on fund management companies. Recent but a few exceptions include; Khorana and Serves (1999) who are interested in when and why fund management companies set up new funds; Massa (2003) who also investigates the effect of the industry structure on the strategies of fund management companies. However, these studies are exclusively the U.S. based. Hence, to

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30 Association for Investment Management and Research, 1991 "Managing the Investment Firms", New York, The U.S.

look at fund management companies in the U.K as a unit of analysis should be promising.

2.8.2. Gap (2)

As the first literature review indicated, agency theory has been extended to analyse organisational effects in modern corporations. Anchored by Fama and Jensen's work (1983a and 1983b), the issue of organisational form has been a topic of empirical literature. By and large, empirical researches in this area have examined the insurance and banking industries. A key reason to investigate such industries is that mutual institutions and stock owned companies co-exist, these industries, providing fertile grounds for testing agency related hypotheses. Nonetheless, the line of research has not been extended to the U.K unit trust industry where various forms of ultimate ownership co-exist.

From the viewpoint of agency literature, the lack of research on unit trust management companies appears odd given the fact that the ultimate ownership for several unit trust management companies was demutualized in the 1990's. Most of the UK literature addressing the demutualization effect has limited itself to studying the insurance and mortgage businesses.

2.8.3 Gap (3)

Massa (2003) and Siggelkow (2003) studies on the U.S. mutual fund industry are also informative as their research perspective is closely related to this thesis. However, their revenue-driven performance measures are problematic because their performance proxies lack controls for the cost elements. This is mainly due to the absence of relevant data relating to corporate performance. To overcome the data limitation, and justify their revenue-driven performance measures, the authors make an assumption that the economies of scale are present in the industry. Siggelkow points out that economies of scale potentially exist at levels of funds, and companies. Ultimately Massa's position may be summarised by stating that *the fixed costs incurred to set up an additional fund are zero* (Massa, 2003, p.255).

However, as will be argued in Chapter III, this position is contentious given that the magnitude of the economies of scale may be less significant than researchers expect. More crucially, according to Collins and Mack (1997), economies of scale begin to vanish when a company's managed asset exceeds $20 billion. Given this evidence, it is necessary to establish the performance measure for the unit trust companies whilst including the cost factors.

In this regard, an important original contribution of this thesis is to develop the efficiency measure by including the financial statement components associated with costs or expenses. Similar to other U.K companies, the unit trust companies are required to file their annual financial reports for the Companies House, the U.K regulatory body. Downloaded from the Companies House web site after payment of the appropriate fees, these reports are valuable data source, allowing for the estimation of the efficiency score based on a few but critical financial statement items.

Viewed from these respects, this thesis attempts to close these gaps by analysing U.K unit trust companies in an elaboration of agency theory. The first and second empirical chapters respectively look at risk and performance of unit trust companies with various forms of ultimate ownership. The third empirical chapter examines the ultimate ownership influence on individual unit trusts, taking into account risk, return and fees of the unit trusts simultaneously.

Chapter III:
The U.K unit trust industry

Before going forward to the enquiry of the ownership effect on performance/risk taking, it is indispensable to understand the UK unit trust industry. To this end, Chapter III consists of three sections, outlining dimensions of unit trusts; (1) products, customers, and operating companies, (2) the fee structures, and (3) the present industry environment.

The aim of the first section is to define what a unit trust is and to describe who buys, sells, and manages them. The regulations covering unit trusts and the related parties are also discussed. This is fundamental information used throughout the rest of this thesis.

The ultimate aim of the second section is to identify and assess the revenue structure of the unit trust company. As the revenue is dependent of the level of fees the company charges, the second sector also explore various fees in the industry. The second section is indispensable for the purpose of the operationalization of risk-taking measures and efficiency measures used in the subsequent chapters. For the estimation of the company's efficiency, and their risk taking proxy, the revenue structure of the company must be clarified.

The final sector examines the prevailing industry characteristics. Fama and Jensen (1983b) argue that the industry characteristics such as the efficiency scale, market concentration is worthy of consideration because these elements may provide one particular organisational form with a competitive advantage compared to other organisational forms. If this is the case, empirical models must include these industry elements as the variables, capturing the reality of the industry. Hence, it is essential to summarise the industry characteristics.

It should be noted that as for the regulatory framework, the Financial Services and Markets Act 2000 (FSMA) was passed in June 2000. In accordance with the FSMA, the Financial Service Authority, the successors of the Securities Investment Board (SIB), works as a single regulator, replacing the previous divisional regulators such as IMRO and SFA.

However, unless specified, the regulations in this chapter refer to the Financial Service Act 1986 for three reasons. First, it is said that the regulatory regime for unit trusts has been carried forward largely unchanged from the Financial Service Act 1986 to the FSMA (Millar, 2002; PricewaterhouseCoopers 2002). Second, the full implementation of the FSMA is from 30 November 2001 so that the effect of the new ACT is relatively new. Third, data collected for empirical analyses are based on the pre-FSMA period.

3.1 Products, Customers and Operating companies

3.1.1 Overview

A unit trust is an investment collective scheme to which individuals and companies may contribute in order to obtain a share in the income and capital gains generated by the trust's assets (Cowdell, 2000). The portfolio of securities owned by a unit trust is divided into a number of equal portions. These proportions are called "units" and held by investors (unit holders).

In contrast with other popular collective investment schemes, investment trusts[1], unit trusts are sometime referred to as open-end funds. This description is worth noting because in theory the size of unit trusts is unrestricted. If cash comes in from fund investors, the unit certificates are issued and more assets are bought. Conversely, if the redemption is requested from the unit holders, the unit trust management company is obliged to repurchase the unit at trading prices. Hence, cash goes out and assets of the unit trusts are sold. Note that as the unit trust management companies have obligations to buy back their units, there is no need for a secondary market in units and they are not traded in the stock exchange.

The trading prices of unit trusts are based on the net asset values of the trusts (NAV). The management company calculates the trading prices on a daily basis. Based on the NAV, there are three important prices: bid, offer, and cancellation. The bid price is applied when the units are redeemed whilst the offer price comes into effect when new units are issued to investors. The cancellation price is the lowest permitted bid price[2], considering the full costs of buying and selling.

Most unit trusts employ the bid-offer pricing practice. The gap between the two prices is often called the bid-offer spread, being of the order of 5 or 6%. Various

[1] Unlike a unit trust , an investment trust is a company quoted on the London Stock Exchange and has its own independent board of directors. As a limited liabilty company, an investment trust is subject to the Compnay Act 1985. Shares of investment trusts can be bought and sold on the stock market. Traded on a discount or at premium basis, the share prices do not necessary reflect the undelying value of assets the trust invests. Similar to other ordinary shares, prices of investemnt trusts' shares depend on demand-supply situations.

elements such as security trading fees, stamp duties, and the manager's front-end fees account for the price spread. Notably, the latter fee becomes revenue in the hands of the unit trust management company. This fee issue will be taken up in the next section because the fees have an effect on the companies' revenues.

Comparison to the US mutual fund

A great deal of research concerning pooled funds has gone into the US mutual funds. Therefore, in reviewing fund literature, it is worthwhile to describe the US mutual fund briefly. The term "mutual fund" refers to the diversified open-end company, as described under the Investment Company Act 1940 (Baumol et al, 1989). The mutual funds are created by investment advisors, which are often part of a large financial group.

By and large, the mutual funds issue and redeem their shares at net asset values whenever investors request. In this respect, the US mutual funds are close to OEICs in the UK (see section 3.1.3). Shares of mutual funds are directly promoted to the public or via distribution networks. The distribution channels include brokers, financial planners, insurance agents, and special task forces sponsored by the fund. These sales forces receive compensations based on a sales charge or so-called "load" which is a fraction of the mutual fund's NAV.

3.1.2 Constitutional structure

As its name implies, unit trusts are legal trusts governed by a trust deed. The trust deed is an agreement between the unit trust management company and the trustee, who are two independent companies in charge of each unit trust

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[2] The cancellation price is calculated on the basis of a formula laid down by the FSA.

operation. The trust deed covers the main aspect of the operation of the unit trust such as the fee charges, investment restrictions, and remunerations to the fund management company and the trustee.

When unit trusts are advertised and promoted to the public, the trusts must be authorised in accordance with the Financial Services and Market Act 2000. The Financial Service Authority draws the following authorisation criteria as minimum safeguards for readily realised investments. It is said that the main objective of these requirements is to ensure that the investments are readily realizable. (Cowdell, 2000, p 239). Examples of the authorisation criteria are;

- Investment must be in securities that are quoted on a recognised stock exchange, of which 10% may be held in unlisted securities or non-British recognised stock exchanges.
- No single share holding can be acquired that, at the time of its purchase, would represent more than 5% of the value of the whole of the trust's portfolio.
- A unit trust may not hold more than 10% of the share capital of one particular company.
- No direct investment in commodities is permitted (Investment in shares of companies dealing commodities is allowed).

3.1.3 Product development

Assets under management

The latest industry statistics reports that the UK unit trust industry has the assets of £201 billion under management as of April 2003 (Investment Management Association, 2003[3]). Table 3.1 also details the UK unit trust management industry over 15 years.

Type of Assets

In order to assist investors with their evaluation of the different unit trusts, the industry association, Association of the Unit Trusts and Investment Funds (AUTIF), categorises into several classes, depending on their stated investment objectives.

One of the key features of the UK unit trust industry is that most unit trusts invest exclusively in equities as Table 4.3 in Chapter IV shows. By fund sectors, the largest asset class is *the UK All Companies* which accounts for 30.7% of the total assets in the industry at the end of 1999. Further, in response to the European Union integration, the European equity (excluding the UK) collects over £28 billion under management, becoming the second most popular fund sector. This subject will be discussed further in the next empirical chapter.

[3] See www.investmentfunds.org.uk/industry_data/ukbusiness/default.htm

Table 3.1 Key statistics for the period 1985-2000

	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987
Total number of Groups	155	159	152	153	161	160	162	156	151	157	154	162	153	139
Total number of funds	1937	1831	1739	1680	1669	1663	1559	1528	1456	1400	1407	1379	1255	1137
Total value of funds (£m)	260685	253805	182637	157672	131877	112631	92116	95518	63874	55145	46342	58159	41574	36330
Total unitholder accounts (m)	16.5	14.11	11.3	9.6	8.02	6.63	6.12	5.04	4.35	4.46	4.63	4.88	4.89	5.05
Total Gross sales (£m)	57196.6	45591.6	39029.1	28882.6	26164.2	18332.8	19671.7	18739.9	9563.3	10482.5	8610.6	10609	7675.7	14545.1
Repurchases (£m)	38911.6	27640.1	26718.6	18634.2	15887.8	11434.8	11422.6	9604.5	8914.4	7713.5	8219	6742.7	5880.4	8214.3
Net investment (£m)	18285	17951.5	12309.8	10253.4	10277	6898	8236.3	9135.4	648.9	2769	391.6	3866.3	1795.3	6330.8
Ratio of sales to repurchases	1.47	1.65	1.46	1.55	1.65	1.6	1.72	1.95	1.07	1.36	1.05	1.57	1.31	1.77
Sales as a % of FUM	21.9	17.9	21.4	18.3	19.8	16.3	21.4	19.6	15	19	18.6	18.2	18	40
Net Investment as a % of FUM	7	7.1	6.7	6.5	7.8	6.1	8.9	9.6	1	50	0.8	6.6	4.3	17.4

Source: Association of Unit Trusts & Investment Funds
UK Fund Industry Review & Directory 2001

Unit linked products

Financial service companies have broadened their product lines by linking with unit trust investments. For example, a unit linked insurance carries a minimum life cover with the large part of the premium balance invested in unit trusts. Similarly, a unit linked personal pension plan is invested in a variety of unit trusts. Returns of such products is linked to the performance of the underlying unit trusts. Hence, some unit trusts are set up and employed for the linked products.

Open Ended Investment Company

In January 1999, a hybrid product, Open Ended Investment Company (thereafter OEICs) was introduced into the UK unit trust industry. With a variable number of certificates like unit trusts, OEICs issue shares and have a board of directors like investment trust companies. Existing unit trusts are allowed to convert into OEICs.

There are two reasons for launching the OEICs. The first reason is that compiled with the European Directives, e.g. *Undertakings for Collective Investments in Transferable Securities* (UCITS), OEICs are easily promoted into continental European markets where an OEIC is a popular form of pooled investment scheme. Next, some unit trust management companies believe that as opposed to the dual pricing practice of unit trusts, OEICs with the single pricing system are better understood by investors, unlocking a new investor segment.

Nonetheless, OEICs have not gained a large market share in the UK. The slow penetration is partly due to (a) the reactive strategy which fund operators are pursuing in order to assess customer and media reaction to OEICs and (b) the expensive conversion cost from existing unit trusts (Sahakien, 1998). In those respects, this thesis does not distinguish OEICs from conventional unit trusts.

3.1.4 Types of unit holders

Unit holders can be divided into two groups: retail and institutional. The institutional unit holders include insurance companies, public and private pension funds, who seek to finance their liabilities through investment[4].

Recently, thanks to the tax efficient saving schemes such as ISA (Individual Savings Account), retail investors have put money into unit trusts much larger than their institutional counterparts. The sales proportion of the retail unit holders to the institutional unit holders are 1.5 in 1996, 2.7 in 1997, 2.2 in 1998 and 4 in 1999. Furthermore, it is interesting to note that retail sales outside an ISA or PEP was accounting for 41% of the total unit trust sales in 2000, in addition to those through the tax saving accounts. Unfortunately, no data is available concerning the split between retail and institutional unit holders by fund assets under management.

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[4] Note that whilst some institutional unit holders purchase unit trusts via their own accounts, their end-investors are member of the public via unitised products.

3.1.5 Operating Companies

Management company

The management company is responsible for the fund start-ups, the investment decisions, and the administrations of the sales and redemption of the units. In many instances, these management companies are subsidiaries of banking or insurance groups. Further, investment companies such as Exeter and Invesco offer a number of unit trusts with their own brand names. Under the Financial Service Act 1986[5], the management company of an authorised unit trust must meet the following requirements:

- It must be a corporate body, incorporated in the UK or other EU member state.
- Its affairs must be administered in the country of incorporation.
- It must have a place of business in the UK.
- It must be a person authorised under the Financial Service Act 1986 to carry out investment business in the UK.

In addition to these requirements above, what is important particularly from my research point of view is that the activities of the unit trust management companies are limited to unit trust management and related business[6]. The management company of an authorised unit trust will not be allowed to engage in any other type of investment business. Therefore, it is fair to say that revenues of the unit trust companies are generated only from their management business.

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[5] Section 78(3) of the Finacial Act 1986.

[6] Ibid. Section 78(4).

By the end of 2000, there were 155 separate management companies forming the UK unit trust industry. Their sizes vary in terms of their managed assets. Further analysis will be presented in the third section of the current chapter.

Trustee

The trustee company acts as the protector of the trust's assets and income on behalf of the unit holders. Hence, the trustee's duty is to monitor the management company's activities, ensuring that the management company complies with the trust deed. The trust deed defines numerous terms and conditions concerning the operation of the unit trust. In general, the trustee company belongs to a bank or an insurance group. From the regulatory point of view, similarly in many ways to the management company, the trustee must be a corporate body incorporated in the UK or in another EU member State. Further the trustee must meet certain financial requirements.

Shown in Table 3.2, there were 10 companies who kept the assets of the UK unit trusts by the end of 1998.

TABLE 3.2. Number of funds and total fund value at 31 December 1995-1998

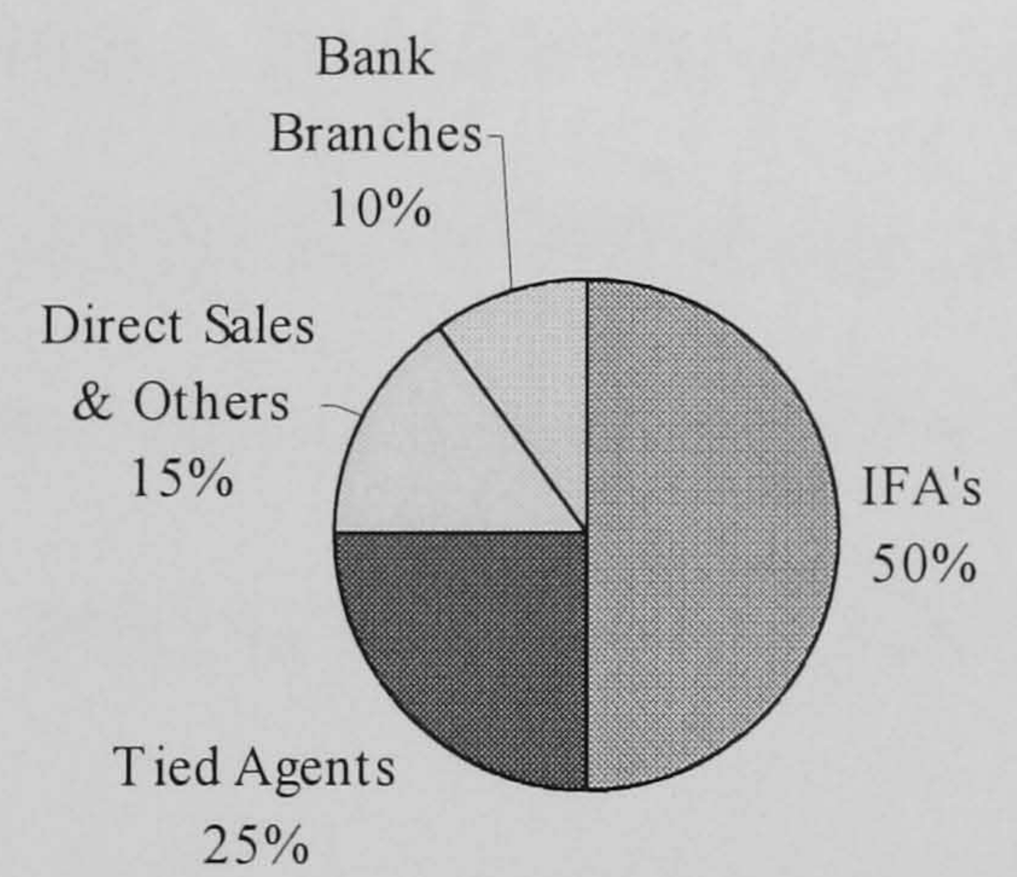
Trustee	*Number of funds 1998*	*Total fund value 1998 £ million*	*Trustee*	*Number of funds 1998*	*Total fund value 1998 £ million*
Bankers Trustee	42	4,233	Lloyds Bank	268	26,311
Bank of New York	42	2,165	Midland Bank	182	16,319
Chase Manhattan	228	28,595	Royal Bank of Scotland	454	43,321
Citicorp	170	26,222	Royal Exchange	52	6,350
Clydesdale Bank	90	19,061	State street Trustees	72	7,653

Source: FT Yearbook Unit Trust & OEICS 1999/2000

3.1.6 Distribution channels

As Figure 3.1 indicates, the UK unit trusts are predominantly distributed by sales agents, who are divided into tied agents and independent financial advisors (IFAs). Despite the fact that the sales agents are paid on commission, it is important to draw a distinction between the two agents. That is, the tied agents are bound to one particular financial company whilst the IFA are allowed to sell all companies' financial products. However, it is noteworthy that direct sales via telephone and internet are developing trends in the industry. A further point to note is that some unit trusts are associated with insurance polices and referred to as unit-linked insurance.

Figure 3.1. Distribution channels in the UK unit trust industry



Source: Walter, 1999 "The Global Asset Management Industry"

3.1.7 Regulators

Similar to other financial institutions in the UK, any business parties involving unit trust operations are regulated by the Financial Service Authorities, formally named the Security Investment Board (SIB). In addition to the legal requirements of the Financial Service Act 1986, any authorised unit trusts are subject to regulation under the Financial Services (Regulated Schemes) Regulations 1991. The regulations deal with detailed business practices such as pricing and dealing in unit trusts. As noted at the beginning of this chapter, the regulations have been carried into the Financial Services and Market Act 2000 with little change.

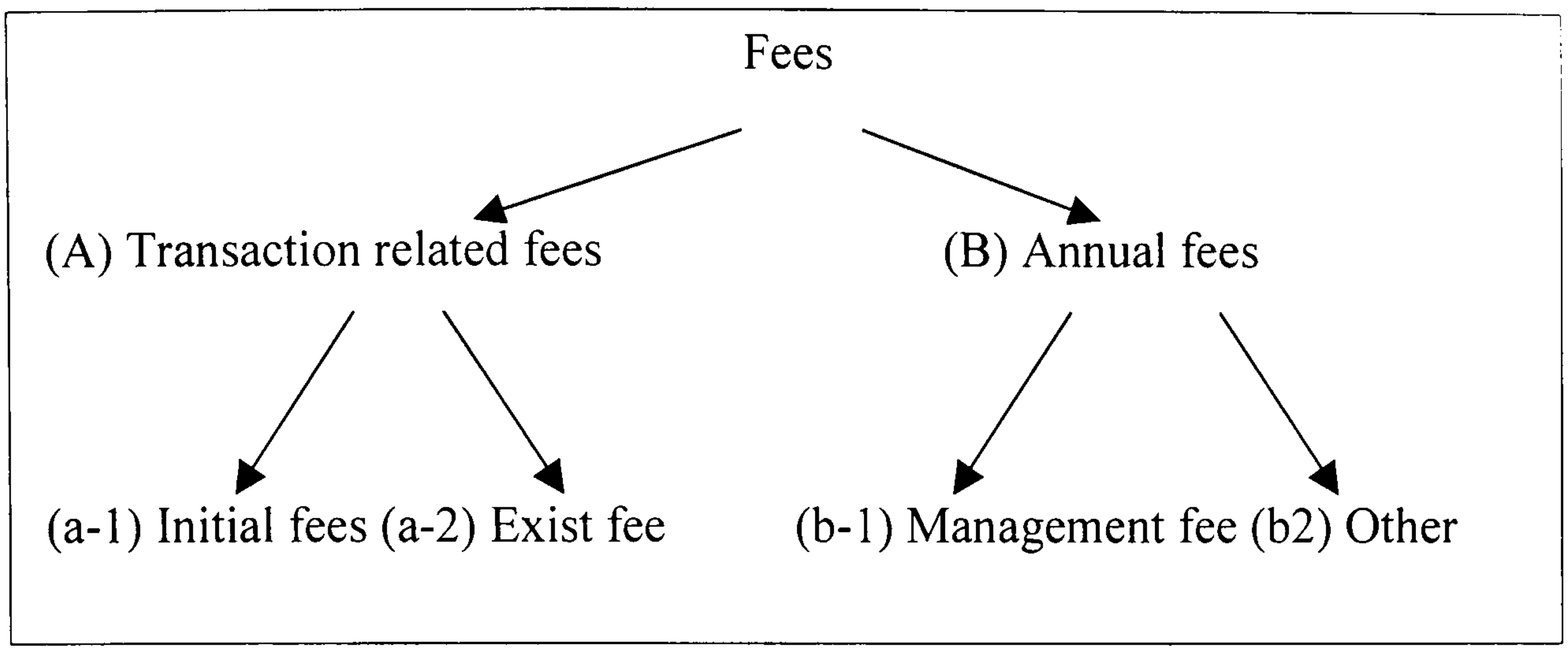
3.2 Revenue sources of unit trust management companies

In studying the unit trust industry, one should not ignore the revenue structure of the industry. Specifically, in the context the current thesis, the description of the current income stream at the level of unit trust management companies is essential, by providing validity of the risk taking measures used in the subsequent empirical. Hence, as the first step of the analysis, this section concentrates on current fee schedules that are commonly used in the UK. Further, similar fee schemes in the US mutual fund industry are also discussed because a lot of previous studies on mutual funds concerned the US mutual funds.

3.2.1 Current fee structures

Broadly speaking, one can find two different fees in funds, depending on when fees are charged. Transaction fees are paid directly by investors when they buy / sell funds whilst annual fees are deducted from fund assets, bit by bit rather than in one lump sum.

Figure 3.2:Type of Fees



Transaction related fees

There are two types of transaction fees; (a) initial charges and (b) exist fees.

(a) Initial charges (or so called load fees): Initial charges are one-off charges payable to fund distributors or financial advisors as their remuneration for the fund sales.

U.K unit trusts

The initial fee in the U.K can range from 0 to 6 percent of the offer price of the unit and upwards. However, most unit trust companies will deduct between 5% and 6% from the initial amount of investment money. According to Lipper Analytical Services, a fund data provider, the average initial charge to retail investors in U.K. equity funds is 4.7 per cent. In addition to the initial fee, there are "other bit" initial fees in the U.K fund industry, due to the market practice of the bit and offer (McWilliams 1997). The bit-offer spread varies among funds, which are presented in Table 3.3.

Table 3.3. Ten largest bid/offer spreads in most popular sectors (Source:McWilliams,1997,p.108)

Fund	*Initial charge*	+	*Other bit*	=	*Spread*	*12-month performance after charges*
Growth & Income						
Barclays Unicorn 500	5.3%		3.3%		8.6%	3.3%
Halifax Accumulation	7.5%		0.2%		7.7%	New fund
MAMPI Income	6.0%		0.9%		6.9%	10.0%
London & Manchester General	6.0%		0.8%		6.8%	8.9%
Barclays Unicorn General	5.3%		1.4%		6.6%	9.0%
Garter UK Equity Income	5.3%		1.4%		6.6%	6.8%
Edinburgh UK Income & Growth	5.0%		1.6%		6.6%	6.1%
Barclasy Unicorn Trustee	5.3%		1.3%		6.5%	8.3%
Cazenove UK Equity	5.0%		1.5%		6.5%	13.2%
Dolphin UK & General	5.5%		1.0%		6.5%	3.4%
Average in sector						**8.3%**
Equity Income						
London & Manchester Income	6.0%		0.8%		6.8%	4.9%
Exeter High Income	6.0%		0.7%		6.7%	-4.3%
Clerical Med. Equity High Income	5.3%		1.4%		6.6%	0.5%
Baring Equity Income	5.0%		1.5%		6.5%	8.7%
Sun Alliance Equity Income	6.0%		0.5%		6.5%	9.3%
Barclays Unicorn Extra Income	5.3%		1.3%		6.5%	5.6%
GT Income	5.0%		1.5%		6.5%	15.4%
Refuge Equity Income	6.0%		0.5%		6.5%	8.7%
Abbey High Income Equity	6.0%		0.5%		6.5%	3.6%
Abtrust Extra Income	3.5%		3.0%		6.5%	-6.7%
Average in sector						**5.9%**
Equity Growth						
Cavendish Opportunities	3.5%		3.6%		7.1%	9.6%
Mercury Asset Income Portfolio	6.0%		0.8%		6.8%	8.3%
Morgan Grenfell UK Growth	5.3%		1.5%		6.8%	10.0%
Baring UK Growth	5.0%		1.8%		6.8%	16.5%
Exeter Capital Growth	6.0%		0.8%		6.8%	-1.7%
Barclays Unicorn Spec. Situations	5.3%		1.5%		6.7%	15.8%
Sovereign Ethical	5.3%		1.5%		6.7%	16.7%
Old Mutual CAM British Growth	5.3%		1.4%		6.6%	1.9%
Barclays Unicorn Capital	5.0%		1.6%		6.6%	8.1%
Tilney UK Equity	5.0%		1.6%		6.6%	New fund
Average in sector						**10.7%**

U.S mutual fund

The range of the initial fees in the U.S mutual fund industry is from 0 to 6 percent, which is similar to those in the U.K unit trust industry. The average front-end charges are around 4-5 percent. Furthermore, bulk discounts are available if the investment amount exceeds 50,000 or 100,000 dollars. (Fredman and Wiles 1998). It is interesting to note that in earlier decades, the front fees were set up at a much higher level, such as 8.5 percent, which is still acceptable as the maximum load charge ruled by the National Association of Securities Dealers (NASD), the U.S governing body for fund sales practices. But the front-end fees have been declining due to competitive pressure in the industry and because of increasing awareness that investors' returns are affected by various sales charges. Another explanation for the declining load fees is that the Securities and Exchange Commission (SEC) allowed fund management companies to pass on marketing and advertising costs to fund holders in 1980. The new fee is called 12b-1 fees, named after the applicable SEC rule. From the management companies' viewpoint, the load fee reduction can be offset by the 12b-1 fees.

(b) Exist fees (also known as back-end charge / contingent deferred sales charge): This is a fee when fund investors redeem their fund holdings. The fee is dependent on how long the investors hold the funds. In general, a sliding fee scale applies, 5 per cent, 4 per cent and so on, depending on the duration of the fund holding by the investor. The purpose of the exit fee is to encourage fund investors to keep their funds. At the same time, from the standpoint of fund managers, investors' money is locked in as the managers' revenue resource. The exit fee is used along with the 12b-1 fee in the U.S. On the other hand, the exit fee is rather new in the U.K as a change in regulations in 1994 allows the unit trust manger to take a redemption charge in addition to the initial charge.

Annual fees

The annual fees are also divided into the management fees and other recurring fees. The management fees are more important as they are paid to fund management companies for their investment analysis / management whilst other fees are associated with administrative functions such as trustees' fees and auditing fees, which are less relevant to this analysis.

The management fees

The fund management companies deduct the management fees bit by bit from their funds' assets. The annual fee scales are common to the UK unit trust industry and the US mutual fund industry, typically ranging from 0.4 percent for money market funds to more than 1.0 percent for international stock funds. The estimated average funds' management fees in the UK was 1.2 percent (James, 2000) or 1.3 percent (McWilliams, 1997). In the U.S market, the directly - marketed funds charged 0.84 per cent on average whilst funds distributed via financial advisors charged 1.24 percent of assets on average (Walter, 1999).

In order to get a sense of the present revenue structure of a typical unit trust management company, an example is taken out from the audited annual statement of Newton unit trust manager. Table 3.4 is a summary of the income statement and its corresponding note.

Table 3.4 The extract from Newton Fund Managers' financial statement.

Newton Fund Managers Limited

	Year to 31 Decmeber 2000	Year to 31 Decmeber 1999
Revenue **	34292	24180
Administartive expenses	-22996	-18511
Operating profit	11296	5669
Interest receeivable	632	410
Interest payable	-152	-10
Other income	16	5
Profit on ordinary activities before tax	11792	6074
Taxation	-3602	-1932
Profit on ordinary activities after tax	8190	4142
Dividents	-2000	
Retained earnings for the year	6190	4142
Retained profit/(deficit) brought forward	2300	-1842
Retained profit carried forward	8490	2300

****Note on Revenue**	Year to 31 Decmeber 2000	Year to 31 Decmeber 1999
Management fees	51,830	35,661
Gross sale of units and shares	1,714,996	1,234,634
Total Turnover	1,766,826	1,270,295
Cost of units and shares	1,661,045	1,186,375
Discounts, commissions, stamp duty and other cost	71,489	59,740
Total cost of sales	1,732,534	1,246,115
Revenue	34,292	24,180

The extract from the Newton Fund Managers limited points fairly clearly to the revenue structure of an unit trust company in the U.K. A key point to remember is that there are two revenue generators: Asset under management and gross sales. This point deserves explicit emphasis. The reason to stress is that offering validity of the asset-based approach, the two revenue factors are foundations in developing risk-taking and efficiency measures used in this thesis.

3.2.2 Considerations for fee setting

Before moving on to the industry's current situation, there are a few issues to be noted concerning the management fees. First, it is a debatable question that because of potential economies of scale (see the following section in detail), the management fees should decrease as their fund assets increase beyond specified levels (often called breakpoints). The practice of reducing the fees is "*far from universal*", (Fredman and Wiles 1998, p47) or the breakpoints are set up at significantly higher levels (McWilliams 1997). The high profitability in the unit trust industry[7] can be attributable to the non-discount practice of management fees.

Pricing power

The first issue leads to the next question; whether price competition is in effect. Another way of saying this is whether unit trust management companies in the U.K have pricing power for their fee setting. Opinions are divergent on this point as the following paragraphs suggest.

On the one hand, McWilliams (1997) points out that some companies are capable of charging more for their funds. He explains that "*there is a public perception that a Mercedes or a Bentley or Rolls is a great performing car; hence, the manufacture charges a premium over and above other cars. And that's what we* *see with unit trusts."* (McWilliams (1997, p.31). His statement is based on the implicit assumption that it is possible to charge more for high performance.

There are additional likely factors to account for the managers' pricing power. The first possible explanation is that investors especially retail unit holders lack reliable ex-ante information about the quality of investment products. The second factor is that retail investors heavily rely on advice from intermediaries who are financially rewarded by unit trust providers. In addition to the incentive factor, retail investors are naïve, failing to understand the fee effect on their investment return. According to AUTIF's annual survey, some 10% of unit holders cited a "reasonable charge" to explain why they bought unit trusts. (See Table 3.5)

Table 3.5: Reasons for choice of particular company

Reasons: Total Sample (%)	2000	1999	1998	1997	1996
Past performance / Good record	33	44	33	35	44
Press recommendation / review	31	15	25	22	21
Reputable / reliable	18	20	19	19	18
Wide range / choice of funds	15	10	12	11	8
Company advertising	11				
Professional advice	9	6	7	8	7
Reasonable charges	**8**	**11**	**7**	**14**	**10**
Well known	5	8	6	9	9
General recommendation	3	4	4	5	6
Don't know	2	1	1	6	5

Source: Unit trust Information Service
Market research survey and report
by AUTIF 2001 March

[7] The City Resaerch Project (1994, p 20) cited from the PriceWaterhouse annual servey that the profitability defined by profits before interest and tax over revenue was nearly 14% on avaerage from 1988 to 1992.

The view above is disputable for a number of reasons. First, it is reported that *the investment performance of unit trusts bears no relationship to their charges.* (Sandler, 2002, forward page 3) Second, unit trust managers who pursue the higher fees must outperform their target market by more than their charges just to stay even with the average. Nonetheless, according to the literature of fund performance in the previous chapter, in reality, it is extremely difficult for fund managers to achieve and maintain superior performance, reflecting the nearly efficient markets. Third, it is the fact that a fund with less fees will generate higher return, other things being equal. In other words, on average, the more you pay the less you get. Recall the empirical evidence from Carhart's work (1997) that high fees account for poor performance. Hooks (1996) and Droms and Walker (1995) also present similar evidence in this point. Finally, both in the U.S and U.K, financial regulators and news media have put considerable pressure on the mutual fund management companies to clarify their fee charges and to reduce their fees[8]. Under such increasing pressure for fee reduction, it is not easy for unit trust companies to set out higher fees.

In view of such controversy, the current research does not take the explicit view that unit trust management companies have pricing power in the industry. Rather, it is fair to assume that although the fee level is important, market forces have tended to bring most fees into line[9]. In order to explore the issue from a micro economical standpoint, the next sub-section provides empirical information of the degree of concentration in the U.K. unit trust industry.

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[8] For instance, see "Feeling the squeeze until squeakky clean", *The Guradian*, 24 May 2003.

[9] Nanda et al (2000) recently illustrated this point with their recent model.

Performance fee

The second issue is about the performance based fee. The issue has promoted research interest in risk-taking of individual funds as summarised in section 2.3.2. However, as noted in section 2.3.2, the performance fees are not permitted under the current UK regulations (See footnote 11 in section 2.3.2). Therefore, this has little connection with the current empirical analysis.

3.3 The current business environment

The goal of this section is to draw further business conditions of the UK unit trust industry. As the first part of the literature review suggested that the survival of an organisation is dependent on how well the organisation copes with agency problems given the particular industry conditions (Fama and Jensen, 1983a), the review of the industry is necessary. It is important to recall the underlying logic of Fama and Jensen's work that the industry structure makes companies with certain ownership forms more (or less) competitive over those with different forms of ownership. Therefore, in order to highlight certain features of the UK unit trust industry, this subsection follows the analytical framework based on the degree of concentration and entry barriers (Samuelson and Marks, 2002).

Figure 3.3 Comparing Market Structure

Number of Firms	Entry Barriers: High	Moderate	None
One	Monopoly	Not Applicable	Not Applicable
Few	Oligopoly	Oligopoly	Not Applicable
Very Many	Not Applicable	Not Applicable	Perfect Competition

Source: Samuelson and Marks (2002, Table 8.1 p. 321)

3.3.1. The degree of competition

As Figure 3.3 shows, a traditional economics textbook displays the spectrum of the market structure by dividing the market into three segments, e.g. perfect competition, oligopoly, and monopoly. In this respect, the number of companies in the industry, i.e. the degree of concentration is a key variable. In addition to the concentration in the industry, economists address the degree of entry barrier as a important determinant of the competition of the industry. Thus, building on the conventional economics framework, this section examines the industry concentration by two measures. Then, the next subsection describes entry barriers in the unit trust industry. Specifically, the entry barriers are considered in terms of (i) economies of scale, (ii) product differentiation (iii) capital requirement, (iv) access to distribution channels and (v) the government policies.

3.3.2. The degree of concentration

In studying features of a certain industry, economists often use the market concentration ratio and the Herfindahl-Hirschman index. The market concentration ratio is defined as the percentage of market share (sales) accounted for by the industry's four or five largest companies. (Mansfiled, 1993). For example, the four company concentration ratio is the sum of the market share of the top four companies, divided by the total market size: = (S1+S2+S3+S4)/St where Sn= the company N's market share in size and, St = the total market size. If the industry consists of a large number of small companies, the ratio is close to zero. By contrast, fewer companies dominate the market, the ratio is close to one. In other words, the closer the ratio is to zero (one), the less (more) concentrated is the industry.

It can be said that the four company concentration ratio is a rough measure because the ratio is based on the market shares of only the four largest companies in an industry (Barney, 2001, p243). In this light, there is another measure of concentration, taken into account the market shares of all companies: The Herfindahl-Hirschman Index (thereafter the Herfindahl index for short). The Herfindahl index is obtained by squaring the market share of the companies in the industry and then summing these square. That is :

$$\text{The Herfindahl Index} = \sum_{i=1}^{n} (\%MarketShare)^2 \text{ X } 10{,}000 \qquad (3.1)$$

The value of the index ranges from 0 to 10,000. Given the range, there is a conventional interpretation concerning the Herfindahl index. For instance, using the Herfindahl Index as the merger guideline, the U.S Justice Department considers that range of 10,000-1,800, 1,800-1,000, and 1,000-0 represent a highly concentrated, moderately concentrated and a low concentrated market respectively (Griffithus and Wall, 1999). In this respect, the concentration ratio is supplemented with the Herfindahl index.

Figure 3.4: Concentration measures in the U.K unit trust industry from 1989 to 2000 (Source: UK Fund Industry 2001 Review and Directory)

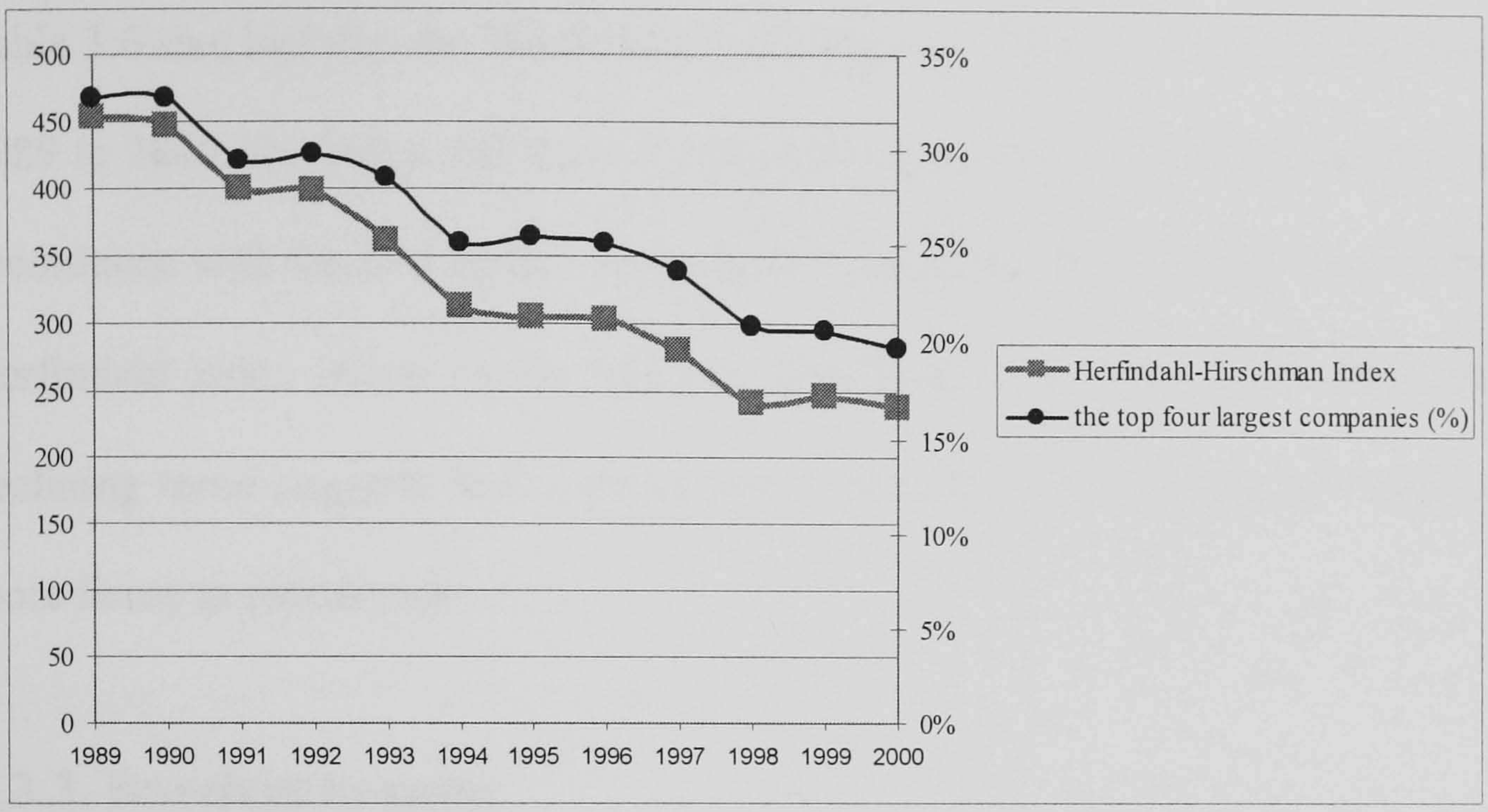

Table 3.6 Concentration measures in the U.K unit trust industry from 1989 to 2000 (Source: UK Fund Industry 2001 Review and Directory)

Year	1989	1990	1991	1992	1993	1994
the top four largest companies (%)	32.79%	32.68%	29.49%	29.80%	28.59%	25.20%
Herfindahl-Hirschman Index	453.2	446.1	399.8	398.6	361	312.5

Year	1995	1996	1997	1998	1999	2000
the top four largest companies (%)	25.52%	25.19%	23.71%	20.86%	20.62%	19.66%
Herfindahl-Hirschman Index	304.3	303.3	279.3	240.5	246.4	238

By applying the two measures to the UK unit trust industry, Table 3.6 reports the degree of concentration of the industry. According to the concentration ratio, the largest four unit trust management companies accounted for 19.66 % of the market share at the end of 2000. In the 12 year duration from 1989 to 2000, the ratio declined from 32.79 to 19.66. The decrease of the ratio suggests that the industry's concentration has weakened. What is more, recall that there is no standard interpretation with respect to the four company concentration ratio. Nonetheless, given the fact that the European fund markets are dominated by subsidiaries of large banks and insurance groups[10], the ratio indicates a relatively low concentration concerning the UK unit trust industry.

Table 3.6 also includes the Herfindahl index figures. Over a 12 year period from 1989 to 2000, the index fell almost constantly from 453 to 238. Apparently, in accordance with the U.S Justice department's guideline, the absolute level of the Herfindahl index is low in the UK unit trust industry. More importantly, the declining trend suggests that competition in the unit trust industry has become more fierce in recent years.

3.3.3. Barriers to entry

The potential barrier for entry into an industry is the next variable which helps highlight the industry characteristics. Certainly, various features are considered as potential barriers to entry. However, in the context of a financial service industry, Bateson (2002) views the following factors as barriers to entry into the industry: Economies of scale, Product differentiation, Capital requirement, Access to distribution channels and Government policies. Consistent with Bateson's approach, this section briefly examines these potential entry barriers which may exist in the unit trust industry.

Economies of scale: Informally, bigger is better where the economies of scale occur. More precisely, the average cost of, i.e. cost per unit of output, declines as the output increases. The basic explanation for the decline in the average cost

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[10] For example, top 10 companies accounted for 65% of the French fund industry (PriceWaterHouseCoopers, 2000a) whilst six groups held 70% of the German fund market (PriceWaterHouseCoopers, 2000b).

is the spread of fixed costs over (Besanko et al, 2000). The economies of scale may confer a cost advantage where a large infrastructure is needed. For example, if the new company is set up at too small a scale, the new company is unable to lower the cost, which matches those of existing producers.

Despite the fact that the fund management industry expand significantly over the last decade, few academic studies examine the issue of economies of scale in the industry. Exceptions are Baumol, Goldfeld, Gordon, and Koehn (1990) and Collins and Mack (1997) who studied the U.S mutual fund companies: Dermine and Roller (1992) who investigated the French mutual fund[11] companies: And more recently, Latzko (1999) who examined economies of scales in terms of administration costs.

The common methodology among these studies relies on the well known trans-log cost function. For example, the trans-log cost function takes the following form in the Latzko's work.

$$\ln COST = \alpha_0 + \alpha_1 \ln ASSETS + \tfrac{1}{2}\, \alpha_2 (\ln ASSETS)^2 + \Sigma_j \alpha_j X_j + e \qquad (3.2)$$

where COST = the fund's total operating expenses
ASSETS = total fund assets
X_j = a vector of fund characteristics that may affect costs[12]
e = a random error term

[11] French mutual funds refer to Societe d'Investissement a Capital Variable, which is often called as SICAV.
[12] The average expense ratio for funds with the same investment objective as the fund in question, the fund's annualised five year return (%), the fund's front / back end fees and the total amount of fund assets managed by the fund family group to which the fund belongs.

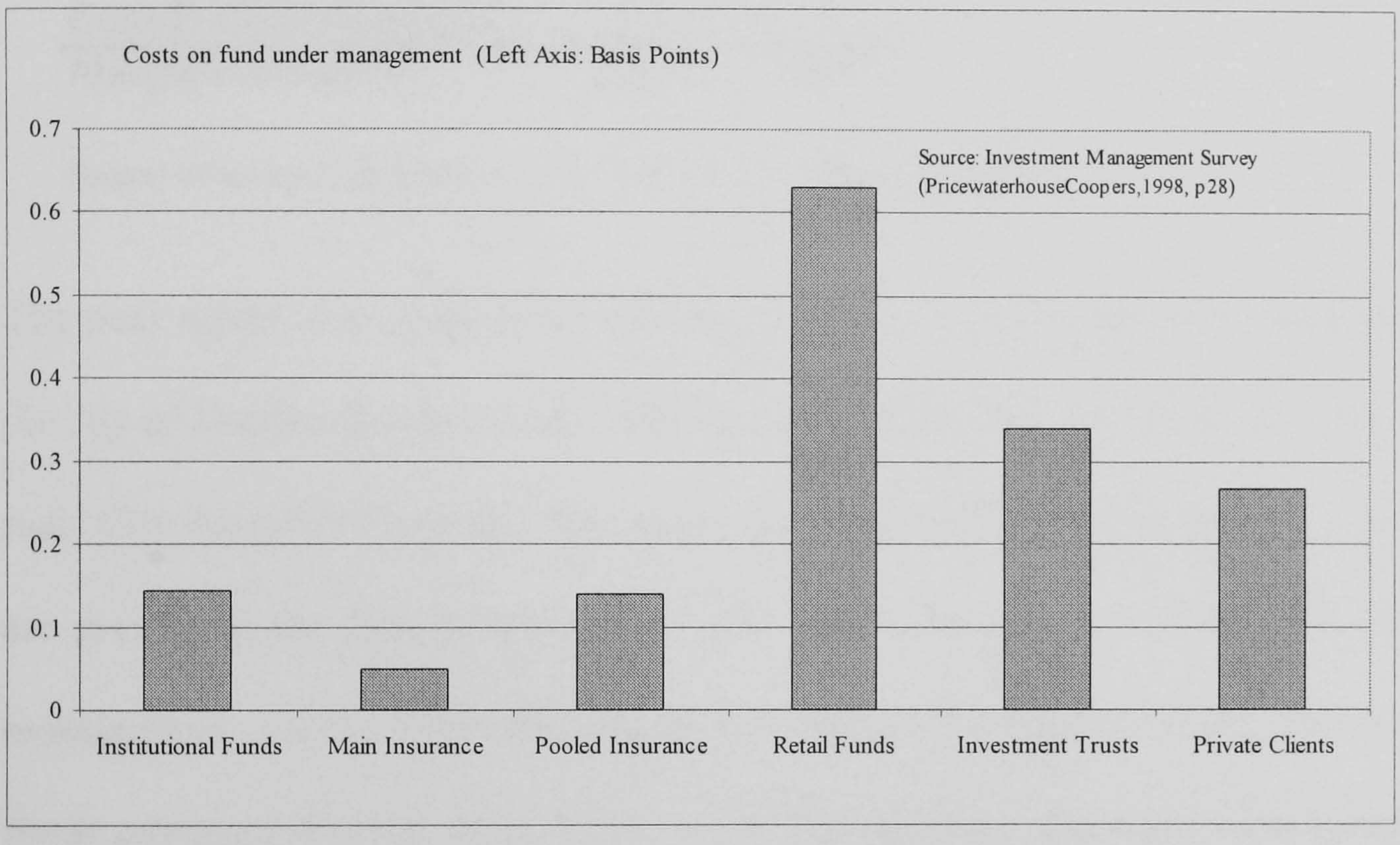
Based on the form above, the measure of economies of scales is given by taking the first derivative of the cost function. That is written as SCALE = ∂ (ln COST) / ∂ (ln ASSET). If SCALE is less than one, the cost increases less than proportionately with their fund asset, indicating that economies of scale is present. On the other hand, if SCALE is more than one, diseconomies of scale exists.

The common factor within these studies is that economies of scale are present. In the case of the U.S, Barmol et al reported that the ratio of scale is 0.855 whilst the corresponding figure from Collins and Mack study is 0.775. In terms of total asset size in the French fund industry, Dermine and Roller found that economies of scale exists for companies whose asset is between 100 million and 2.9 billion French Franc. Similarly, Latzko found economies of scale at the individual fund level.

Interestingly, it is also reported that diseconomies of scale emerge if the asset size exceeds a certain size. The thresholds are over 20 billion dollars in the U.S mutual fund industry (Collins and Mack, 1997) and over 2.9 billion French Franc in France (Dermine and Roller, 1992).

UK evidence: in the case of the U.K unit trust industry, only two less-academic reports have been examined economies of scale within the industry. The first report is from PricewaterhouseCoopers, conducting an annual survey concerning the asset management business in the U.K since 1988. The survey covers various financial service groups such as UK institutional business, non UK institutional business, main insurance, pooled insurance, and retail funds. One of the analyses addresses economies of scale for each product segment (See Figure 3.4).

Figure 3.5 Cost on fund under management (basis points) across different business segments in 1997 (Source: PricewaterhouseCoopers,1998)



Making a distinction between the top five companies and the rest of the sample in terms of their funds under management (FUM), the analysis presents three ratios; revenue over FUM, costs over FUM, and operating profit over revenue. Table 3.7 indicates the presence of economies of scale in the retail fund business. The results are consistent with the preceding findings concerning the U.S and French fund industries. However, it is worth noting that the degree of the economies of scale is not substantial between the top five companies and the remaining companies.

Table 3.7 Analysis of product leaders' results

	Top 5	The rest
Retail funds (unit trusts/OEIC)		
Revenue/FUM (basis point)	97	81
Costs/FUM (basis point)	67	59
Margin/revenue (%)	**31%**	**28%**
Investment trusts		
Revenue/FUM (basis point)	62	76
Costs/FUM (basis point)	34	33
Margin/revenue (%)	**45%**	**56%**

Source: Investment Management Survey (PricewaterhouseCoopers,1998, p13)

The next report; *the competitive advantage of the fund management industry in the city of London* (Laslett, et al, 1994) is made by the city of London as a part of their *City Research Projects*. The report suggested that some economies of scale are present in the case of unit trusts. The reason for this view is that *the fund management task is essentially a fixed cost, and profits depends on the amount of funds attracted* (Laslett, et al, 1994, p 21). Nevertheless, the report also pointed out that overall at the company level, there are no substantial economies or diseconomies of scale related to the total volume of funds under management. As clear evidence for this notion, the report stated that large and small companies survive, achieving high profitability.

Notwithstanding the lack of academic studies on the scale economies in the U.K unit trust industry, the balance of evidence from the preceding works indicates that the economies of scale seems to exist in the industry but the magnitude of the scale is not so substantial. Chapter V will be informative in this point as the chapter investigates the relationship between efficiency and assets under management of the unit trust companies.

Product differentiation: The product differentiation is embodied in the physical or the perceived features of the product, working as a barrier to entry that existing companies own brand identifications and customer loyalty. If potential new entrants do not have such brand recognitions, it takes substantial costs not only to establish their new brands, but also to overcome competition against the existing brands (Barney, 2001, p72).

In the case of unit trusts, to differentiate one unit trust from those of competitors is not easy task because a unit trust with one management company appears to be almost identical to those with any other management companies. However, as summarised in section 2.7.1 in Chapter II, a recent work by Massa (2003) demonstrates how the U.S mutual fund management company can differentiate themselves from other rival companies in term of their fund fees, the fund investment objective, and the company's total product mix.

To the extent that the majority of unit trusts have been commoditised, it is argued that this is where a strong brand plays an important role in the UK unit trust industry. In other words, brand is to de-commoditise products given the current financial service market (Sahakien, 1998). Massa (2003) takes a similar view that investors perceive two funds in the same category run by different companies more different than two funds in the different category run by the same company.

As a matter of fact, there is evidence that branding is successful in the unit trust industry. Companies such as Virgin group, Marks & Spencers and Tesco have successfully entered the unit trust market, attracting new customers. Table 3.8 reports their market shares from 0.45% in 1995 to 1.38% in 1999 showing that companies with strong brands have an advantage in entering the unit trust industry.

Table 3.8: Market shares of new companies with strong brands

	1995	1996	1997	1998	1999	2000
Virgin Direct: Assets (million)	137	456	1,146	1,720	2,381	2,364
Market Share %	*0.12%*	*0.35%*	*0.73%*	*0.94%*	*0.94%*	*0.91%*
Marks & Spencer: Assets (million)	373	476	694	1,003	1,185	1,122
Market Share %	*0.33%*	*0.36%*	*0.44%*	*0.55%*	*0.47%*	*0.43%*
Tesco: Assets (million)	-	-	-	-	98.77	104
Market Share %					*0.04%*	*0.04%*

Source: UK Fund Industry Review & Directory 2000, 2001

Capital requirement: Bateson (2002) simply described that a new venture in a financial service requires large amounts of capital to start because an investment will be substantial. If this is the case, the capital requirement can work as a barrier to entry. The reason is that larger incumbent companies have easy access to a lower cost of capital than new entrants. (Mata and Portugal, 2002). As a result of the relatively high cost of capital for the new entrants, the potentially positive NPV project turns to be the negative NPV one for the new companies.

However, the sheer size of capital requirement as a barrier to entry is irrelevant here for two reasons. The first principal reason is based on the Investment Management Regulatory Organisation (IMRO)' s regulation. The IMRO imposes the following requirement on their members of fund management companies (Laslett, et al 1994).

- Those executing transactions and holding customers' assets must have liquid capital worth 13 weeks of their expenditure;
- Those executing transactions, but not holding customers' assets, must have liquid capital worth 6 weeks expenditure; and
- Those neither executing transactions nor holding customers' assets must have gross capital worth £5000.

Certainly, it is debatable whether the amount of capital matching with 13 week or 6 week of the company's expenditure is a tough constraint. However, recall the quotation from the City Research Project (Laslett et al, 1994, p12) that *the fund management task is essentially a fixed cost.* If this notion holds, and further assume that the management company has more power to control their expenditure than to control their revenue that fluctuates along with capital markets, the current capital requirement may not be so severe.

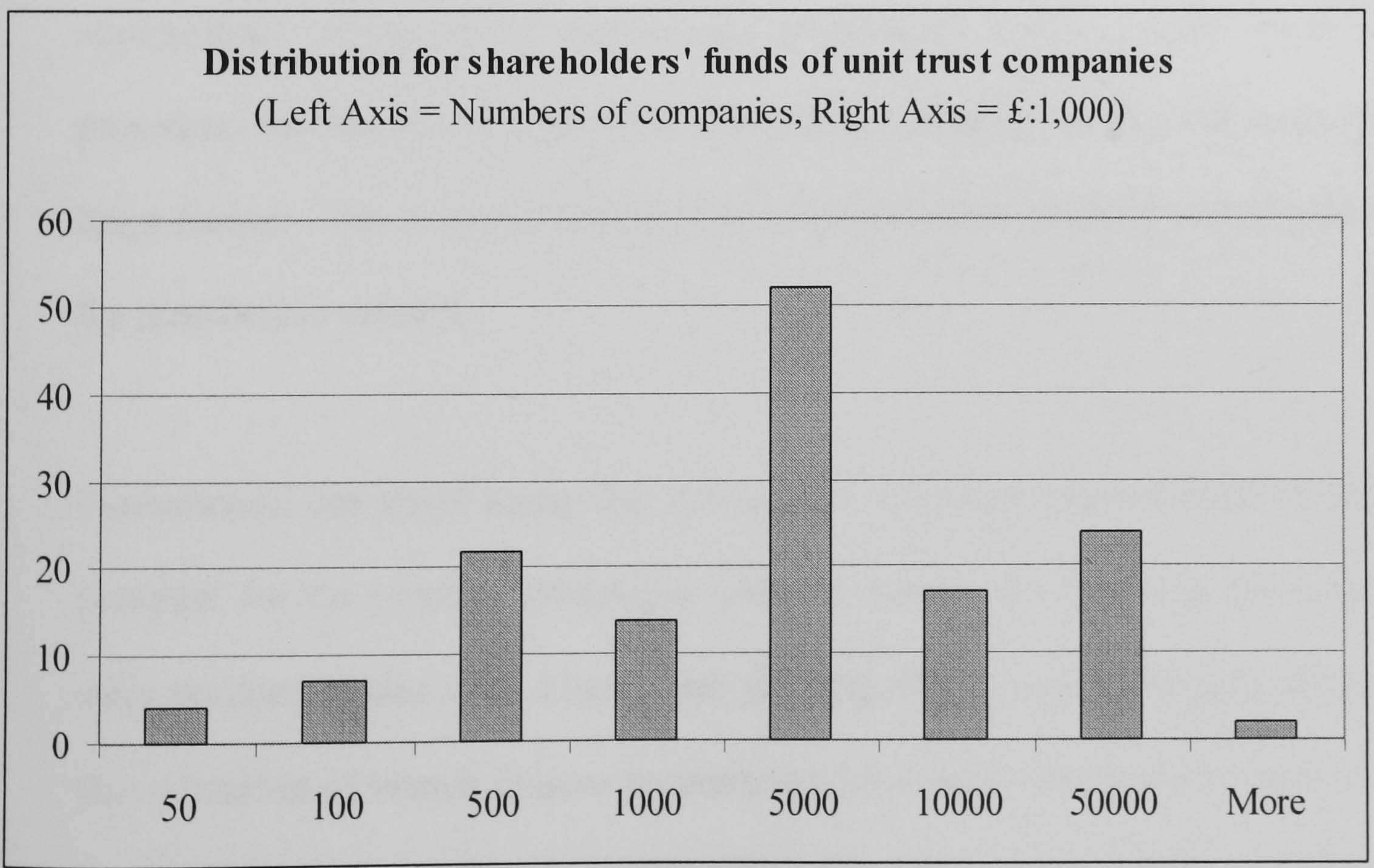
The next reason is related to financial theory. That is, if the capital markets are efficient, a new company can obtain capital to invest in any positive net present value (NPV) projects. Therefore, on balance, it appears that there is no severe requirement for capital in the unit trust industry. On the empirical side, Table 3.9 summarises sizes of capital for unit trust management companies. The size of capital significantly varies, suggesting that there is no clearer evidence of capital requirement being a barrier to entry.

Table 3.9: Descriptive statistics for shareholders' funds of unit trust management companies

Shareholders' Funds	£
Mean	6,722,840
Standard Deviation	12,038,320
Minimum	11,429
Maximum	75,756,000

Shareholders Funds (£:1,000)	*Number of Companies*
50	4
100	7
500	22
1000	14
5000	52
10000	17
50000	24
More	2

Figure 3.6 Distribution for shareholders' funds of unit trust management companies



Access to distribution channels: If there are distribution networks established by incumbent companies and used exclusively for themselves, it is difficult for new entrants to break into the industry, and costly to create new distribution channels. In this sense, many existing financial service organisations have an advantage over new entrants because of their large branch network. Such dominant distribution systems are in common across the global retail fund industry (PricewaterhouseCoopers, Investment Management Industry Profile: United Kingdom, 2002, p.17).

However, the UK unit trust industry is said to be relatively open in terms of the distribution system for three reasons. Primarily, as the preceding section points out, independent financial advisors (IFAs) are major distributors in the UK financial service industry, accounting for 60% of net sales in 2000 (Investment Management Association, 2003[13]). Recall the fact that the IFAs have occupational obligation to recommend investments from a wide range of providers, by identifying more than one product provider so that the customer has a choice. This suggests that there is a room for new entrants with regard to the distribution channel.

Furthermore, one could argue that direct sales via telephone and Internet have potential for the popular distribution channel despite the fact that the current sales portion remains low. Finally and less importantly, one must keep in mind that a number of branch closure programmes have been introduced recently due to the high overhead. This is an interesting trend from a theoretical perspective

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[13] Avaiabale at: <URL: http://www.investmentfunds.org.uk/industry_data>

that a joint distribution of bank, insurance and investment services enables the company to spread costs by using the branch network more intensively (See section 7.5.1 in Chapter VII. for *bancassures*).

Government policy: The City Research Project (Laslett et al, 1994; p 33) argued that the U.K has been a relatively free environment for financial transactions, compared with most European financial centres. No exchange control or controls on capital flows has been made since 1979. Further, the Financial Service Act 1986, followed by the Financial Services and Markets Act 2000, has changed the financial business environment more competitive. The change results in the development of the fund management business in the U.K.

3.3.4. Section Summary

The final section highlights characteristics of the U.K. unit trust industry. Given the industrial economics framework, a few interesting features become evident. For example, the lack of any dominant players, together with the slow but continuous increase in the number of management companies indicates entry barriers to the U.K unit trust industry are relatively low. It is also noteworthy that a few new entrants with their strong brands increase their market shares. The evidence suggests the possibility that differentiation strategies such as the branding have positive impacts on the market share in the unit trust industry (See Massa 2003 and Sigglekow 2003, for the similar evidence).

Fama and Jensen (1983 b) list several industrial elements serving as comparative advantages that one type of organisational form has over other types. One of the areas where public companies have a comparative advantage is the business that requires a large capital, taking advantage of the economies of scale.

The final section provides some evidence that the scale economies exist in the industry. However, the presence of the economies of scale must be interpreted with caution because the degree of the scale economies is relatively small. Notably, one must not ignore the fact that the diseconomies of scale emerge when the managed asset of the company exceeds a certain amount. Related to the issue of economies of scales, the capital requirement is subject to the size of the business expenditure so that the companies may be able to manage. Such evidence suggest that the large amount of capital may be favourable but not absolutely necessary to run the unit trust business in the U.K.

3.4 Chapter Summary

The U.K unit trust industry has expanded significantly in the past decade. The total fund asset under management increases from 20.3 billion in 1985 to 260.6 billion pounds in 2000. The first section outlined the structure of unit trusts, their investors and their operating companies behind such a phenomenal growth of the industry.

Next, crucial for the development of risk and performance measures used in the empirical chapters in the present thesis, the second section depicted the typical income structure of a unit trust management company. Under the current fee scheme, assets under management as well as new sales are viewed as key income drivers. Notwithstanding, a management company appears to have less pricing power over the fee settings.

Finally, the U.K unit trust industry is characterised by (i) the economies of scale is present but the magnitude is smaller than expected, (ii) the market structure's movement toward the perfect competition, and (iii) the use of branding and product differentiation to help capture the market share. Given the mixed features of the industry, Fama and Jensen's implication that a stock company has an advantage in business where economies of scale are present, requiring a large capital is not beyond contention.

Nonetheless, the basic analysis of the industry is indispensable because these industry characteristics should be included in the empirical models in the subsequent chapters as a form of variables. For example, models in Chapter IV develop the efficiency ratio based on revenue, capital employed, and administration expenses. Other examples are that most of the models in the empirical chapters incorporate the size of the company' managed asset, controlling for the potential effect of the scale economies. This controlling variable is used to assess the robustness of the models.

The subsequent empirical chapters attempt to formulate a number of hypotheses by taking into account the industry characteristics.

Chapter IV
Analysis of Corporate Risk-Taking

4.1 Introduction

The agency theory and its applications to financial studies are outlined in the literature review chapter. In essence, the theory explores the relationship between principals and agents who act on their behalf. The assumption is that interests among stakeholders in modern corporations e.g. managers, shareholders, and debt-holders vary because the nature of their residual claims are different. In this set-up, it is argued that without proper controlling mechanisms, such a divergence of interests can affect any business activity, and ultimately the value of the company.

The line of research with regard to the controlling mechanisms has progressed from the standpoint of organisational forms. Along with the agency paradigm, several researchers have focused on the effects of the organisational form on the level of risk that a company takes. Those who investigated the relationship between organisational form and the risk taking of a firm include Fama and Jensen (1983a and b), Mayers and Smith (1988,1994), Knopf and Teall (1996), and Esty (1997a and b).

By comparing the risk-taking activities of stock-owned companies with those of mutual institutions, the aftermentioned developed their hypotheses on the organisational effect. Fama and Jensen (1983a and b) and Mayers and Smith (1988,1994) addressed comparative advantages in dealing with the agency problems whilst Knopf and Teall (1996) and Esty (1997a and b) emphasised the nature of the residual claims in stock owned companies, using an option-pricing framework.

Building on the foundation of the financial literature, the aim of the first empirical analysis is to explore the connection between risk-taking activities and ultimate ownership, e.g. the organisational form of a holding company in the UK unit trust industry. To this end, this chapter employs three different risk proxies because a study by Regan and Tzeng (1999) suggested that the relationship between organisational form and risk bearing activities is dependent on a choice of the risk proxy.

For the purpose of the analysis regarding the effect of organisational form on risk-taking activities of unit trust companies, Chapter IV consists of several sections. In section 4.2 a closer examination of several scholars' arguments is presented. Subsequently, based on the preceding discussion points, the set of hypotheses is developed. The research methodology is discussed in section 4.3. Included in the methodology section are variable formation, data collection, and selection of statistical models. In conclusion section 4.4 provides the results from the statistical analyses.

4. 2. Review and formation of hypotheses

4.2.1. Overview of background hypotheses

In order to establish a set of testable hypotheses, this section provides reviews of the agency theoretic literature on the relationship between organisational form and risk-taking. Specifically the review in this section focuses on the three important hypotheses in this area: Cash flow uncertainty hypothesis (Fama and Jensen, 1983b), Residual incentive hypothesis (Rasmusen, 1988 and Esty, 1997a), and Managerial discretion hypothesis (Mayers and Smith, 1988 and 1994, and Lamm-Tennant and Starks, 1993).

4.2.2 Cash flow uncertainty hypothesis

Focusing on residual claims, which can distinguish organisational forms from one another, Fama and Jensen (1983a and b) stated that the diversity of residual claimants within these organisational forms can lead to comparative advantages of various organisational forms over the others. In the context of this research subject, the most important difference between mutuals and corporations is that the residual claims are redeemable on demand in mutual institutions. This is not the case for stock companies' equities. Due to the non-redeemable nature of the residual claims in the stock owned company, demands for a secondary market emerge. In the secondary market where the stock company's shares are exchanged, the residual claims against uncertain cash flow business are priced more efficiently than would be the case with redeemable residual claims for which there would be no secondary market (Fama and Jensen, 1983a and b). This view leads to the following implication: compared with mutual institutions, corporate organisations should be more involved in activities where future cash flow is less certain because the capital market mechanism comes into play for evaluating such risk projects.

To enrich their argument, Fama and Jensen examined revenues of the banking and insurance industries where different organisational forms co-exist. Making a distinction between revenue from business activities[1] and that from financial activities, the authors considered the business revenue as a less stable cash flow resource than the financial related revenues. Hence, they expected that corporate financial organisations were likely to have product portfolios that make for a less certain cash flow, i.e. more business receipts as a percentage of total receipts.

Based on the cross sectional data, Fama and Jensen found that as their hypothesis predicted corporate banks had more business receipts than mutual banks. However, the data for casual insurance showed a mixed result as the mutual insurers had a higher ratio of business receipts to total receipts.

Note that studying Fama and Jensen' work, Lamm-Tennant and Starks (1993) interpret that uncertainty of future net cash flow is referred to as the risk proxy for the insurance business. By borrowing the Lamm-Tennant and Starks' view and extending the cash flow hypothesis to the U.K unit trust industry, the

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[1] Business revenue is referred to as revenues other than interest, dividends, and capital gains.

following hypothesis can be established. Unit trust management companies owed by proprietary companies should partake in riskier activities than those owned by mutual institutions.

4.2.3 Residual incentive hypothesis

Building on the option-pricing paradigm (Black and Scholes, 1973), Esty (1997a and b) asserted that compared with mutual ownership, stock ownership is likely to adopt a higher risk strategy, aiming at large pay-outs which belongs to stock owners.

Esty's basic framework from the option-pricing theory is that the pay-off to leveraged equity resembles a call option on the company assets and the value of the option is a function of the company's volatility. Clearly, the idea above leads to the classic conflict of interests between shareholders and debt-holders, often referred to as the wealth transfer effect.

Esty (1997a and b) presented the following reasons for such a conflict. The primary reason is that members in a mutual institution are not only residual claimants but also fixed claimants. In such a situation, where the level of risk rises, the increasing value of the residual claim is offset by the decreasing value of the fixed claims. By contrast, in a stock-owned company where the fixed claimants and residual claimants are separated, the residual claimants do not necessarily lose their residual value when the risk increases. Rather, the value of their residual claims increases as the risk increases so that a strong incentive exists for the residual claimants; i.e. shareholders in the company, to take higher risk.

As long as the mutual is solvent, members in the mutual institution are less interested in monitoring their mutual organisation than shareholders in the stock owned company. It is not practical for the mutual members to sell their residual claims so that the gains with the residual claims are limited. On the contrary, shareholders of the stock owned company can trade the shares more easily and more quickly, making capital gains. Finally, it is possible to issue additional equity shares to make up for losses which the risky project incurs. In a sense, by issuing new shares the existing shareholders can extend the maturity of their call-option type wealth. On the other hand, mutual institutions are not allowed to increase their capital in the same manner. These factors drive shareholders to take risk whereas the mutual members are becoming indifferent to their mutual institution's activities.

Esty (1997a) used the quarterly financial reports of more than 3000 thrifts from 1982 to 1988. Viewing profit variability (one cross sectional and one time-series) as risk measures, Esty regressed the risk measures on organisation form and a number of control variables. His results showed that stock oriented saving and loans companies (S&Ls) exhibited significantly higher profit variability during the period in question. Based on the results, Esty concluded that ownership was a determinant to the risk taking of the S&Ls.

Esty (1997b) also conducted a striking case study, showing how different forms of organisation affected risk-taking activities. Esty studied two different S&Ls, a stock based S&L, *Twin City* and a mutual institution, *Minden*, on the basis that in terms of size, location, asset composition, and capitalisation, both S&Ls shared quite a similar business background aside from their different organisation form, i.e. stock converted ownership versus mutuals. The evidence provided in the cases of Twin City and Minden supports Esty's hypothesise. Following their conversion into a stock S&L, Twin City pursued an unsustainable level of expansion by investing non-mortgage loans business whilst paying a large amount of dividend and salary to shareholders and their directors. As a result of the excessive expansion, Twin city became bankrupt whereas Minden stuck to their traditional home mortgage activities and survived.

For the objective of this chapter, the residual incentive hypothesis, therefore gives rise to the following hypothesis: Proprietary companies engage in higher risk activities than comparable mutuals.

4.2.4 The first hypothesis

Both hypotheses summarised above have suggested the common implication, which is defined as the first testable hypothesis.

H (1): Risk Taking. Unit trust management companies whose ultimate owners are stock (*mutual*) owned companies should engage in more (*less*) risky activities given the permitted asset management business.

The next important task is to define the risk-taking measures and to make them operationalised in order to reflect the risk dimensions discussed in this section. This issue is addressed in section 4.3. Before turning to the methodology section, it is desirable to review the following managerial discretion hypothesis that helps shed additional light on risk-bearing activities of the unit trust management companies.

4.2.5 Managerial discretion hypothesis

Whilst Fama and Jensen (1983a and b) viewed the capital market as the assessor of uncertain cash flow projects, Mayers and Smith (1988 and 1994) emphasised disciplinary mechanisms of the capital markets and shareholder meetings against managers. Mayers and Smith argued that agency problems are inevitable in both stock-owned corporations and mutual institutions. Nonetheless, controlling and monitoring managerial activities is more efficient and less costly in stock-owned companies than in mutual organisations for the following reason: Opportunistic managers working for stock owned companies are often removed either by annual general meetings or by a course of action of merger and acquisitions. In contrast, such managers in mutuals are only removed through a proxy fight, which is rarely held, by widely diffused small policyholders. This observation leads to the underlying notion of the managerial discretion hypothesis. In essence, because giving discretionary power to managers is more expensive in mutual associations than in stock-owned companies, the mutual organisations should be more prevalent in business activities where less managerial discretion is required.

However, the following two remarks should be considered in testing the managerial discretionary hypothesis. Primarily, it is rather problematic to measure the managerial discretion. Secondly, the managerial discretion hypothesis offers little clear explanation for the linkage between organisational forms and their risk taking.

With regard to the first issue, Mayers and Smith admitted to the difficulty of measuring managerial discretion. Nevertheless, as an alternative solution, the authors examined the line of business, taking a view that the actual lines of business mirror the degree of managerial discretion. More specifically, an analysis of the line of business is useful in two respects. Primarily, such an analysis should provide some indications of whether different ownership structures should dominant in particular lines of business (business specialisation). Secondly, the analysis reveals the business concentration, which should be representative of the degree of managerial discretion. The rationale is that a concentration in a few lines of business can curb managerial discretion.

With regard to the association between organisational forms and risk-taking, it is worth considering the research of Lamm-Tennant and Starks (1993), who refined the managerial discretion hypothesis in the following manner. Assuming that the need of managerial discretion is reflective of the degree of business risk, Lamm-

Tennant and Starks indicated that mutual organisation are likely to pursue less risky business than stock-owned counterparts.

From an empirical perspective, Mayers and Smith (1988, 1994) conducted the following two researches. In their first research, Mayers and Smith (1988) applied their theory to the U.S insurance market where four different organisational forms co-exist, i.e. common stock companies, mutual companies, reciprocal associations, and Lloyds associations. Investigating "line of business specialisation", "line of business concentration" and "geographic concentration" in the data sample of 1479 insurance firms for 1981, the authors attempted to identify any cross sectional difference among these different organisations as the influence of ownership form on business risk. Based on the data from the A.M Best Company[2] for 1981, the cross sectional analysis indicated that mutual and stock owned insurers have their own preferences for insurance products although it was hard to pinpoint where their competitiveness lay. However, it is not clear if business concentration significantly differs between mutual insurers and stock owned insurers. These observations presented mixed evidence concerning the managerial discretion hypothesis.

In their subsequent study, Mayers and Smith (1994) focused on the U.S common stock insurers. The main reason for selecting common stock insurers was that the potential effects of taxes and regulation on ownership could be reduced by studying ultimate ownership variations among common stock firms. In their

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[2] The data sample consisted of 1058 common stock insurance companies, 319 mutual insurers, sixty reciprocal associations, and forty-two Lloyds associations.

study, the stock insurance companies were grouped into widely held, closely held, mutual owned and association owned stock companies. Their data sample included the U.S 1216 insurance firms in 1981. Based on the 26 lines of insurance business, Mayers and Smith investigated the production allocation[3] among the insurers. Their analysis showed that the production allocations of mutual owned stock insurers were more similar to those of mutual insurers than those of widely held stock companies. Furthermore, according to their logistic regression results, ownership was significantly related to the degree of managerial discretion, measured by the allocation of business, line-of–business specialisation, and geographic concentration. This evidence formed empirical support for the managerial discretion hypothesis.

Lamm-Tennant and Starks (1993) empirically examined the U.S property liability insurance industry. With data covering 95% of the U.S property liability industry over an eight-year period, 1980-1987, the authors employed a logistic regression model to analyse the relationship between organisation form and risk taking. It is important to note that in their model, the variance of firm loss ratio was computed as risk proxy of an insurance firm.

Their analysis presented a few significant results: (i) As an overall result, stock corporate insurers tended to have higher variance of loss ratio than mutual insurers. (ii) In order to examine lines of business closer, the stock corporation insurers engaged in more lines of business with higher risk than mutual insurers.

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[3] "Production allocation" refers to the percentage of total business allocated by company to the particular line of insurance activities.

(iii) With regard to geographic breakdown of their business activities, stock corporate insurers were inclined to concentrate in states which had higher variance of the loss ratio. Their observations were consistence with the implications of the managerial discretion hypothesis of Mayers and Smith.

4.2.6 The second and third hypotheses

According to Mayers and Smith (1988 and 1994), the cost of monitoring managers is higher in a mutual organisation, the managers are limited in their decision making authority. As a result, mutual organisations concentrate on business where the need for such authority, e.g. the managerial discretion, is lower. Applying the Mayers and Smith's logic to the U.K unit trust industry, the managerial discretion hypothesis can be testable by splitting into two sub-hypotheses.

H (2): Line of Business Specialisation. There should be a difference between mutual and stock owned unit trust management companies in terms of particular lines of fund business, which account for the degree of managerial discretion.

H (3): Line of Business Concentration. The number of funds or different fund types should be smaller in mutual owned unit trust management companies than stock owned counterparts.

One can argue that the two hypotheses may not fit the bill for the scope of this chapter because of no explicit linkage between the managerial discretion and the risk bearing activities. Nonetheless, testing hypotheses (H2) and (H3) is valuable for two reasons. Firstly, following the Lamm-Tennant and Starks (1993)' view, it is possible to relate hypotheses (H2) and (H3) to the context of this chapter. As noted briefly, Lamm-Tennant and Starks make an assumption that "*managerial discretion requirements are reflected by the riskiness of the business income. Then, Mayers and Smith's managerial discretion hypothesis also implies that mutual insurer should be involved in the less risky activities on either a by-line or total firm basis*" (p.33).

Second, because no single and perfect risk measure for the company exists, a number of different risk measures should be used for the cross-examination purpose. By sorting each fund category into the high and low risk groups, the hypothesis (1) computes the risk-taking index on the basis of the two fund categories and uses the index as the risk proxy. In contrast, by testing hypotheses (H2) and (H3), it is possible to distinguish patterns across the different organisational forms at the individual category level. For these reasons, hypotheses (H2) and (H3) should provide additional insights on the risk-bearing activities across the three types of ultimate ownership.

4.3 Methodology

In order to test the set of hypotheses in section 4.2, the following methodology section is divided into several sub-sections. Section 4.3.1 outlines the research design. Section 4.3.2 addresses how variables are defined and operationalised. Section 4.3.3 discusses measurement validity. Coupled with the variables, section 4.3.4 describes data collection and sample of the data set. The last sub-section of 4.3.5 describes statistic models whilst providing explanations and justifications for the use of particular specific models.

4.3.1 Research design

The underlying research design through out the empirical chapters is a cross sectional research format for the following reasons (Bryman, 2001):

More than one case: the current research is ultimately interested in variations in respect of ultimate ownership in the UK unit trust industry where more than one type of ultimate ownership exist; mutual organisation, exchange listed company and privately owned company.

Non-manipulable variables and Patterns of associations: Related to the first point, the research focus is not on the causality but on the relationship between variables. This may create a problem if one is interested in a causal relationship between the variables.

In order to have certain ideas about causality, it is necessary to manipulate the ultimate ownership variable and examine changes of a dependent variable. However, as the ultimate ownership variable simply cannot be manipulated, this is not feasible. The point to emphasise is that *because the features of an experiment design are not present* (Bryman, 2001,p.40), it is not possible to be certain whether the relationship is causal or otherwise.

One of the possible methods is to examine risk taking and performance for a number of unit trust management companies whose ultimate ownership has been converted from mutual to stock owned company. This type of causality analysis should compare the risk-taking and performance of these companies before the ownership change with those after the change. However, it is not feasible to adopt such a research method primarily because the demutualisation boom has occurred in the U.K since the mid 1990's. As a result, a very small amount of time series data is available for unit trust companies that experienced the demutualisation via their ultimate ownership in conducting analyses on the basis of audited financial statements.

A single point in time: Finally and similarly to the issue of availability of annual financial information, the empirical investigations scrutinise a single point in time, in that data on the variables such as risk taking, performance, and ultimate ownership form of the unit trust management companies are collected simultaneously. It is also noteworthy that this cross-sectional approach corresponds to that of Mayers and Smith's study (1988). The main reason for the cross-sectional or "snap shot approach" are twofold. The first and foremost, the analysis of companies in a rapidly changing financial industry is a demanding task. Specifically, to identify certain characteristics common to one type of organisational form can be problematic. As several companies have gone though the organisational changes, it is hard to maintain the consistency with regard to a set of the companies in the data. For this reason, the sample year used in this chapter is 1999-2000, which is the most stabilised year as less frequent demutualisation occurred in the U.K financial industry after the mid-1990's demutualisation wave.

Secondly, the product mix as a unit of risk taking proxy of a unit trust management company may change slowly in the long run but will not change completely overnight. For instance, it is very unlikely that a unit trust company would wind up all the existing unit trusts whilst establishing new ones in each year. Such a complete change would be unfavourable not only for unit holders who invest in the existing unit trusts for a long term perspective, but also for the company itself that often makes use of their long term performance as a means of advertisement. In a related manner, it is not possible for unit trust management companies to ignore the current practice of performance evaluation. Fund performance agencies such as S&P Micropal, MorningStar, and FT fund service, providing influential fund valuation data[4], always take into account the three-year or longer performance when evaluating unit trust performance.

[4] An article of Financial Times pointed out that 65% of net new money has been channelled into funds rated in the top third –up from 60% last year (James Mawson, "Managers call for rating reform", Financial Times, 12 August, 2002

4.3.2 Variable formation

Section 2 presented several risk-taking measures within the research area of the risk-organisation relationship. In studying the risk of the unit trust management business, a question of interest is how risk is measured. There are a few possible risk measures. For example, from the practitioner's perspective, PricewaterhouseCoopers (2000) categorised various risk across the fund management organisation into the following types; organisational and systematic risk, market and credit risk, compliance and regulatory risk, human resource risk, strategic risk, third party and e-business risk. This is a cause for concern because the linkage between organisational form and risk-taking depends on a choice of the risk-taking measure (Regan and Tzeng, 1999).

Connection to company's income source

Chapter III reveals the way in which unit trust management companies generate their revenue, suggesting the importance of the size of the fund assets under management. Thus, the definition of risk in this research context should be linked to the fund assets generating the income of the unit trust management company. Such an approach can be justified in two ways.

Firstly, building on the literature that reveals fund assets under management are directly related to management fee income (Chevalier and Ellison, 1997, Massa, 2003 and Siggelkow, 2003) it seems plausible to define fluctuation of the fund assets under management as a risk for the unit trust management company. The implicit view for this is that business risk is linked to the company's operating income.

On the empirical side, a number of periodical articles point out that the business closure of the fund management company may occur when the company fails to raise and keep sufficient amounts of funds' assets, which are the principal revenue generators. The following serves as a good example. According to *the Barrons'*(1998), the U.S money magazine, United Asset Management shut down their mutual fund subsidiary, HMH, because HMH did not have the critical mass to continue their business after they were informed of a large withdrawal from their fund by a major fund investor[5]. This point of view echoed the *Economist*'s article (1994), describing "*the industry's worst nightmare*" as " *a mass redemption of mutual funds*"[6]. The U.K financial magazine, *Money Management* (2001) also reported that "*business risk for an investment management firm is, quite simply the risk of losing the mandate to manage a fund*[7]". These articles provide some justification for the line of reasoning that; in terms of the company's revenue, the total assets of the managed funds can be used as a business risk factor of the unit trust company.

Focus on product mix

Given these justifications, the next task is to develop a risk proxy that is closely linked to the managed assets for a unit trust company in the UK. The key

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[5] Barry Henderson "Mutual Funds: Another member whacked", Barron's 11 May 1998, Vol 78, issue 19

[6] Anonymous, "Running out of stream" Economists, 24 December 1994, Vol 333. Issue 7895

[7] Sir Mark Weinberg "Business risk before performance" Money Management June 2001, p80

solution for this task falls on the company's set of fund products. The main logic behind this view is that the product mix should reflect the company's risk decision because the company can choose types of assets and objectives in which to invest when launching their new funds. This line of argument is supported by a recent study by Massa (2003, p252), stating that each company's choice consists of the decision to set up a fund with specific characteristics.

There are further benefits for focusing on the product mix of a unit trust management company. One must recall that the total asset of the unit trust company is comprised of a set of individual unit trusts. Unit trusts are distinguishable according to their investment objectives defined by the primary type of securities in which the funds invest. Such fund categories are often referred to as the fund sector. As various fund categories are present, it is possible to assert that the company's product mix can have a portfolio effect or diversification effect on the total asset under management, parallel to the conventional investment portfolio. It is intuitively obvious that risk is greater if the company relies on the single product than on multiple fund products. Furthermore, different fund assets have different levels of risk. In other words, some fund sectors are more risky than others because of the investment objective. Using a simple test the topic is further examined from a validity perspective, at the end of this section.

In addition to the principal reasons above, two recent papers by Massa (2003) and Siggelkow (2003) provide strong support for the product mix approach, reporting evidence that the company's product set accounts for the uncertainty of cash flow into the company. It should be also noted that a similar risk proxy was employed in other financial literature. Lee et al (1997) demonstrated that the insurers' portfolio component, which consists of stocks, bonds, and other assets was analysed as the risk measure for the property liability insurance industry. From a slightly different angle, Mayers and Smith (1988, 1994) considered the line of business specialisation and concentration as risk measures in their insurance studies. Following these empirical studies, the fund mix analysis should reveal the line of business in the fund management companies, enhancing the present risk analysis of the company.

As for the current business practice, the diversity of a product range is often used as a risk proxy by industry consultants. One example is PricewaterhouseCoopers (1998) who conduct the annual survey for the UK asset management industries: PricewaterhouseCoopers states that "*a recurrent finding in our surveys over the past decades has been the correlation between the diversity of product range and profitability. Focused, specialist businesses has been consistently more profitable on average than those active in a wide range of products*" (Investment Management Survey, 1998, p 19). Of course, in the light of the risk-return connection, their finding may not necessarily hold to the unit trust business because their annual survey includes not only retail fund business but also institutional businesses such as insurance and pension fund management businesses. Nonetheless, PricewaterhouseCoopers should be regarded as valuable support for the product based approach as the risk proxy for an asset management company in general.

In essence, the examples from both academic literature and a consultant's practice support the product mix approach, which is used as the risk proxy for a unit trust management company.

Alternatively, one can argue that the volatility of the stock price can be a proxy of the stock owned unit trust companies. But, all unit trust management companies themselves are not traded in stock exchanges. The more important remark is from Knopf and Teall (1996) who studied the risk-taking behaviour of the U.S thrifts. The researchers pointed out that "(stock) *return variability in the thrift may not have been intended by management* (p1331)".

As a solution, Esty (1997a) demonstrates in his empirical work that the profit variability can be used as the risk proxy for non-listed financial institutions. However, a close examination of financial statements of the UK unit trust companies in Chapter III and IV reveals that accounting based measures such as return on asset, debt-equity ratio and operating margins are subject to the company's transfer pricing policy within their financial group. It is up to the group policy about the capital allocation to their unit trust management subsidiary. Moreover, it is the group internal accounting rule that determines how much the unit trust company pay to their associated group companies in order to cover the cost of advisory or marketing fees. Therefore, the group accounting policies are very likely to distort the reality of their business operations. This is an important factor to emphasise when measuring performance of individual unit trust management companies. Hence, this issue will be further addressed in the next chapter where the relationship between efficiency and ultimate ownership is examined.

Common Framework

The proceeding sections justify the use of the fund mix as a basis of the risk-taking of the unit trust management company. It is now necessary to compute the risk related measures for a set of the hypotheses; risk activity (H1), business specialisation (H2), and business concentration (H3). Certainly, each hypothesis requires different risk measures. However, the underlying and common factor across the risk measures is the unit trust's investment objective. More precisely, as a measure of the product mix analysis, this chapter focuses not on individual unit trusts but on the investment objective, i.e. the fund sector classification into which each unit trust is sorted. The reasons are threefold. Firstly, the nature of an individual fund's risk is well portrayed in the fund sector into which the individual fund is categorised. Massa (2003) notes that *segmentation* (i.e. a fund category) *reduces the scope and range of activity of the manager and forces him to invest only in the assets specific to the fund's category"* (p.250). Another way of saying this is that given the well-defined investment objective for each sector, risk and return of funds within the fund sector are unlikely to vary widely. Appendix 4-b shows some lists descriptions of the fund sector objectives. Secondly, evidence from Khorana and Servaes (1999), Massa (2003) and Siggelkow (2003) suggests that the fund's investment objective is one of the most important factors from the fund management companies' perspective. Thirdly, this sector-basis approach is advantageous in the way that sector information is publicly available from several data resources.

Computation of risky business activities (H1)

The variable formation for testing hypothesis (H1) is a complex task. There are two fundamental ideas leading to the variable development.

Standard deviation as risk: Despite the fact that there is a general lack of agreement concerning the notion of risk, almost all investment textbooks define risk to be its volatility of returns measured by the standard deviation. In other word, the term risk is defined as the dispersal of actual outcomes from expected (or averaged) results. Given the notion of risk in the investment literature, the first hypothesis testing relies on the standard deviation framework for computing the risk proxy.

Investment return and money flow: It is of some interest to say that the aggregated size of assets under management is affected by numerous factors. The value of the underlying investment is one factor which affects the size of the assets under management. Furthermore, money that flows into the unit trust industry as well as into the individual unit trusts is an important element, affecting the asset size of the company. Building on the above point, this study focuses on two characteristics of individual fund sectors as risk factors affecting the company's asset size. The first element is the return generated by the sectors. The second factor is the level of actual net money that flows from the unit holders into the sectors.

Based on the two concepts summarised above, the risk measures involve the following computation phases. The first is to calculate the standard deviation of each sector on the basis of (i) the averaged monthly return of all the unit trusts in the sector and (ii) net money flow of the unit trusts in the sector. Each fund sector is ranked according to the standard deviations of (i) and (ii). At the second stage, the sector rankings are split into the top half and the bottom half by ascending order of (i) and (ii). The top (or bottom) half group is referred to as the high (or low) risk sector. Subsequently, the proportion of the top half sectors over the total asset of each company is calculated. The range is from 0 to 100 percent.

Computation in detail: Every month, Money Management publishes the standard deviation of return for each sector. The standard deviation of sector *j*'s return is computed as

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{36}(r_{ij} - \bar{r}_j)^2}{35}} \tag{4-1}$$

where

σ_j = the standard deviation of the averaged return of all the unit trusts in sector j over the 36 month period.

r_{ij} = averaged monthly return of all the unit trusts in the sector j during month i

$\bar{r}_j$ = sector j's average monthly return over the 36 month period (from January 1996 to December 1999).

On the other hand, calculation of the standard deviation of money flow over the 36 month period is problematic due to changes of the AUTIF fund categories which often occurred over the last decade. For this reason, the 32 sector classification needs to be adjusted in order to compute the standard deviation of the sectors' money flows. As a solution, the 32 sectors classified in June 1999 were regrouped to 16 sectors, by the sectors' geographic orientations and by the sectors' capital or income growth orientations. A note in Table 4.1 shows the detail for this regrouping. It should be noted that the adjustment process keeps the 16 sector classification closely matched up with the prior sector classification systems used before June 1999.

In addition to the regrouping procedure, this analysis excluded two particular months, August 1998 and June 1999 when the classification systems were updated. The reason for excluding the two periods is to ensure the consistency of money flow changes. In a manner similar to Sirri and Tufano (1998), net asset flow is calculated as

$$\text{Net Asset Flow}_{i\,t} = [\text{Asset}_{i,t} - \text{Asset}_{i,\,t-1} \times (1+R_{i,t})] \qquad (4\text{-}2)$$

where

$\text{Asset}_{i,\,t}$ = the industry's total asset in fund sector i at the end of month t

R = the return of fund sector i during the month t

Thus, the monthly net asset flow ratio is computed as follows;

$$\text{Net Asset Flow Ratio}_{i,t}\ (\text{NAFR}_{i,t}) = (\text{Net Asset Flow}_{i,t}) / (\text{Asset}_{i,\,t-1}) \qquad (4\text{-}3)$$

Based on the computation above, the standard deviation of the ratio is calculated as follows.

$$= \sqrt{\frac{\sum_{t=1}^{34} (NAFR_{i,t} - \overline{NAFR_i})^2}{33}} \qquad (4\text{-}4)$$

The results of (4-1) and (4-4) are ranked and split into the top half and the bottom half by ascending order. Table 4.1 presents these rankings. For each sample company, the proportion of the top half sectors over the total asset of each company is calculated. The range is from 0 to 100 percent.

Table 4.1 Fund sectors with low/high standard deviation of returns (1-a) and Money flow (1-b)

Table 1-a

Sectors	Return_SD
Far East Specialist	13.47
Global Emerging Markets	10.18
Far East Excluding Japan	9.85
Japanese Specialist	9.63
Far East Including Japan	8.17
Japan	7.32
European Specialist	6.89
North America Specialist	6.76
Global Specialist	6.71
Europe Excluding UK	6.2
UK Smaller Companies	5.75
North America	5.24
Europe Including UK	5.2
Global Growth	4.96
UK All Companies	4.34
Active Managed	4.21
Index Bear Funds	4.14
UK Equity Income	3.88
Global Equity Income	3.82
UK Specialist	3.77
Balanced Managed	3.72
Global Equity & Bond	3.59
UK Equity & Bond	2.96
UK Equity & Bond Income	2.91
Managed Income	2.79
Cautious Managed	2.72
Property	2.02
Global Bonds	1.78
UK General Bonds	1.55
UK Gilt	1.53
Guaranteed/Protected Funds	1.44
UK Money Market	0.08

Table1-b

Sectors	STDEV(34months)
Emerging	0.154
Index Bear	0.112
Property	0.112
Asia	0.111
UK_Small	0.102
Global Equity Income	0.077
North America	0.075
Global Growh	0.075
Europe	0.074
UK_Equity Income	0.074
Japan	0.070
Global_Bonds	0.066
UK_All Companies	0.048
Managed	0.047
UK_Bonds	0.040
Money Market	0.031

There are 32 fund sectors classified by the Association of Unit Trusts and Investment Funds. Table (1-a) shows the sector's standard deviation of monthly returns over 36 months (from 1997 to 1999). The data is taken from the Money Management February 2000. Sectors in the top half are defined as the high risk sectors

Table (1-b) shows the sector's standard deviation of monthly net flows over 34 months (from 1997 to 1999). The data is taken from the AUTIF web site. Sectors in the top half are aggregated and defined as the high risk.

Note for Table 1-b
"UK Bonds" includes UK General Bonds, UK Gilts
"Managed" includes Managed Income, UK Equity & Bond Income, Cautious Managed, Balanced Managed, and Active Managed
"UK All Companies" includes UK All Companies and UK Specialist
"Japan" includes Japan and Japanese Specialist
"Asia" includes of Far East Including Japan, Far East Excluding Japan and Far East Specialist
"Europe" includes Europe Including UK, Europe Excluding UK and European Specialist
"North America" includes North America and North America Specialist

Computation of line of business specialisation (H2)

The aim of the hypothesis (H2) is to compare the ultimate ownership groups in terms of their asset distribution across the 32 fund sectors. For this purpose, a measure of business specialisation is a simple asset weight (%) of each fund sector within a unit trust management company.

Computation of line of business concentration (H3)

Two Herfindahl indices are computed to test out the hypothesis (H3). The first index is based on the number of funds within a unit trust management company and written as:

$$\text{The fund based Herfindahl index} = \sum_{i=1}^{n} (FundAsset\%)^2 \times 10{,}000 \qquad (4\text{-}5)$$

The second index is based on the number of fund sectors within a unit trust management company and written as:

$$\text{The sector based Herfindahl index} = \sum_{i=1}^{n} (SectorAsset\%)^2 \times 10{,}000 \qquad (4\text{-}6)$$

Used in recent research papers by Khorana and Servaes (2000), Massa (2003) and Siggelkow (2003), the first index captures the breadth of concentration at the fund level whilst the second represents the degree of concentration at the investment objective level.

Ownership variables

Based on the fact that unit trust companies are usually subsidiaries of financial groups, this research divides the ultimate ownership characteristics of the groups into the three forms; mutual, quoted and private group. This classification is meaningful from two perspectives. From the standpoint of external control mechanisms such as stock markets, the split between quoted companies and privately owned companies is essential because the stock market monitoring mechanism helps mitigate the agency problem between a listed company's owners and its managers. In contrast, such an external control mechanism is not applicable for a privately owned company.

Additionally, in the context of ownership concentration, it is reasonable to suppose that the stock owned companies have dispersed ownership whereas the private owned companies have concentrated ownership. At this point, stakes of quoted company shareholders can account for small portions of their well-diversified wealth. On the other hand, shareholders' interest of the privately owned companies are relatively under-diversified. To the extent that the value of the business represents a major part of the owners' wealth in private owned business entities, under-diversified owners are more risk averse than stock company owners whose wealth can be diversified (Zhang, 1998). From the viewpoint of testing the hypothesis, it is expected that the degree of risk taking of unit trust management companies owed by private companies should range between those of mutual owners and quoted company owners.

In the U.K, it is relatively easy to make a distinction between public and privately owned companies by referring to the London Stock Exchange rules. The London Stock Exchange sets out the listing criteria for a public limited company (The London Stock Exchange, 2002). These criteria, for example, include incorporation under the relevant laws, audited accounts, track records covering a three-year period, directors with appropriate collective experience and expertise to run all areas of the business. In addition to these general requirements, there are other conditions that are more important to the purpose of the analyses in this thesis. As for the financial requirements,

- Working capital should be large enough to cover not only its current needs but also at least the next 12 months.
- At least, 25% of the listed company's shares should be in public hand.
- A total market capitalisation should not be less than £700,000 and would normally be expected to be much larger.

With regard to the relationship with large shareholders, the company must be able to carry out its business independently, at arms' length from any shareholders with a controlling interest[8].

To a certain extent, the directors of a private company may deem such an arm's length relationship to be a loss of their managerial control. Furthermore, due to the greater level of accountability owned to external shareholders, the directors are likely to lose much of the privacy and autonomy that they may have enjoyed when running a private company.

On the mutual side, the constitutions of financial mutual organisations vary (Armitage and Kirk, 1994). For example, building societies are governed by the

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[8] The controlling interest refers to anyone with control of more than 30% of the shares, or who can influence the appointment of directors

Building Societies Act whereas Co-operative associations are established under the Industrial and Provident Societies Act. The sample companies are classified by ultimate ownership type in Appendix 4-a.

4.3.2 Measurement Validity

The issue of validity is of some importance. Consequently, the present thesis uses measures which have been utilised in the research papers previously described. Arguably this provides a certain validity to the present research. To begin with, it can be said at the very minimum level the risk variable on the basis of the company's product mix is satisfied with face validity. The face validity refers to *professional agreement that a scale logically appears to accurately measure what it is intended to measure* (Zikmund, 2003,p302). The way in which the product mix approach provides the face validity is that the measure is created with a format of standard deviation, which is viewed as a conventional risk framework among standard investment textbooks.

Criterion validity can be observed in the sense that *in criterion related validity, an indicator is compared with another measure of the same construct in which the researcher has confidence* (Punch, 1998, p101). An element of such criterion validity arises from paragraphs in 3.1.2, noting that the product mix approach is compatible to the portfolio analysis of diversification.

A criterion at this point is a diversification effect, leading to risk reduction. This is relevant to the concept of risk-taking in question. In the context of standard portfolio management (Strong, 2000), such a diversification effect means that the variance of return, e.g. total return of a portfolio, declines as the number of securities included in the portfolio increases.

For the purpose of comparison, the risk measure in the current empirical analysis can be validated by checking whether or not the criterion variable, a diversification effect is present in the product mix of a unit trust management company. In practice, a simple concurrent-criterion validation can be tested by correlating the variance of a company's product mix with the number of product mix components, e.g. individual unit trusts run by the company.

For simplicity, one can imagine a unit trust management running one unit trust that exactly replicates the FT 100 index. Over the last three years, the standard deviation of the index's monthly return is 4.64% (See Appendix 4-c). Let us see what would have happened if the company decides to expand the business by introducing one Japanese equity index trust that perfectly follows the Nikkei 225 index over the same time period. The corresponding standard deviation for the Nikkei index is 5.94%. Provided the asset size of the Japan index trust is the same as that of the UK index trust, the standard deviation of the monthly return the company's product mix reduces from 4.64% to 4.39% as showed in Appendix 4-c. In spite of the simple assumption such as no transaction fees or money flow effects, this observation corresponds to the standard diversification effect of a stock portfolio, providing certain criterion validity for the product mix based risk measure.

Based on the validation points as well as a number of reasons described in preceding paragraphs of sections 3.1.2 and 3.1.3, the product mix based variables in the current analysis appear to be valid measures for risk-taking activities in the UK unit trust industry.

4.3.3 Data Collection

The sample data on the UK unit trusts and their management companies is mainly collected from four resources; *The Financial Times Unit Trust & OEICs Year book 1999/2000, The UK Fund Industry Review and Directory 2000,* monthly magazine *Money Management* and *The Association of Unit Trust and Investment Funds (AUTIF) website.* With the Financial Times Unit Trust & OEICs Year book and the UK Fund Industry Review and Directory, each company's ultimate ownership is verified. These industry directories also provide individual fund information which contains the sector classification, size of the fund and various fee charges.

The data sample of the year 1999 included all UK unit trust companies whose ownership type was confirmed from the two industry directories. Furthermore, observations with pension sector funds are eliminated because the sector data was not available from *Money Management.* The selection criteria is not a major problem as the overall sample asset size is 253,443 million pounds, accounting for 99.8% of the industry's assets at the end of 1999. The final sample consists of 142 unit trust management companies and 1678 authorised unit trusts, representing 89.3 % of the companies, 91.6 % of the unit trusts in the UK unit trust industry, respectively. With regard to the ownership characteristics of the financial groups, the sample data on the UK unit trust management companies includes 87 quoted company owned, 31 private company owned and 24 mutual owned. Appendix 4-a lists names of companies by ultimate ownership group.

As for the fund sectors, fund performance companies like Morningstar, S&P Micropal, and Reuters provide their own classification systems in order to assist investors with their evaluation of the different unit trusts. However, as these classifications share a great deal in common with AUTIF's sector categories, this study follows the association's classification which had 32 fund sectors at the end of 1999, depending on the investment objectives.

It should be noted that as new funds with distinctive objectives like dot-com or telecom funds increase AUTIF review the classification from time to time, reflecting such new products. Indeed, AUTIF introduced a new *managed* sector in early 1998, revising the classification in June 1999. The reason for the change is to comply with the pan European trade associations to which AUTIF belongs. More recently, as from April 2000, AUTIF are modifying several sector classifications that are associated with ethical funds, small-capital company funds, and UK bond funds. Despite the changes of the sector categorisation, the mainstream sectors remain the same in terms of geographic orientation and by capital or income growth orientation. For these reasons, this study employs the AUTIF's classification set out in June 1999.

4.3.4 Statistical Models

Statistical Tests for the first hypothesis

The goal of the first hypothesis test is to determine whether the proportion of assets invested in high-risk sectors differs significantly among the different ownership models, such as mutual, public and private company. To compare the three ownership groups, the difference tests used for the initial analysis include not only a one way analysis of variance (ANOVA) but also a Kruskal-Wallis test. Despite the fact that the distribution of the aggregated asset weights of the high risk categories appears to be non-normal, the reason for using the parametric and non-parametric tests is that: *one of the unsolved issues in data analysis is the question of when parametric rather than non-parametric tests should be used* (Bryman and Cramer, 1999, p.117). From this viewpoint, rather than relying on a specific assumption, the analysis employed the two tests.

The next test for the first hypothesis is to assess the strength of the relationship between risk proxy and ownership type, whilst controlling potential influential factors. The independent variables include not only nominal ones, e.g. dummy variables for the ultimate ownership form, but also a few potential influential factors of risky activities in the form of continuous level of measurements. The previous literature suggests that the control variables are size and age of the company (Esty, 1997a, and Siggelkow, 2003). For this reason, it is important to include these factors in the model. Taking into account these points, the multiple regression model will achieve the objective of testing the hypothesis.

It is debatable whether parametric models such as Tobit multiple regression are routinely applicable to the testing the first hypothesis. One justification is that *studies where the values of the statistics used to analyse samples drawn from populations which have been artificially set up to violate the normal distribution and the homogeneous variances have been found not to differ greatly from those for samples which have been drawn from populations which do not violate these conditions* (Bryman and Cramer, 1999, p.119).

From this point of view, benefits from controlling influential factors by employing the Tobit model seem to outweigh costs arising from the potential mis-specification of the sample distribution.

Justification for interaction variables

It is noteworthy that in employing the multiple regression approach, there are several miscellaneous issues to consider. Firstly, one can say that by using analysis of covariance (ANCOVA), the explanatory power of the multiple regression model will increase. This is because ANCOVA can remove *extraneous influences for the dependent variable* (Hair et al 1999, page 346). In the case of the current analysis, it is intuitively argued that the total size of assets under management of a unit trust company can be a key factor to affect the degree of its risk taking activities. For example, from the company's management perspective, the large size of asset under management generates more fee incomes whilst lowering the risk of financial distress. If this is the case, the size of assets under management can be treated as a covariate.

However, one must keep in mind that there is one important assumption for using ANCOVA that: the covariate has an equal effect on the dependent variable across the groups. This assumption is often referred to as "the homogeneity of regression effect". This is a strong assumption and not suitable for the current hypothesis testing because the effect of a company's managed asset size on their risk-taking activities may differ across the different ownership groups.

Justification for Tobit regression

Instead of the ANCOVA, it is helpful to make use of interaction variables. Given the research context, an interaction variable is formed as the product of two variables; managed asset size and organisational dummy variable for a company. The rationale for including such an interaction variable is that the change in risky activities with respect to the asset size depends on the type of ultimate ownership. The multiple regression allows us to use such interaction variables easily.

The next justification is concerned with a limited dependent variable, which is bounded by a certain cut-off. In this research context, one must recall that the observed value of the risk-taking measure based on the asset proportion of the risky sectors should be 0% to 100%. Furthermore, the risk proxy based on the Herfindahl index should range between 312 (this is the case of the most diversified company whose assets are evenly spread across the 32 fund sectors) and 10,000 (the company has a single fund product). Such limited dependent variables do not conform to the requirements of the conventional liner regression mode where the dependent variable must range from minus infinity to plus infinity. Hence, it is vital to employ a regression model for a limited dependent variable.

From the viewpoint of the limited dependent variable, several models have been developed (see, for instance, Maddala, 1999). For binary responses, probit model and logit models are often used. The former is based on the standard normal cumulative distribution function whereas the latter is dependent on the logit function. For another non negative limited dependent variable, typical regression models are the Tobit, truncated, and Poisson. In particular, the former two models are used with a continuous dependent variable and often referred to as censored models. The latter model is used with a count dependent variable.

Nevertheless, among the models for a limited dependent variable, the empirical analyses in the current thesis employ the Tobit model because the truncation model is for the sample data drawn from a subset of a large population of interests (Greene, 2003, p.756). The general formulation is usually given in terms of an index function (Greene, 2003, p.754)

$$y_i^* = X_i'\beta + \varepsilon_i \quad y_i=0 \text{ if } y_i^* \leq 0,$$

$$y_i=y^* \text{ if } y_i^* > 0, \tag{4-7}$$

As a main reason for the Tobit regression approach, the nature of the dependent variable used in the empirical analyses is essentially continuous and strictly positive in value. However, one potential limitation can be found from classic econometric books. Maddala (1992) stated that "*the Tobit model is, strictly speaking, applicable in only those situations where the latent variable can, in* *principal, take negative values, but these negative values are not observed because of censoring. Where the zero observations are a consequence of individual decisions, these decisions should be modelled appropriately and the Tobit model should not be used mechanically."* (Maddala, 1992, p 345). To rephrase Maddala's point, the traditional censoring of data is an issue of data observability whist the consequence of individual decisions is an observable "choice" or "outcome". Often referred to as the corner solution response, one example for the observable outcome is the amount of alcohol consumption by an individual. In the population of people, this variable takes on a wide range of values. For some significant fraction, the amount to spend on alcohol is zero.

To dispute Maddala's claim, two possible justifications can be made: on the methodological side, a few authors of recent econometric text books dispute that the Tobit model is convenient not only for the censored data, but also for the corner solution outcome. Specifically, with regard to a problem of the corner solution outcome, Wooldridge (2003) argues that *the Tobit is applicable to non-negative outcomes that pile up at zero but also take on a broad range of positive value* [9](Wooldridge 2003, page 592).

From a literature perspective, there have been a number of empirical studies that have taken advantage of the Tobit model with regard to the mutual versus stock ownership debate. For example, studying the U.S demutualised Saving & Loans

[9] His explanation is that, for the purpose censoring data, $E(y^* | x) = x\beta$ is of interest and the vector β provides with information. For the corner solution outcome, one is not interested in the conditional expectation. e.g. $E(y^* | x)$ but in $E(y | x)$ or $E(y | x, y>0)$. Arguably, given the expressions above, Wooldridge states that the Tobit model allows us to estimate the values of x and β that determine y given x- either conditional on $y>0$ or unconditional.

companies (S&L's), Kroszner and Strahan (1996) used the Tobit regression model where the company's dividends as the non-negative regressand and the income factors were regressors. A further example is Esty's (1997a) work, which is often referred to in the current thesis. By using the Tobit model, Esty regressed the proportion of the stock owned S&L's companies in each state of the U.S on the macro economics conditions for the state, finding no relationship between local risk-taking opportunities and the formation or presence of stock owned S&L;s.

For these grounds, one must keep in mind that the current thesis employs the Tobit model not only for the present chapter but also for the subsequent chapters. The common objective throughout the thesis is to assess the ultimate ownership effect on risk-taking (Chapter IV) and efficiency (Chapter V) of a unit trust management company, and on the performance of their unit trusts that the company offers (Chapter VI).

Estimation of the Tobit regression is computed not through the ordinary least squared estimation, but through the maximum likelihood estimation. The obvious reason for this is that the ordinary least squared estimation of the parameters obtained from the subset of the latent dependent variable, y* will be biased. The bias arises from the fact that in using the latent y*, there is no guarantee that $E(\varepsilon_i)$ will be necessarily zero. Without $E(\varepsilon i) = 0$, it is impossible to keep the ordinary least squared estimation unbiased (See, Wooldridge,2003, section 17.2).

The Tobit model is set up in the following format;

$$\begin{aligned} \text{Risk}_j = \alpha \quad & + \beta_1 (\text{Log\_Asset}_j) + \beta_2 (\text{Company Age}_j) \\ & + \beta_2 (\text{Quoted Ownership\_Dummy}_j) \\ & + \beta_3 (\text{Private Ownership\_Dummy}_j) + \varepsilon_{j,} \end{aligned} \qquad (4\text{-}8)$$

where

Risk_j = Company j's risk taking measure

Log_Asset_j = the logarithm of Company j's total asset.

Company Age = the age of company j

Quoted Ownership = 1 if company j is a quoted company ownership, otherwise 0.

Private Ownership = 1 if company j is owned by a private company, otherwise 0.

$\varepsilon_{j,}$ = the random error term

In order to get further insight concerning the size effect, the basic model is modified by including the interaction variables, i.e. (the ownership dummy variable) x (company size). The preceding model (3-1) is now described as

$$\begin{aligned} \text{Risk}_{k\,j} = \alpha \quad & + \beta_1 (\text{Log\_Asset}_j) + \beta_2 (\text{Company Age}) \\ & + \beta_2 (\text{Quoted Ownership\_Dummy}_j) \\ & + \beta_3 (\text{Private Ownership\_Dummy}_j) \\ & + \beta_4 (\text{Interaction of Quoted Ownership with the Log Asset}_j) \\ & + \beta_5 (\text{Interaction of Private Ownership with the Log Asset}_j) \\ & + \varepsilon_{j,} \end{aligned} \qquad (4\text{-}9)$$

where

$\text{Risk}_{k,j}$ = Company j's risk taking measure

Log_Asset_j = the logarithm of Company j's total asset.

Company Age = the age of company j

Quoted Ownership = 1 if company j is a quoted company ownership, otherwise 0.

Private Ownership = 1 if company j is owned by a private company, otherwise 0.

Interaction of Quoted Ownership with the Log Asset = the log asset of the company if the company j is owned by a quoted company group, otherwise 0.

Interaction of Private Ownership with the Log Asset = the log asset of the company if the company j is owned by a quoted company group, otherwise 0.

$\varepsilon_{j,}$ = the random error term

Statistical Tests for the hypothesis (H2) and (H3)

Examining the ownership effect, the first hypothesis (H1) concentrates on risky activities across unit trust management companies with different ultimate owners. Shifting from the approach based on the two broad classifications, i.e. the high and low fund sectors, the next set of hypotheses focuses on the number of fund categories, and the weighted asset (%) of each fund' category within the companies. In essence, the aim of hypotheses (H2) and (H3) is to test whether companies with mutual ownership and with stock ownership differ in terms of their line of business specification and line of concentration.

There are a relatively large number of independence tests that include the Chi-square test for goodness of fit, T-test for comparing two means, Z-test for comparing two proportions and analysis of variance (hereafter ANOVA). However, for the present hypothesis testing, the Kruskal-Wallis test is used, because the ultimate analysis is to compare the continuous dependent variable, e.g. the proportion of a fund with a given investment objective, on a ultimate ownership variable of more than two independent groups, e.g. mutual, listed and privately owned groups. Therefore, it is clear that any binary approaches such as T-test are not appropriate.

It is evident that ANOVA is closest in sprit to the Kruskal-Wallis test. However, there is a critical distinction between ANOVA and the Kruskal-Wallis test in terms of their assumptions. Whilst ANOVA is used on the basis of parametric data sample, the Kruskal-Wallis test is suitable for non-parametric data sample. In this regard, Table 4.9 indicates that the distribution of asset weight for each section is unlikely to be normal across the ownership groups. For this reason, the Kruskal-Wallis test is employed as the main method for the second and third hypothesis testing. Nonetheless, it is interesting to quote from Bayan and Crane (1997, p119) that: *the value of the statistics used to analyse samples drawn from populations which have been artificially set up to violate these conditions, e.g. the normal distribution, have been found not to differ greatly from those for samples which have drawn from populations which do not violate these conditions*. On this basis and as a supplement to the Kruskal Wallis test, it is also worth using ANOVA for the current analysis. An additional benefit in using ANOVA is that the post-ANOVA tests, which are often referred to as posteriors or post-hoc tests allows us to specifically differentiate between certain types of groups. Hence, if it is necessary, such post-hoc tests can be used on the basis of the results of ANOVA.

In summary, hypothesis (H2) considers the line of business specialisation which is proxied by the asset size of each fund category for all three types of ownership. To test the hypothesis, this study compares the means (medians) of each category weight across the three ultimate ownership types, using both analysis of variance (ANOVA) and the Kruskal Wallis test. In a similar manner, hypothesis (H3) examines whether the line of business concentration differs among the three ownership types. In addition to the tests on the individual fund category (H2), hypothesis (H3) calculates the Herfindahl index based on fund categories, then comparing the means of the Herfindahl index with ANOVA and the Kruskal Wallis test.

4.4 Results

4.4.1 Overall data sample

Table 4.2 presents the summary statistics for the overall unit trust industry, separating the sample companies into mutual, quoted and private owned groups. Several features are apparent. Firstly, the quoted company group holds 74.3% market share in terms of asset size (Table 4.2-a), 72% in terms of total funds to offer (Table 4.2-c). Secondly, a considerable gap between mean and median (Table 4.2-a) suggests that there are a few extremely large companies in the sample whereas nearly half of the sample companies have less than 500 million assets to manage. This is particularly true in the case of the privately owned company group.

Supporting this tendency, Table 4.2-b shows the distribution of the sample companies according to the size and ownership classifications. The mutual owned group and the privately owned group have size distribution that are tilted toward small companies, showing that half of the mutual sample companies and two third of the privately owned sample companies have less than 500 million assets to manage.

Table 4.2-b also reveals that a significant gap exists between the top tier and the bottom tier in terms of the asset under management. On average, the asset size of the large company group is more than twenty times bigger than that of the small company group.

Table 4.2 Descriptive Statistics

Descriptive statistics for the sample of 142 unit trust management companies in the UK. Data are obtained from Financial Times Unit Trust & OEICs Year Book. All pound values are expressed in millions. Data is based on year end of 1999.

		Mutual	Quoted	Private	Total
4.2-a	ASSETS (Million)	n=24	n=87	n=31	N=142
	Asset by ownership	38,204	188,450	26,788	253,443
	Mean	1,592	2,166	864	1,785
	Median	553	1,062	102	533
	Std. Deviation	2,120	3,003	2,781	2,857
	Minimum	2	2	4	2
	Maximum	8,371	14,581	14,975	14,975

	Asset Distribution By size (Million)	Mutual	Quoted	Private	Total
4.2-b	Over 10,000	0	3	1	4
	5,000-10,000	2	7	1	10
	1,000-5,000	9	37	1	47
	500-1,000	1	7	4	12
	less than 500	12	33	24	69

4.2-c	Number of Funds	Mutual	Quoted	Private	Total
	Total funds by ownership	204	1,221	255	1,680
	Mean	9	14	8	12
	Median	6	11	3	9
	Std. Deviation	9	11	10	10
	Minimum	1	1	1	1
	Maximum	35	50	36	50

4.2-d	Number of Funds (distribution)	Mutual	Quoted	Private	Total
	Over 40	0	4	0	4
	30-39	1	2	2	5
	20-29	2	18	2	22
	10-19	4	27	6	37
	less than 9	17	36	21	74

4.2-e	Number of Sectors	Mutual	Quoted	Private	Total
	Mean	6.3	9.7	5.2	8.2
	Median	5.0	10.0	2.0	7.0
	Std. Deviation	5.5	5.9	4.8	5.9
	Minimum	1.0	1.0	1.0	1.0
	Maximum	21.0	22.0	18.0	22.0

	Number of sectors (distribution)	Mutual	Quoted	Private	Total
4.2-f	Over 29	1	5	0	6
	15-29	1	18	1	20
	10-14	4	21	6	31
	5-9	8	20	6	34
	1-4	10	23	18	51

4.2-g	Company's age	Mutual	Quoted	Private	Total
	Mean	14	16	11	15
	Median	13	13	5	12
	Std. Deviation	10	13	13	13
	Minimum	0	0	0	0
	Maximum	39	68	65	68

Tables 4.3 provides the unit trust sector information. Clearly, there is one large sector, *the UK all companies* which accounts for (a) 30% in terms the total assets invested in the UK, and (b) 17% in terms of the total numbers of unit trusts in the UK. After *the UK all companies* sector, the major sectors are *Global Growth* and *European excluding U.K.* The former accounts for 9% and 11% of the total fund assets and the total numbers of unit trusts in the UK respectively whilst the latter accounts for 11% of the total fund assets and 6.5% of the total unit trusts, reflecting the growing importance of Europe as an investment sector.

Table 4.3 Fund sectors in the UK unit trust industry.

The sample consists of 32 fund sectors at year end 1999.
The classification was defined by the Association of Unit Trusts and Investment Funds in 1999. Data are obtained from Financial Times Unit Trust & OEICs Year Book.

Sector	Name	Size (£ Million)	%	# of funds	%
1	UK All Companies	77,877.8	30.7%	291	17.3%
2	UK Equity Income	23,747.3	9.4%	92	5.5%
3	UK Smaller Companies	12,504.5	4.9%	74	4.4%
4	UK General Bonds	13,691.4	5.4%	92	5.5%
5	UK Gilt	1,877.0	0.7%	42	2.5%
6	UK Equity & Bond	452.2	0.2%	3	0.2%
7	UK Equity & Bond Income	6,262.6	2.5%	45	2.7%
8	UK Specialist	1,317.6	0.5%	18	1.1%
9	Active Managed	5,251.5	2.1%	55	3.3%
10	Balanced Managed	10,616.1	4.2%	71	4.2%
11	Cautious Managed	491.4	0.2%	9	0.5%
12	Managed Income	780.1	0.3%	16	1.0%
13	Global Growth	22,539.9	8.9%	184	10.9%
14	Global Equity Income	530.9	0.2%	10	0.6%
15	Global Equity & Bond	1,445.6	0.6%	28	1.7%
16	Global Bonds	2,527.1	1.0%	56	3.3%
17	UK Money Market	921.7	0.4%	46	2.7%
18	Global Emerging Markets	2,512.6	1.0%	35	2.1%
19	Global Specialist	3,824.7	1.5%	38	2.3%
20	Europe Excluding UK	28,148.7	11.1%	109	6.5%
21	Europe Including UK	1,090.8	0.4%	14	0.8%
22	European Specialist	2,192.6	0.9%	22	1.3%
23	Far East Excluding Japan	6,539.9	2.6%	73	4.3%
24	Far East Including Japan	2,007.4	0.8%	22	1.3%
25	Far East Specialist	310.4	0.1%	11	0.7%
26	Japan	8,266.0	3.3%	77	4.6%
27	Japanese Specialist	1,148.4	0.5%	12	0.7%
28	North America	12,031.1	4.7%	90	5.3%
29	North America Specialist	1,129.6	0.4%	21	1.2%
30	Guaranteed/Protected Funds	1,002.3	0.4%	18	1.1%
31	Index Bear Funds	16.8	0.0%	1	0.1%
32	Property	386.6	0.2%	3	0.2%

4.4.2 Testing Hypothesis (1) with risk-taking measures

Summary statistics

From the discussion in the literature review section, there are several ways to measure the risk-taking of unit trust management companies. As discussed, focusing on the product set or the aggregated asset allocation for each company, the test for hypothesis (H1) uses the percentage of products invested in high risk fund categories as the risk proxy. Specifically, two risk proxies are employed based on (i) fluctuation of averaged return of all unit trusts in the category and (ii) fluctuation of net money flow of all unit trusts in the category over the total asset size of the all unit trusts in the category.

The summary statistics for the two risk measures are provided in Table 4.4. It is clear from Table 4.4-a that more than 70% of the all companies' assets (mean = 73%, median = 79%) are invested in sectors with high volatility of return. Described in the methodology section, the sectors with high volatility of return refer to top half sectors (out 32 fund sectors) ranked by standard deviation of the monthly return over the 36-month period. (See Table 4.1 for the sector information.) Surprisingly, the mean (70%) and the median (74%) of the quoted company group are smaller than those of the mutual group (mean = 78%, median = 82%) and the private company group (mean = 79%, median = 96%). A possible explanation is that the high risk category used here includes popular fund sectors such as *UK all companies* and *Global Growth*. It is important to realise that the risk variables do not follow the shape of a normal distribution as their mean and median do not coincide.

Table 4.4 Descriptive Statistics of risky sector weights and Independence Tests by ownership type

4.4-a shows proportion (%) of fund sectors with high standard deviation of returns.

Descriptives Statistics (%)	Mutual	Quoted	Private	Total
Mean	78	70	79	73
Median	82	74	96	79
Std. Deviation	26	22	29	25
Minimum	0	0	0	0
Maximum	100	100	100	100

ANOVA
F value = 2.257
Significance >5% (=0.108)

Kruskal Wallis Test
Chi-Square = 11.020***
Significance <1% (=0.004)

4.4-b indicates the distribution of the sample companies by proportion of fund sectors with high standard deviation of returns.

Distribution (No.of Companies)	Mutual	Quoted	Private	Total
0-19%	1	3	2	6
20-39%	1	4	2	7
40-59%	2	23	3	28
60-79%	7	24	3	34
80-100%	13	33	21	67

4.4-c shows proportion (%) of fund sectors with high ratio of money flow.

Descriptives Statistics (%)	Mutual	Quoted	Private	Total
Mean	21	26	41	29
Median	15	23	33	25
Std. Deviation	23	24	34	27
Minimum	0	0	0	0
Maximum	100	100	100	100

ANOVA
F value = 5.124***
Significance <1% (=0.007)

Kruskal Wallis Test
Chi-Square = 7.296***
Significance <1% (=0.026)

4.4-d indicates the distribution of the sample companies by proportion of fund sectors with high money flow ratio

Distribution (No.of Companies)	Mutual	Quoted	Private	Total
0-19%	15	39	8	62
20-39%	5	31	11	47
40-59%	1	11	5	17
60-79%	3	1	1	5
80-100%	0	5	6	11

Table 4.5 Correlation matrix between the risk variables and other features of the product mix of the unit trust management company.

Table 4.5 (a): Pearson' r

Correlations

		# of Sectors	# of Funds	Log_Asset	Index_units	Index_sectors	High_SD	High_Flow
# of Sectors	Pearson Correlation	1.000	.927**	.771**	-.739**	-.758**	-.089	-.035
	Sig. (2-tailed)	.	.000	.000	.000	.000	.292	.677
	N	142	142	142	142	142	142	142
# of Funds	Pearson Correlation	.927**	1.000	.731**	-.677**	-.654**	-.058	-.043
	Sig. (2-tailed)	.000	.	.000	.000	.000	.490	.614
	N	142	142	142	142	142	142	142
Log_Asset	Pearson Correlation	.771**	.731**	1.000	-.655**	-.656**	-.019	-.225**
	Sig. (2-tailed)	.000	.000	.	.000	.000	.818	.007
	N	142	142	142	142	142	142	142
Index_units	Pearson Correlation	-.739**	-.677**	-.655**	1.000	.962**	.220**	-.093
	Sig. (2-tailed)	.000	.000	.000	.	.000	.009	.273
	N	142	142	142	142	142	142	142
Index_sectors	Pearson Correlation	-.758**	-.654**	-.656**	.962**	1.000	.231**	-.054
	Sig. (2-tailed)	.000	.000	.000	.000	.	.006	.526
	N	142	142	142	142	142	142	142
High_SD	Pearson Correlation	-.089	-.058	-.019	.220**	.231**	1.000	.265**
	Sig. (2-tailed)	.292	.490	.818	.009	.006	.	.001
	N	142	142	142	142	142	142	142
High_Flow	Pearson Correlation	-.035	-.043	-.225**	-.093	-.054	.265**	1.000
	Sig. (2-tailed)	.677	.614	.007	.273	.526	.001	.
	N	142	142	142	142	142	142	142

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.5 (b): Spearman's rho

Correlations

			# of Sectors	# of Funds	Log_Asset	Index_units	Index_sectors	High_SD	High_Flow
Spearman's rho	# of Sectors	Correlation Coefficient	1.000	.969**	.808**	-.857**	-.857**	-.286**	.190*
		Sig. (2-tailed)	.	.000	.000	.000	.000	.001	.024
		N	142	142	142	142	142	142	142
	# of Funds	Correlation Coefficient	.969**	1.000	.801**	-.897**	-.827**	-.281**	.184*
		Sig. (2-tailed)	.000	.	.000	.000	.000	.001	.028
		N	142	142	142	142	142	142	142
	Log_Asset	Correlation Coefficient	.808**	.801**	1.000	-.659**	-.620**	-.157	-.032
		Sig. (2-tailed)	.000	.000	.	.000	.000	.062	.705
		N	142	142	142	142	142	142	142
	Index_units	Correlation Coefficient	-.857**	-.897**	-.659**	1.000	.923**	.304**	-.337**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000
		N	142	142	142	142	142	142	142
	Index_sectors	Correlation Coefficient	-.857**	-.827**	-.620**	.923**	1.000	.328**	-.365**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000
		N	142	142	142	142	142	142	142
	High_SD	Correlation Coefficient	-.286**	-.281**	-.157	.304**	.328**	1.000	.160
		Sig. (2-tailed)	.001	.001	.062	.000	.000	.	.057
		N	142	142	142	142	142	142	142
	High_Flow	Correlation Coefficient	.190*	.184*	-.032	-.337**	-.365**	.160	1.000
		Sig. (2-tailed)	.024	.028	.705	.000	.000	.057	.
		N	142	142	142	142	142	142	142

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

where

Index-units	= the Herfindahl index based on the number of unit trusts in a company
Index-sectors	= the Herfindahl index based on the number of unit trust sectors in a company
High_SD	= proportion (%) of fund sectors with high standard deviation of returns.
High_Flow	= proportion (%) of fund sectors with high ratio of money flow.

As no single measure of difference is best for all situations (Norusis, 2000, p.365) Pearson's r in Table 4.5 (a) and Sprearman' ρ in Table 4.5 (b) are used. Table 4.5 (a) and (b) show a correlation matrix between the risk variable and other features of the product mix of the unit trust management company. However, given the non-normal distribution of the variables, it is better to summarise the results of Spearman's correlation coefficient.

It is notable that because the sum of the high risk proxy (%) and the corresponding low risk proxy (%) is one, the correlation coefficients of these with other variables are identical with an opposite direction. Two noteworthy features are the correlation coefficients of high risk variables; (i) high risk variable based on return volatility, and (ii) high risk variable based on money flow volatility. As for (i), the high risk variable based on return volatility, the associations with the two Herfindahl indices are positive and moderate ($\rho=0.304$, $p<0.01$ for the fund based Herfindahl index , $\rho=0.328$, $p<0.01$ for the sector based Herfindahl index). This suggests that when a company expands its product range, it is likely to set up a unit trust, which is sorted into the fund sector with low volatility of return.

By contrast, the high risk variable with high volatility of money flow shows significant associations with the two Herfindahl indices; ($\rho=-0.337$, $p<0.01$ for the fund based Herfindahl index, $\rho=0.365$, $p<0.01$ for the sector based Herfindahl index). This suggests that when a company expands its product range, it is likely to set up a unit trust, which is sorted into the fund sector with high volatility of money flow.

The association between the two high risk variables is also noteworthy. The correlation coefficient between the two variables is positive but insignificant. The closeness of relationship is 0.160. In an attempt to capture different dimensions of the corporate risk-taking activities, such a weak association between the two risk measures seems to justify the current approach with multiple measures.

Independent Tests

Notably, because such popular fund segments are grouped into the risky sector with a high fluctuation of return, it is difficult to identify distinctive patterns among the different ownership concerning their asset allocation (%) for the high risk sector. In this respect, the results of ANOVA in 4.4-a in Table 4.4 reinforces the weak distinction, showing that differences amongst the different ultimate ownership are likely to have arisen by sampling error ($F=2.257$, $p=0.108$). Nonetheless, a result of the Kruskal-Wallis test indicate chi-square is 11.02 at the significant level ($p = 0.04$), implying that the allocation of fund products differs across companies with different ultimate owners.

Results in 4.4-c in Table 4.4 show that the differences among the alternative ownership groups are becoming apparent when the risk proxy is based on the fluctuation of money flow. The mean (41%) and median (33%) of the privately owned group are much higher than those of other two groups (mean = 26%, median = 15% for mutual, mean = 26%, median = 23% for quoted company ownership).

Of further note is the fact that the mutual owned group has the smallest asset proportion in the sectors with the high money flow ratio. This is consistent with the implication from the primary proposition: mutual institutions are more risk-averse than stock owned companies. Furthermore, results form ANOVA and a Kruskal-Wallis test in 4.4-c in Table 4.4 help ensure that significant differences exist among the ultimate ownership groups, providing F=5.124, p= 0.07 for ANOVA and chi-square = 7.29, p = 0.026 for the Kruskal-Wallis test.

Tests by Tobit model

Models (1) and (2): Risk based on return volatility

The Tobit regression analyses are employed so as to ensure that the results above are not driven by size and age effects of a company. Clearly, results in Table 4.6 verify the preceding observations. The results of model (1) in Table 4.6 shows that the estimate model (1) is insignificant at the 5 % level (p=0.064) and no coefficient is significant either. However, including variables that interact ownership class with the size of the company, model (2) increases the goodness-of-fit with a chi-square of 16.69 at the 1% significant level (p=0.01) as shown in model (2) in Table 4.6.

Table 4.6 Tobit regressions relating asset weights of risky sector to ownership type
(risk is based on fund return volatility)

The following tables present the results from Tobit regressions on the relationship between risk taking measures to ownership type. T-statistics are reported in parentheses. **, * represent the 5% and the 10% significant levels respectively.

Assets in sectors with high volatility of returns

	Model 1 Without Interaction	Model 2 With Interaction
Constant	**0.848** (8.53)**	**0.55** (3.17)**
Log_Asset	-0.017 (-0.53)	0.93 (1.45)
Company Age	0.00 (0.35)	0.001 (0.65)
Quoted Dummy	-0.105 (-1.54)	0.175 (0.84)
Private Dummy	0.06 (0.73)	**0.66** (2.8)**
(Asset)*(Quoted)		-0.109 (-1.48)
(Asset)*(Private)		**-0.255** (-2.76)**

Censored <=0	3	3
Censored >=1	25	25
Log Likelihood	-47.52	-43.61
Chi^2	8.89	16.69
Probability > Chi^2	0.064	**0.01**
Pseudo R2	0.085	0.16

Regression model (1)

$$\text{Risk}_j = \alpha + \beta_1 (\text{Log\_Asset}_j) + \beta_2 (\text{Company Age}) + \beta_3 (\text{Quoted\_Dummy}) + \beta_4 (\text{Private\_Dummy}) + \varepsilon_j$$

Regression model (2)

$$\text{Risk}_j = \alpha + \beta_1 (\text{Log\_Asset}_j)\ \beta_2 (\text{Company Age}) + \beta_3 (\text{Quoted\_Dummy}) + \beta_4 (\text{Private\_Dummy}) + \beta_5 [(\text{Log\_Asset}_j) \times (\text{Quoted\_Dummy})] + \beta_6 [(\text{Log\_Asset}_j) \times (\text{Private\_Dummy})] + \varepsilon_j$$

where
Risk_j = Company j's asset proportion invested in the risky sectors
Log_Asset_j = the logarithm of Company j's total asset.
Company Age = the number of years that the company has been established
Quoted = 1 if company j is owned by an exchange listed company, otherwise 0.
Private = 1 if company j is owned by a privately owned company, otherwise 0.
Log_Asset_j x Quoted _Dummy = the interaction variable of the log asset with quoted ownership
Log_Asset_j x Private_Dummy = the interaction variable of the log asset with private ownership
ε_j = the random error term

Moreover, the coefficient of the dummy variable of the private ownership is positive (0.66) and significant (t= 2.8) and the interaction variable of the private ownership with the asset size is negative (-0.256) and significant (t= -2.76). This implies that in comparison with other ultimate ownership groups, unit trust management companies with private ownership are likely to have more fund assets invested in the sectors where the returns are highly fluctuating. By contrast, no significant difference is found between two other classes, i.e. mutual and quoted company ownership, indicating that hypothesis (1) is not supported. In short, the results provide mixed support to hypothesis (1) whereas verifying that companies with private ownership pursue high risk by managing relatively large assets with high return volatility.

Models (3) and (4): Risk based on money flow

When the risk taking proxy is defined as the asset proportion invested in sectors where the money flows are highly fluctuating, both models without (model 3) and with the interaction variables (model 4) are significant at the 5% level. Model (3) in Table 4.7 shows the results without the interaction variables, indicating a similar pattern to model (1). That is, the goodness-of-fit of the model is significant (p=0.012) and the coefficient of the privately owned group is positive (0.24) and significant (t= 2.61). Thus, fund assets of unit trust management companies with private ownership are invested in the sectors where the money flows are highly unstable.

Significant and more interesting results from model (4) are also found in Table 4.7. The coefficients of size and age of the company are positively related to the asset proportion of the risky sector (size = 0.183, and age = 0.004). The former significant level is 5% (t= 2.26) whilst the latter is 10% (t= 1.76). This means that if the company's asset or the company's age increases, the company is likely to have more assets invested in funds where money flows are erratic. In other words, accumulating experience over time helps the company to expand their funds into the high-risk areas.

More importantly, the coefficients associated with quoted and private company ownership are positive (0.917 and 1.07, respectively) and significant (t = 3.46, and t = 3.86, respectively), providing evidence that companies with stock ownership are taking a higher risk than those with mutual ownership. Furthermore, the coefficients of the interaction variables are negative (-0.296 for quoted ownership and –0.327 for private ownership) and significant (t =-3.28 and t =-3.13, respectively), suggesting that stock owners' preference for the risky sectors decreases as their asset size increase. Viewed collectively, the evidence is consistent with the primary hypothesis that stock ownership companies take higher risks than their mutual ownership counterparts.

Table 4.7 Tobit regressions relating asset weights of risky sector to ownership type
(risk is based on money flow volatility)

The following tables present the results from Tobit regressions on the relationship between risk taking measures to ownership type. T-statistics are reported in parentheses. **, * represent the 5% and the 10% significant levels respectively.

Assets in sectors with high volatility of money flow

	Model 3 Without Interaction	Model 4 With Interaction
Constant	**0.247** (2.21)**	**-0.42** (-1.79)*
Log_Asset	**-0.061** (-1.66)*	**0.183** (2.26)**
Company Age	0.003 (1.59)	**0.004** (1.76)*
Quoted Dummy	0.104 (1.37)	**0.917** (3.46)**
Private Dummy	**0.24** (2.61)**	**1.07** (3.86)**
(Asset)*(Quoted)		**-0.296** (-3.28)**
(Asset)*(Private)		**-0.327** (-3.13)**

Censored <=0	26	26
Censored >=1	7	7
Log Likelihood	-65.2	-58.51
Chi^2	12.74	26.11
Probability > Chi^2	**0.012**	**0.00**
Pseudo R2	0.0089	0.182

Regression model (3)

Risk $_j$ = $\alpha + \beta_1$ (Log_Asset$_j$) + β_2 (Company Age)
+ β_3 (Quoted _Dummy) + β_4 (Private_Dummy) + $\varepsilon_{j,}$

Regression model (4)

Risk $_j$ = $\alpha + \beta_1$ (Log_Asset$_j$) β_2 (Company Age) + β_3 (Quoted _Dummy) +
β_4 (Private_Dummy) + β_5 [(Log_Asset$_j$) x (Quoted _Dummy)]
+ β_6 [(Log_Asset$_j$) x (Private_Dummy)] + $\varepsilon_{j,}$

where

Risk $_j$ = Company j's asset proportion invested in the risky sectors
Log_Asset$_j$ = the logarithm of Company j's total asset.
Company Age = the number of years that the company has been established
Quoted = 1 if company j is owned by an exchange listed company, otherwise 0.
Private = 1 if company j is owned by a privately owned company, otherwise 0.
Log_Asset$_j$ x Quoted _Dummy = the interaction variable of the log asset with quoted ownership
Log_Asset$_j$ x Private_Dummy = the interaction variable of the log asset with private ownership
$\varepsilon_{j,}$ = the random error term

4.4.3 Testing Hypothesis (2): Line of business specialisation

Table 4.8 depicts popular fund sectors by the different ultimate ownership groups, 1showing distributions of sample companies offering funds across the 32 sectors. Similar to Table 4.3, 120 unit trust management companies or 84% of the sample companies have fund assets categorised into the *UK all companies* sector. However, as hypothesis (2) predicts, there seem to be variations in fund product allocation across the three ultimate ownership groups. For example, *Global Equity and Bond* funds are offered by 12 companies (13%) of the sample companies with the quoted company ownership and 5 companies (16%) of the sample companies with the private ownership. In contrast to these stock owned groups, no unit trust management companies owned by mutual institutions offer the *Global Equity and Bond* sector fund. These variations appear to support hypothesis (2) of the line of business specialisation.

In order to gain further insight, Table 4.9 shows results for both ANOVA and Kruskal and Wallis tests. The ANOVA results indicate that asset proportions of fund sector 2, 8, 13 and 15 over the total asset size are significantly different among mutual, quoted and private ownership groups. In the same way, the results of Kruskal and Wallis tests indicate that the asset fractions of sector 2,3,4,5,8, and 20 exhibit significant variations among the three ultimate ownership groups.

Table 4.8 Distributions of sample companies offering funds across 32 fund sectors by ownership type.

The first four columns are total assets (million pounds) across the sectors. The middle four columns show the number of funds across the sectors. The last four columns are the number of companies offering funds across the sectors. Based on year end 1999, data are obtained from Financial Times Unit Trust & OEICs Year Book.

		Asset Size				No. of Funds				Companies			
		Mutual	Quoted	Private	Sub_Total	Mutual	Quoted	Private	Sub_Total	Mutual	Quoted	Private	Sub_Total
Sector1	UK All Companies	12,697.60	59,416.38	5,763.77	77,877.75	39	208	44	291	21	77	22	120
Sector2	UK Equity Income	1,079.74	21,974.13	693.40	23,747.27	7	81	4	92	7	56	4	67
Sector3	UK Smaller Companies	1,765.88	9,798.19	940.42	12,504.49	7	58	9	74	7	48	9	64
Sector4	UK General Bonds	647.68	11,624.82	1,418.86	13,691.36	8	75	9	92	7	56	6	69
Sector5	UK Gilt	36.07	1,508.44	332.49	1,877.00	3	34	5	42	3	24	2	29
Sector6	UK Equity & Bond	3.46	448.72	-	452.18	1	2	0	3	1	2	0	3
Sector7	UK Equity & Bond Income	697.27	4,851.19	714.14	6,262.60	9	30	6	45	7	24	6	37
Sector8	UK Specialist	969.26	348.32	-	1,317.58	7	11	0	18	5	10	0	15
Sector9	Active Managed	272.76	4,690.82	287.87	5,251.45	5	35	15	55	4	28	8	40
Sector10	Balanced Managed	1,434.26	8,814.98	366.85	10,616.09	10	52	9	71	8	38	7	53
Sector11	Cautious Managed	10.13	481.25	-	491.38	1	8	0	9	1	8	0	9
Sector12	Managed Income	9.60	737.66	32.85	780.11	1	12	3	16	1	12	2	15
Sector13	Global Growth	9,051.49	10,052.48	3,435.93	22,539.90	23	110	51	184	14	63	22	99
Sector14	Global Equity Income	8.34	503.96	18.61	530.91	1	6	3	10	1	6	2	9
Sector15	Global Equity & Bond	-	834.25	611.37	1,445.62	0	15	13	28	0	12	5	17
Sector16	Global Bonds	219.35	1,779.22	528.48	2,527.05	7	42	7	56	4	31	7	42
Sector17	UK Money Market	33.82	543.97	343.94	921.73	6	34	6	46	6	32	4	42
Sector18	Global Emerging Markets	127.78	1,937.46	447.33	2,512.57	4	23	8	35	2	18	7	27
Sector19	Global Specialist	259.79	3,205.72	359.22	3,824.73	4	28	6	38	4	20	5	29
Sector20	Europe Excluding UK	4,203.86	19,744.46	4,200.40	28,148.72	16	79	14	109	12	57	9	78
Sector21	Europe Including UK	23.26	1,038.19	29.37	1,090.82	1	10	3	14	1	9	2	12
Sector22	European Specialist	4.55	2,014.37	173.65	2,192.57	1	17	4	22	1	13	3	17
Sector23	Far East Excluding Japan	502.49	4,833.00	1,204.41	6,539.90	11	52	10	73	8	43	6	57
Sector24	Far East Including Japan	814.86	1,107.75	84.79	2,007.40	3	16	3	22	3	15	3	21
Sector25	Far East Specialist	28.53	246.56	35.36	310.45	2	7	2	11	1	7	1	9
Sector26	Japan	965.83	4,883.50	2,416.64	8,265.97	10	57	10	77	8	45	7	60
Sector27	Japanese Specialist	38.79	1,109.59	-	1,148.38	1	11	0	12	1	10	0	11
Sector28	North America	1,937.32	7,853.70	2,240.08	12,031.10	13	67	10	90	11	49	8	68
Sector29	North America Specialist	15.04	1,006.93	107.67	1,129.64	1	17	3	21	1	15	3	19
Sector30	Guaranteed/Protected Funds	345.49	656.85	-	1,002.34	2	16	0	18	2	7	0	9
Sector31	Index Bear Funds	-	16.81	-	16.81	0	1	0	1	0	1	0	1
Sector32	Property	-	386.62	-	386.62	0	3	0	3	0	3	0	3
	Total	38,204	188,450	26,788	253,443	204	1217	257	1678	24	87	31	142

Table 4.9 Asset differences across 32 fund sector.

Asset weight for an individual sector is measured by the fraction (%) of each ownership group's asset invested in the individual sector. Significance of differences is accessed using a F-test for means and the non-parametric Kruskal Wallis ranks test.

Sector 1	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.33	0.43	0.32	0.29	1.715	0.184	5.431	0.07
Std. Deviation	0.31	0.32	0.27	0.38				
Median	0.25	0.34	0.27	0.10				
Sector 2	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.07	0.02	0.10	0.00	12.218	0.00	33.548	0.00
Std. Deviation	0.12	0.03	0.14	0.01				
Median	0.00	0.00	0.05	0.00				
Sector 3	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.05	0.02	0.06	0.05	1.085	0.341	7.36	0.03
Std. Deviation	0.11	0.05	0.13	0.11				
Median	0.00	0.00	0.01	0.00				
Sector 4	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.04	0.03	0.06	0.02	2.513	0.085	16.405	0.00
Std. Deviation	0.09	0.06	0.10	0.05				
Median	0.00	0.00	0.01	0.00				
Sector 5	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.02	0.00	0.03	0.00	1.013	0.366	7.759	0.02
Std. Deviation	0.10	0.00	0.13	0.01				
Median	0.00	0.00	0.00	0.00				
Sector 6	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.01	0.00	0.00	1.226	0.297	1.191	0.55
Std. Deviation	0.02	0.04	0.01	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 7	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.02	0.03	0.02	0.01	0.841	0.433	1.029	0.60
Std. Deviation	0.07	0.10	0.06	0.04				
Median	0.00	0.00	0.00	0.00				
Sector 8	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.02	0.00	0.00	6.386	0.002	6.944	0.03
Std. Deviation	0.03	0.07	0.01	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 9	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.03	0.05	0.02	0.02	0.627	0.536	2.058	0.36
Std. Deviation	0.10	0.20	0.07	0.05				
Median	0.00	0.00	0.00	0.00				
Sector 10	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.05	0.10	0.05	0.03	1.812	0.167	3.314	0.19
Std. Deviation	0.14	0.24	0.11	0.11				
Median	0.00	0.00	0.00	0.00				
Sector 11	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.00	1.163	0.316	2.929	0.23
Std. Deviation	0.01	0.00	0.01	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 12	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.01	0.00	1.573	0.211	2.775	0.25
Std. Deviation	0.01	0.00	0.02	0.01				
Median	0.00	0.00	0.00	0.00				
Sector 13	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.14	0.13	0.10	0.27	6.4	0.002	5.696	0.06
Std. Deviation	0.24	0.21	0.19	0.33				
Median	0.04	0.03	0.03	0.16				
Sector 14	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.00	0.01	0.01	0.416	0.661	0.271	0.87
Std. Deviation	0.06	0.00	0.06	0.07				
Median	0.00	0.00	0.00	0.00				
Sector 15	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.02	0.00	0.00	0.09	7.454	0.001	4.254	0.12
Std. Deviation	0.12	0.00	0.01	0.24				
Median	0.00	0.00	0.00	0.00				
Sector 16	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.00	0.01	0.03	0.953	0.388	3.397	0.18
Std. Deviation	0.06	0.01	0.05	0.10				
Median	0.00	0.00	0.00	0.00				

sector 1	UK All Companies
sector 2	UK Equity Income
sector 3	UK Smaller Companies
sector 4	UK General Bonds
sector 5	UK Gilt
sector 6	UK Equity & Bond
sector 7	UK Equity & Bond Incom
sector 8	UK Specialist
sector 9	Active Managed
sector 10	Balanced Managed
sector 11	Cautious Managed
sector 12	Managed Income
sector 13	Global Growth
sector 14	Global Equity Income
sector 15	Global Equity & Bond
sector 16	Global Bonds

Table 4.9 (continued) Asset differences across 32 fund sector.

Asset weight for an individual sector is measured by the fraction (%) of each ownership group's asset invested in the individual sector. Significance of differences is accessed using a F-test for means and the non-parametric Kruskal Wallis ranks test.

Sector 17	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.00	0.888	0.414	5.47	0.07
Std. Deviation	0.01	0.00	0.00	0.01				
Median	0.00	0.00	0.00	0.00				
Sector 18	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.00	0.00	0.02	2.637	0.075	2.348	0.31
Std. Deviation	0.03	0.01	0.01	0.05				
Median	0.00	0.00	0.00	0.00				
Sector 19	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.02	0.00	0.02	0.01	1.457	0.236	1.121	0.57
Std. Deviation	0.05	0.01	0.06	0.03				
Median	0.00	0.00	0.00	0.00				
Sector 20	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.07	0.07	0.08	0.04	2.297	0.104	8.315	0.02
Std. Deviation	0.09	0.09	0.09	0.08				
Median	0.03	0.00	0.05	0.00				
Sector 21	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.01	0.01	0.01	0.026	0.974	0.946	0.62
Std. Deviation	0.03	0.04	0.03	0.02				
Median	0.00	0.00	0.00	0.00				
Sector 22	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.01	0.00	1.092	0.338	2.407	0.30
Std. Deviation	0.02	0.00	0.02	0.01				
Median	0.00	0.00	0.00	0.00				
Sector 23	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.02	0.01	0.02	0.02	0.644	0.527	6.428	0.04
Std. Deviation	0.04	0.01	0.03	0.06				
Median	0.00	0.00	0.00	0.00				
Sector 24	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.01	0.01	0.01	0.328	0.721	1.05	0.59
Std. Deviation	0.02	0.03	0.02	0.02				
Median	0.00	0.00	0.00	0.00				
Sector 25	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.00	0.798	0.452	1.137	0.57
Std. Deviation	0.00	0.00	0.00	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 26	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.02	0.01	0.02	0.03	1.433	0.242	4.139	0.13
Std. Deviation	0.04	0.03	0.03	0.08				
Median	0.00	0.00	0.01	0.00				
Sector 27	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.00	1.449	0.238	4.729	0.09
Std. Deviation	0.01	0.00	0.01	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 28	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.03	0.03	0.03	0.02	1.288	0.279	5.686	0.06
Std. Deviation	0.05	0.05	0.05	0.03				
Median	0.00	0.00	0.02	0.00				
Sector 29	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.01	0.997	0.372	3.278	0.19
Std. Deviation	0.02	0.00	0.01	0.03				
Median	0.00	0.00	0.00	0.00				
Sector 30	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.01	0.01	0.01	0.00	0.594	0.553	2.664	0.26
Std. Deviation	0.05	0.02	0.06	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 31	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.00	0.313	0.732	0.632	0.73
Std. Deviation	0.00	0.00	0.00	0.00				
Median	0.00	0.00	0.00	0.00				
Sector 32	Total	Mutual	Quoted	Private	ANOVA (F value)	Sig.	Kruskal Wallis	Sig.
Mean	0.00	0.00	0.00	0.00	0.535	0.587	1.924	0.38
Std. Deviation	0.02	0.00	0.03	0.00				
Median	0.00	0.00	0.00	0.00				

sector 17	UK Money Market
sector 18	Global Emerging
sector 19	Global Specialist
sector 20	Europe Ex. UK
sector 21	Europe Inc.UK
sector 22	European Specialist
sector 23	Far East Exc. Japan
sector 24	Far East Inc Japan
sector 25	Far East Specialist
sector 26	Japan
sector 27	Japanese Specialist
sector 28	North America
sector 29	N-America Specialist
sector 30	Guaranteed Funds
sector 31	Index Bear Funds
sector 32	Property

In particular, both the statistical analyses agree that the asset weights of sector 2, *UK Equity Income* and sector 8, *UK Specialists* show noticeable differences by ultimate ownership type. A close inspection reveals that companies owned by quoted company groups show a higher preference for sector 2 (mean 10% and median 5%) than companies owned by mutuals (mean 2%, median 0%) and by private owners (mean 0% and median 0%). With regard to sector 8 where a number of ethical funds are present[10], mutual owned companies show their higher preference for the fund sector (mean 2%, median 0%) than those of the two counterparts.

The above analysis provides evidence that companies with different ultimate ownership have favoured certain sectors of unit trusts, supporting hypothesis (H2). At this stage, it may be interesting to consider why some fund sectors are preferable for a certain ownership type, by examining the nature of the fund sectors from the risk-taking perspective. For this reason, Tables 4.1 (1-a) and (1-b) provide two dimensions of risk, sectors' return and sectors' money flow fluctuation. Nonetheless, it is difficult to identify any particular characteristics derived from Table 4.1 (1-a) as the difference of returns between fund sectors 2 and 8 is marginal. In addition, the money flow ratio of sector 8 is not available due to the fact that the sector 8 is rather new branched off from the U.K equity category.

[10] A list of unit trusts in this sector is presented in Appendix 4.b.

4.4.4 Testing Hypothesis (3): Line of business concentration

Independent tests

As a proxy for the business concentration or the business diversification in reverse, the test of hypothesis (H3) requires the Herfindahl indices based on (i) number of unit trusts and on (ii) number of fund sectors which an individual company offers. Table 4.10 summarises, by ultimate ownership category, the Herfindahl indices per company. In panel 10-a, the means (=3678) and the medians (=2358) show that overall the unit trust companies have diversified product mixes. Specifically, unit trust management companies with the quoted company ownership have the lower Herfindahl indices (mean =2952, median = 2006 for the unit trust based Herfindahl index, mean =3567, median =2731, for the fund sector based Herfindahl index). To provide additional evidence, significance of the differences among the ultimate ownership groups is assessed with a F-statistics and the non parametric Kruskal Wallis test. The results in Table 4.11 confirm that the difference of the business concentration is significant at the 1 % level. For the unit trust based Herfindahl index, and the fund sector based Herfindahl index, F values are 7.1, and 6.4, chi-square are 9.6 and 10.1 respectively. Hence, the product concentration differs by ultimate ownership.

Table 4.10 Herfindahl Index (A measure of the level of concentration)

Based on the sample companies at year end 1999, the tables below present the risk measures based on the Herfindahl index
Two Herfindahl indices are measured for each company in terms of
(10-a,b) number of individual unit trusts and
(10-c,d) number of fund categories

The Herfindahl index is obtained by squaring the asset weight of the various unit trusts (sectors), and then summing those squares. That is defined as
$H = \Sigma (m_{jk})^2 \times 10{,}000$ where m_{jk} is the percentage holding of J^{th} unit trust (fund sector) for company k
A single unit trust / fund sector would take the value of 10,000.

Herfindahl index based on number of unit trusts

10-a: Descriptive Statistics	Mutual n = 24	Quoted n = 87	Private n = 31	Total N = 142
Mean	4,697	2,952	4,927	3,678
Median	4,189	2,006	3,795	2,358
Std. Deviation	3,282	2,443	3,668	3,017
Minimum	972	564	467	467
Maximum	10,000	10,000	10,000	10,000

10-b: Distribution	Mutual	Quoted	Private	Total
1-1999 Least Concentrated	7	43	9	59
2000-3999	5	27	8	40
4000-5999	4	6	3	13
6000-7999	3	4	2	9
8000-10000 Most Concentrated	5	7	9	21
Number of Companies	24	87	31	142

Herfindahl index based on number of categories

10-c: Descriptive Statistics	Mutual	Quoted	Private	Total
Mean	5,036	3,567	5,467	4,230
Median	4,493	2,732	5,012	3,111
Std. Deviation	3,033	2,452	3,444	2,900
Minimum	1,434	1,130	1,276	1,130
Maximum	10,000	10,000	10,000	10,000

10-d: Distribution	Mutual	Quoted	Private	Total
1-1999 Least Concentrated	3	31	8	42
2000-3999	9	32	7	48
4000-5999	3	10	3	16
6000-7999	4	6	3	13
8000-10000 Most Concentrated	5	8	10	23
Number of Companies	24	87	31	142

Data Source: FT Unit Trust & OEICs Year book (year 2000/2001)

Table 4.11 Mean Tests for two Herfindahl Indices (A measure of the level of concentration in funds/fund sectors)

The null hypothesis is that all ownership types means are equal in terms of Herfindahl index
(11-a) based on the number of funds which a company offers
(11-b) based on the number of fund sectors which a company offers

11-a: Herfindahl index based on number of unit trusts	F value	Chi-Square	Significance
ANOVA	7.109		0.001
Kruskal Wallis Test		9.661	0.008

11-b: Herfindahl index based on number of fund categories	F value	Chi-Square	Significance
ANOVA	6.487		0.002
Kruskal Wallis Test		10.134	0.006

Tests by Tobit model

To control factors that might affect the ownership-risk-relationship, this study estimates the Tobit regressions. The model attempts to relate the score of the Herfindahl index to the ownership category as well as to other factors such as size and age of the company. Furthermore, by exploiting the potential size effect of the company on their risk-taking, model 2 includes the interaction variables. i.e. (company size) x (the ownership dummy variable).

Table 4.12 shows the regression results, confirming the higher diversified product mixes of the quoted company ownership. The coefficient on the dummy variable denoting the quoted company ownership is negative (-1263) and significant (t=-2.18). Similarly, the coefficient of the privately owned group is also negative (-919) but insignificant (t=-1.32). Nonetheless, when the interaction variables are added in model (2), no new evidence emerges as the coefficients of the interaction variables are insignificant whereas the quoted company ownership dummy variable is –3,330.5 and significant at the 10% level (t=-1.78). Hence, the concentration hypothesis (H3) is supported to the extent that compared with the quoted company ownership, the number of funds is smaller in mutual ownership.

Table 4.12 Tobit regressions relating diversification to ownership type

The following tables present the results from Tobit regressions on the relationship between diversification to ownership type. T-statistics are reported in parentheses. **, * represent the 5% and the 10% significant levels respectively.

Herfindahl Index based on number of unit trusts

	Model 1 Without Interaction	Model 2 With Interaction
Constant	**10939.28** (t=12.8)**	**12023** (t=7.54)**
Log_Asset	**-2165** (t=-7.54)**	**-2588.4** (t=-4.47)**
Company Age	-29.75 (t=-1.6)	-27.0 (t=-1.45)
Quoted Dummy	**-1263** (t=-2.18)**	**-3330.5** (t=-1.78)*
Private Dummy	-919.84 (t=-1.32)	-949.63 (t=-0.48)
(Asset)*(Quoted)		749 (t=1.14)
(Asset)*(Private)		-99 (t=-0.13)

Censored >=10000	17	17
Log Likelihood	-1173	-1171.7
Chi^2	86.12	88.57
Probability > Chi^2	**0.00**	**0.00**
Pseudo R2	0.0354	0.0364

Regression model (1)

$$H\text{-Index}_j = \alpha + \beta_1 (\text{Log\_Asset}_j) + \beta_2 (\text{Company Age}) + \beta_3 (\text{Quoted\_Dummy}) + \beta_4 (\text{Private\_Dummy}) + \varepsilon_{j,}$$

Regression model (2)

$$H\_index_j = \alpha + \beta_1 (\text{Log\_Asset}_j)\ \beta_2 (\text{Company Age}) + \beta_3 (\text{Quoted\_Dummy}) + \beta_4 (\text{Private\_Dummy}) + \beta_5 [(\text{Log\_Asset}_j) \times (\text{Quoted\_Dummy})] + \beta_6 [(\text{Log\_Asset}_j) \times (\text{Private\_Dummy})] + \varepsilon_{j,}$$

where

H_index_j = Company j's Herfindahl Index based on funds / sectors

Log_Asset_j = the logarithm of Company j's total asset.

Company Age = the number of years that the company has been established

Quoted = 1 if company j is owned by an exchange listed company, otherwise 0.

Private = 1 if company j is owned by a privately owned company, otherwise 0.

Log_Asset_j x Quoted _Dummy = the interaction variable of the log asset with quoted ownership

Log_Asset_j x Private_Dummy = the interaction variable of the log asset with private ownership

$\varepsilon_{j,}$ = the random error term

Models (3) and (4) in Table 4.13 test whether the product diversification defined by the fund sector segments differs across the three ultimate ownership groups. The results indicate that there is a less significant linkage between the ownership types and their product diversification after controlling the size effect, as the coefficient of the quoted ownership is negative (-1003) and significant at the 10% level (t=-1.8).

Table 4.13 Tobit regressions relating diversification to ownership type

The following tables present the results from Tobit regressions on the relationship between diversification to ownership type. T-statistics are reported in parentheses. **, * represent the 5% and the 10% significant levels respectively.

Herfindahl Index based on numberof fund categories

	Model 3 Without Interaction	Model 4 With Interaction
Constant	**11094.17** (t=13.43)**	**11822.29** (t=7.7)**
Log_Asset	**-2101** (t=-7.57)**	**-2390.9** (t= -4.29)**
Company Age	-28.5 (t=-1.59)	-25.72 (t= -1.43)
Quoted Dummy	**-1003.97** (t=-1.8)*	-2617.05 (t= -1.45)
Private Dummy	-671.12 (t=-0.99)	-264.41 (t= -0.14)
(Asset)*(Quoted)		581.28 (t=0.92)
(Asset)*(Private)		-271.09 (t= -0.36)
Censored >=10000	17	17
Log Likelihood	-1167.5	-1166.39
Chi^2	85.9	88.14
Probability > Chi^2	**0.00**	**0.00**
Pseudo R2	0.0355	0.0364

Regression model (3)

$$\text{H-Index}_j = \alpha + \beta_1 (\text{Log\_Asset}_j) + \beta_2 (\text{Company Age}) + \beta_3 (\text{Quoted \_Dummy}) + \beta_4 (\text{Private\_Dummy}) + \varepsilon_{j.}$$

Regression model (4)

$$\text{H\_index}_j = \alpha + \beta_1 (\text{Log\_Asset}_j)\ \beta_2 (\text{Company Age}) + \beta_3 (\text{Quoted \_Dummy}) + \beta_4 (\text{Private\_Dummy}) + \beta_5 [(\text{Log\_Asset}_j) \times (\text{Quoted \_Dummy})] + \beta_6 [(\text{Log\_Asset}_j) \times (\text{Private\_Dummy})] + \varepsilon_{j.}$$

where

H_index_j = Company j's Herfindahl Index based on funds / sectors

Log_Asset_j = the logarithm of Company j's total asset.

Company Age = the number of years that the company has been established

Quoted = 1 if company j is owned by an exchange listed company, otherwise 0.

Private = 1 if company j is owned by a privately owned company, otherwise 0.

Log_Asset_j x Quoted _Dummy = the interaction variable of the log asset with quoted ownership

Log_Asset_j x Private_Dummy = the interaction variable of the log asset with private ownership

$\varepsilon_{j.}$ = the random error term

Overall, the evidence in Tables 4.12 and 13 suggest that the hypothesis of the line of business concentration is partially supported when the concentration is measured by the Herfindahl index on the basis of the number of funds. However, such an association is weak when the Herfindahl index on the basis of the number of fund categories is used as the concentration proxy.

A recent research by Massa (2003) provides a potential explanation for these observations. According to Massa, the proliferation strategy for the fund management company can be made in two ways. The first fund proliferation strategy is based on the number of funds being offered by the company. The second proliferation strategy is based on the number of fund categories in which the company is simultaneously operating. Borrowing Massa's notion on the proliferation strategy, it can be said that the three types of organisational forms differ in terms of the first proliferation strategy but not in terms of the second proliferation strategy. Given the observations, the company's implicit assumption behind the strategy may be that investors are paying more attention to the fund specific characteristics such as performance to the category to which the fund belongs.

What is more, the difference exists between mutual and quoted ownership but there is no clear distinction between mutual and private owned companies. This is a far removed from what was expected, indicating the current method is limited for further analysis. In this regard, factor analysis can be a useful tool for this purpose as the factor analysis can identify factors underlying a set of variables, e.g. fund categories (Kachigan, 1991). By clustering a large number of variables such as return variance, money flow variance, fees, total size, and the number of accounts into a few number of homogeneous sets and creating a new variable, e.g. a factor. Then, it is possible to distinguish one fund category from others. Nevertheless, such factor analysis is not feasible for the current analysis because sector 8 is rather a new category so that sufficient data for computing the money flow ratio is not available.

4.5 Summary and Conclusion

The ultimate ownership effect has not been investigated in the UK unit trust industry to the same degree as in the insurance and banking industries. This chapter employs agency paradigm to examine hypotheses regarding the risk taking behaviour of mutual versus stock owned companies in the UK unit trust industry. The theoretical argument exploits various mechanisms to control conflicts of interest between owners and managers. In an attempt to identify such control mechanisms, prior studies presented empirical results using various risk-taking measures. In this light, focusing on a set of unit trusts that a company offers, this chapter analyses assets invested in high risk fund categories (H1), the line of business specialisation (H2), and the line of business concentration (H3) .

The risk-taking hypothesis (H1) is supported but subject to the choice of a risk proxy. When the risk is measured by stability of money flows into a fund category, companies with stock ownership have more assets in such risky categories than the comparable mutual group. Hence, the finding is consistent with hypothesis (1). One possible interpretation of the above finding above is that stock owned companies are taking more business risk, which is represented by money flow instability.

Interestingly, when the risk is defined as asset proportions for sectors with high volatility of return, there is no difference between mutual and quoted ownership group but the private ownership group has more unit trusts categorised into the high risk sector than the former two groups. The private owned company's propensity for unit trusts with higher risk can be explained by their unique characteristics. According to Megginson (1997), the private company is characterised by *non-alienable shares, a very tight ownership structure consisting of a relative handful of major shareholders* (Megginson, 1997, p59). Given these characteristics, Megginson points out that the comparative advantages of the private company lie in "*principally focus, flexibility, and unity of will*" (p.60). It can be said that because of the tight ownership structure, important decision making can be made and executed quickly by managers who have significant ownership stakes in the company. If this is the case, there is no doubt that such a quick decision making and implementation is beneficial in investing high risk equity markets where shares change rapidly and constantly and the liquidity of shares is limited. Another possible explanation is that because the private companies are relatively small in general, they almost have to adopt a niche strategy, developing a contestable expertise in the industry. To sum up, the results partially support the risk-taking hypothesis (H1) and the support is not overwhelming and subject to the risk proxy.

As for hypothesis (H2), the independent tests for the business specialisation (H2) confirm some differences across mutual, quoted and private ownership groups. For example, on average, unit trust management companies owned by quoted companies show a relatively strong preference for *UK Equity Income* sector whilst mutual owned unit trust management companies have more assets in the *UK Specialists* sector than the other two ownership groups.

Regarding the hypothesis of business concentration (H3) where the degree of concentration was based on the number of different funds per company, unit trust companies with quoted company ownership have a more diversified product set than the other two ownership types. Nonetheless, such a pattern is not found when the magnitude of concentration is based on the number of fund sectors per company. Thus, the line of business concentration is also partially supported, depending on the way of measuring the concentration. It is possible to argue that the way of diversification that the quoted company group pursues is to increase the number of funds, but it is not necessary to spread new funds across different fund segments.

By testing the three hypotheses empirically, Chapter IV has explored the relationship between ownership and risk-taking. In accordance with agency paradigm, the overall evidence indicate that companies with different ultimate ownership behave differently in terms of risk-taking activities. However, this depends on the choice of risk proxies, affecting the relationship between ownership and risk-taking.

Shifting the focus from risk-taking to the performance of unit trust management companies, Chapter V investigates the efficiency - ultimate ownership connection in the UK unit trust industry.

Chapter V
Analysis of Corporate Efficiency

5.1 Introduction

As corporate risk-taking is a critical factor to company performance (Bromiley, 1991), the previous chapter explored the relationship between ultimate organisational form and risk-taking of UK unit trust management companies. Chapter V continues the line of enquiry into effects of organisational form, by shifting the focus from risk-taking to performance of unit trust management companies. The ultimate goal of this chapter is to compare performance of companies with mutual ownership and those with proprietary ownership.

In order to achieve this task, there is one question to be answered; how "performance" of unit trust management companies is defined and measured? As "*measuring firm performance has been a major challenge for researchers* (Mingfang and Simerly, 1998, p173)", a formation of performance variable is crucial but also difficult. For this ground, a substantial part of this chapter has addressed such variable formations and models with the variables.

The plan of Chapter V is as follows: Section 5.2 begins with a review of existing literature on performance-ownership relationship, leading to a central hypothesis in section 5.3. Section 5.4 highlights measurement issues. The emphasis in the section is on variable formation of performance. Section 5.5 introduces a model development of a multiple stage Data Envelopment Analysis (DEA) accompanied with Tobit regression, whilst addressing key model design issues. Section 5.6 provides detailed sample data. Finally, section 5.7 brings together the key empirical results found in the preceding research methods.

5.2 Literature Review

In Chapter II agency studies such as Jensen and Meckling (1976) began with the premise that owners and managers have divergent interests. Based on such an assumption, the authors demonstrated that because ownership and control in modern corporations is separated, it is inevitable to see agency problems between the owners and the managers of a company. Observed as an example of the opportunistic behaviours of managers, typical agency problems include managers' lower effort levels, value-reducing growth or diversification strategies, and excess consumption of fringe benefits. Undoubtedly, such behaviour leads to lower operating efficiency, resulting in a reduction of the company's performance.

Based on the agency perspective, a number of researchers have studied corporate performance. The recurring area of research is the relationship between corporate performance as an indicator of underlying agency problems and potential control mechanisms for the agency problems. A typical controlling mechanism is the concentration of ownership, managerial ownership, and large shareholders' effect. By reviewing early literature that addresses these control mechanisms, the following literature section attempts to establish a few hypotheses regarding the performance-ownership relationship.

5.2.1 Concentration of ownership

In general, the financial literature distinguishes companies with stocks that are closely held, i.e. concentrated ownership, from those stocks that are widely held, i.e. dispersed ownership (Chaganti and Damanpour, 1991). In this respect, an early study pointed out that the diffusion of ownership is to weaken the owners' control over professional managers (Berle and Means, 1932), to the extent that ownership concentration represents the power of shareholders (Thomsen and Pedersen, 2000). The above notion suggests that the more concentrated ownership a company has, the smaller agency problems the company faces. To follow this logic, a positive relationship should be expected between the concentration of ownership and performance of a company.

However, opinions vary as to the positive association between concentration of ownership and performance of company. Demsetz (1983), for example, states that ownership structure is *an endogenous outcome of competitive selection in which various cost advantages and disadvantages are balanced to arrive at an equilibrium organisation of the firm* (Demsetz, 1983, page 384). From a slightly different angle, Leech and Leahy (1991) also argue that higher concentration of ownership indicates less shares available in the market, resulting in weak market based disciplines over managers of the company. Hence, the debate becomes an empirical question.

On the empirical side, Demsetz and Lehn (1985) estimated a linear relationship between ownership concentration and accounting based performance of company. Their sample data consisted of 511 U.S companies in 1980. After controlling the firm size, business uncertainty[1] and regulated industries[2], the authors found no positive correlation between concentration of ownership and performance of company. Holderness and Sheehan (1988) and Leech and Leahy (1991) also report the similar observations that concentration of ownership dose not automatically award superior performance of company. Given the no significant relationship between ownership concentration and company performance, a simple numerical measure of ownership concentration may be naïve. The problem is that early analyses of the concentration effect gave no consideration to elements of ownership concentration, e.g. the identity of owners. In order to fill the void, the following review of literature examines the managerial ownership effect (section 5.2.2) and the large block-holders' effect on corporate performance (section 5.2.3).

5.2.2 Expense preference hypothesis

The line of ownership concentration is extended to the control over managers' rent-seeking behaviour. The argument is that managers who are not the owners or shareholders of their company pursue strategies that increase their personal benefits at the expense of the company's owners (Williamson 1963). Viewed from the conflict of interests between owners and managers, it is often argued that mutual organisations pose serious control problems over such owner-manager conflicts because mechanisms for controlling owner-manager conflicts are less available or more costly in mutual organisations than in market listed companies (Fraser and Zardkoohi, 1996; Cummins et al, 1999). As for the

[1] Instability of a company environment is computed by the non-systematic risk of the company's stock
[2] Dummy variables are used for a regulated utility, regulated financial institution, or media company.

market listed companies such mechanisms refer to the market for corporate control. The examples are mergers, tender offers, leverage buy-outs, proxy offerings and voting rights. Except the voting for de-mutualisation, subsequent to the merger and acquisition deal, none of these mechanisms is present for the mutual organisations. This means that mutual policy holders and mutual depositors can not easily dismiss manager nor can they compensate them for acting in the owners' interests by providing ownership e.g. stock options. As a result of the relatively weak control mechanisms in the mutual organisations, it is argued that the mutual organisations are likely to suffer more from the manager's rent-seeking behaviour than the quoted company counterparts.

5.2.3 Managerial ownership effect

Arguably, the most direct method to mitigate the agency problem is to provide the manager with a share of the company (Byrd, et al 1998). Through acquiring some of the company's shares, the managers are becoming "insider" or "managerial" owners. As a result, the managers' interests are more closely aligned to those of the owners. This "convergence-of-interest" hypothesis suggests that ceteris paribus, managers' incentives to maximise owners' wealth increase as the managers' shareholdings increase. As the hypothesis predicts, a number of empirical studies present a positive relationship between managerial ownership and company performance.

Nonetheless, as the following research found, the relationship is non-monotonous. Morck, Shleifer and Vishny (1988) analysed the linkage between Tobin's Q[3] and managerial holdings, using a sample of 371 companies from the U.S *Fortune500 group.* Morck et al regressed Tobin's Q on the three explanatory variables of managerial ownership, depending on the degree of the managerial ownership level; (i) less than 5%, (ii) between 5-25% and (iii) over 25% of the managerial ownership concentration. The results of their piecewise regression show that coefficients of (i) and (iii) are positive whilst a coefficient of (ii) is negative. The results suggest that as the managers' holdings reach a certain degree the managerial ownership can adversely affect corporate performance, possibly because managers with large shareholdings become more risk averse. In a similar study, McConnell and Servaes (1990) provide evidence with substantially large sample data consisting of more than 1000 U.S corporations for 1976 and for 1986. The authors found that Tobin's Q increases with managerial ownership up to 40% of the total outstanding shares and decreases after that.

The explanation for the non-linear association is that as managers' shareholdings become large enough to secure their positions, the managers become entrenched, allowing them more freedom to pursue non-value-maximising activities. This refers to the entrenchment hypothesis. The results of the empirical studies noted above appear to support the hypothesis.

[3] Tobin's Q is the ratio of the market value of the stock to the replacement value of the company's assets.

5.2.4 Large shareholder effect

By extending the notion of concentration of ownership further, the existing literature suggest that corporate performance may be related to large ownership groups, like institutional investors and corporate or individual block shareholders. Shleifer and Vishny (1986) argue that the presence of large shareholders should increase the likelihood of monitoring, which should subsequently decrease agency costs and increase the company value. There are a number of ways in which block shareholders can bring significant pressure on managerial decisions. These include negotiating with management, exercising a proxy contest, and participating in the choice of board members.

There are a number of reasons that account for the positive impact of the block holders on corporate performance. Firstly, as benefits brought by monitoring actions are shared amongst all shareholders on a pro rata basis, a large block holder gains a large proportion of the benefits whereas owners with small shareholdings gain more than their fair shares of the benefit at little or no cost.

The latter is referred to as the "free riders". As small shareholders have little incentive to monitor their company, this becomes a serious problem for a company with such dispersed ownership, leading to decreased efficiency. In this respect, it is argued that block holder ownership such as institutional investors provides a partial solution to the free-rider problem, by enhancing their own monitoring activities (Gillan and Starks, 2000). Secondly, block holders are often professional investors such as pension fund managers. These professional shareholders are believed to have special capabilities in evaluating business activities. In this light, their costs of analysing management proposals are less than those of ordinary shareholders. Finally, in recent years large shareholder activism has occurred. For instance, Gillan and Starks (2000) reported that there were 2042 proposals by large shareholders over the period of 1987-1994 in the U.S. Possible backgrounds of the shareholder activism are (i) market controls such as hostile take-overs become rare whilst large investors are encouraged by their regulatory bodies to be active on behalf of their clients[4] (The Economist, 1992; Solomon and Solomon, 1999). (ii) Selling large shareholdings without creating downward price pressure is difficult (Byrd et al 1998), (iii) As passive investment becomes popular, institutions following an index investment strategy are locking their large shareholdings into long-term stakes. (The Economist, 1992). The latter two situations in particular drive institutional investors to look for a vote, rather than to "disinvest". This issue is taken up in the next section.

4 The Cadbury Report of the U.K explained that institutional investors should use their voting rights to effect changes, rather than to exit. The Security Exchange Committee in the U.S encourages useful contacts between managers and shareholders ("*Arise, the Active Shareholder*" The Economist, July 4, 1992).

Empirical evidence of the relationship between block-holders and performance of company is mixed. McConnell and Servaes (1990) find a positive linkage between Tobin's Q ratio and institutional ownership, but no significant relationship between Tobin's Q and undifferentiated block holders. Certainly, their results indicate the importance of the identity of large block holders. Mikkelson and Ruback (1991) posit that, as a proxy of corporate performance, the stock price increases as a response to the accumulation of shares and the announcement of block holdings. Consistent with the findings of Mikkelson and Ruback, Shome and Singh (1995) report positive stock price reactions to block investments made by corporate and institutional investment shareholders. Nonetheless, the authors find weak evidence, of the monitoring on a daily operational level on the ground that, changes in a company's cash flow and capital expenditure do not differ between companies with and without block holdings.

Overall, in analysing the impact of ownership on corporate performance, the existing literature suggests that not only the degree of ownership concentration but also the type of ownership are important. However, there is mixed evidence on the question of whether various owners and their concentration levels can be effective as a disciplining mechanism.

5.3 Building Hypotheses

5.3.1 Hypothesized effects of the severe free rider problem

These arguments help distinguish characteristics of ultimate ownership used in the present research. Namely, from the standpoint of the concentration of ownership, mutual institutions and quoted companies fall under the dispersed ownership category whereas privately owned companies belong to the concentrated ownership group. It is important to recall the idea of the ownership-control literature by Berle and Means (1932) and more recently by Jensen (1989), who note that if ownership is widely dispersed, there is no individual (or group) with either voting power or indeed the incentive to exercise control in order to pursue profit maximisation. As a result, professional managers, rather than the owners, have effective power to influence the owners operating more at arms length.

Conversely, as briefly reviewed in the prior section, there are conflicting arguments as to the relationship between ownership concentration and company performance. Demsetz (1983) predicts no significant relationship between ownership concentration and performance of company because the positive and negative effects of the ownership concentration will usually balance out.

Leech and Leahy (1991) suggest a negative relationship between degree of ownership concentration and company performance. Given the academic debate and results of empirical research, it is not straightforward to establish the hypothesis. Nonetheless, focusing on the weak incentive of a large number of small shareholders as a consequence of dispersed ownership, it seems plausible that mutual institutions are less likely to be subject to owner-pressure than other organisational forms. The rationale is that each owner, e.g. account holder or policyholder, holds only a small percentage of ownership of their mutual institution. Moreover, such mutual institutions do not have any block shareholders with sufficiently strong incentives to monitor the management of the mutual organisation. In other words, no one in the mutual organisation has a sufficient interest to bear the costs of maintaining and increasing the value of their mutual institution. Therefore, the primary hypothesis regarding the ownership-performance relationship is: Performance of unit trust management companies owned by stock companies is better than that of those owned by mutual institutions.

5.3.2 Hypothesized effects of institutional investors

As for the type of ultimate owners, this analysis assumes that the identity of large block holders is of importance, drawing on a few recent works such as Porta et al (1999), Thomsen and Pedersen (2000) and Gillan and Starks (2000). These authors emphasise that a lot of large owners such as pension funds, banks, corporations and governments work as agents for their ultimate owners and that objective and risk preference differ among a set of categories of final owners. In this account, one should bear in mind that mutual institutions have no large block holders due to the fact that owners of mutual institutions are individuals who use their mutual institution's services like insurance, savings and mortgages. By contrast, shareholders of market-listed companies are not only individuals but also large block holders such as institutional investors and other corporations.

Similarly, shareholders of privately owned companies consist of large block holders. However, in contrast to those of quoted companies, large block holders in private owned companies are often entrepreneur or founding families[5].

Following Thomsen and Pederson's classification, large block holders are sorted into several groups, e.g. institutional investors, family owners, and non-financial corporate owners.

Institutional investors

Institutional investors refer to public and private pension funds, collective investment schemes like mutual funds in the U.S and unit trusts in the U.K, and foundations such as university endowments. Their corporate governance activism is a matter of both law and economics.

On the legal side, the institutional investors have fiduciary duty because money invested by the institutional investors is ultimately "other peoples' money." (Parthiban and Pahul, 1996). It is argued that the principle of trust law requires these fiduciaries not only to protect the value of investments, but also to enhance them when possible (Sherman, 1990). Hence, in order to avoid a breach of their legal obligations, institutional investors are expected to utilise their shareowners' rights including voting on proxies.

[5] Shome and Singh (1995) reveal that individuals hold the largest block shareholdings of the small size companies.

In terms of economic gains to the institutional investors, increased shareholding of their portfolio companies makes it more difficult for them to sell their shareholdings without adversely affecting the stock prices (see also Chapter VI). Moreover, institutional investors with a passive strategy, i.e. a market index based investment, have little room to change shareholding of an index component. Therefore, it seems old-fashioned to follow *"the Wall Street Rule"* that institutional investors vote with the management of their portfolio companies or sell their shares, rather than opposing the management (Monks and Minow, 1995).

For these reasons, it is worth noting that performance of institutional investors is often measured in terms of financial success and their objective can therefore be described as "shareholder-value" and liquidity (Thomsen and Pederson, 2000, page 693).

Individual or family owners

Entrepreneur or family owners play a double role in the company, concerned not only with the survival of their company (as owners'), but also the control over the company (as the company's managers). Further, the entrepreneur or family owners with significant shareholdings may derive private benefit from running their company at the expense of minority shareholders (See, for example, Holderness and Sheehan, 1985).

Corporate owners

The term "corporate owners" refers to stock owned non-financial business entities. At the extreme, the Japanese Keiretsu groups provide good examples when considering the effects of corporate block holdings on corporate performance. There are pros and cons of such corporate block holders. On the positive side, corporate block holders take an active monitoring roll in a manner similar that of institutional investors. For instance, Holderness and Sheehan's (1988) indicate that corporate block holders send their representatives for their invested companies, placing them in senior managerial positions. Furthermore, if the corporate block holders have business connections with their invested companies, the block-holding companies can reduce various transaction costs whilst the invested companies expect synergy gains (Shome and Singh, 1995).

On the other hand, the potential benefits accompany some costs. The most negative impact would be that corporate block holders may reduce the value of the invested company by expropriating wealth from the company. To a lesser extent, evidence from Brickley et al (1988), suggests that block shareholders with business connections to the company may be less effective at monitoring than those without business ties.

Overall, the objectives of institutional investors can be distinguished from those of family block holders and corporate block holders. In essence, the latter are likely to pursue non-shareholder value maximisation whilst the former has a fiduciary duty to protect their clients' wealth. In light of this, by extending Thomsen and Pedersen's (2000) conjecture that ceteris paribus, there is a positive ownership effect of institutional investor on shareholder value, the second hypothesis for this chapter is as follows: Unit trust companies owned by quoted companies perform better than those owned by private companies or by mutual organisations.

5.4 Efficiency as a performance variable

5.4.1 Background

To test out the two hypotheses noted in the preceding sections, it is necessary to specify the variable of company performance. However, an underlying difficulty in developing the performance variable is that data concerning individual unit trust management companies is limited and complicated in several respects. For example, as briefly noted in the early chapters, shares of unit trust management companies are not listed in exchanges. Consequently, conventional market-based performance measures such as Tobin's Q and relative return to market indexes are not obtainable.

Further limitation and complexity exists in making use of the financial statement. One must recall section 3.1.5 in Chapter III, which briefly stated that a unit trust management company often serves as a quasi-nominee within the group by outsourcing its investment management business to the fellow specialist companies. On this premise, transactions are a normal feature of business between the unit trust management company and its affiliates such as administration services and portfolio management companies. In studying the financial statement of a unit trust company, such group transactions lead to complicated information in two ways.

The first of these complications is associated with an abbreviated format. The profit and loss account of an individual unit trust management company is often abbreviated in a manner that *Financial Reporting Standards 8, Related Party Disclosures* (FRS 8)[6], allows group companies to present minimum information regarding the inter-group transactions. The Aberdeen group, for example, employs this accounting policy. A note taken out from the annual financial statement of Aberdeen Unit Trust Managers reads that *the Company has taken advantage of the exemption contained in FRS 8 and has not to disclose transactions or balances with entities which form part of the group* (Aberdeen Unit trust annual financial statement, p7, Note 1). As a result of this practice, it is not clear exactly how much the Aberdeen Unit Trust manager limited pays for the investment advice from the Aberdeen Asset Management, an investment arm of the Aberdeen group. This example demonstrates that because of such an accounting standard, there is not always comprehensive information provided in audited financial statements of individual unit trust management companies.

Related to the first point, the next point is that a potential transfer pricing is present where a portfolio management company sells its advice to a unit trust management company within the group. This practice is likely to distort the true picture of the profitability of the unit trust management company because *the price at which services are exchanged takes on a significance* (Watts, 1996, p740). In the context of a financial service group, the higher the investment advisory fee, the portfolio management company providing the investment

[6] This is issued in November 1995.

advice will appear more profitable. The unit trust management company using the advice for running their unit trusts will appear less profitable.

The following paragraph explicitly points out that such a transfer pricing practice is present. *All staff performing work for the Company are employees of and have contracts with State Street Global Advisors United Kingdom limited. Full reimbursement of staff costs is made by State Street Unit Trust Management Limited under the world wide transfer pricing system adopted by State Street Corporation.* (Taken out from Note 3 to the accounts in Report and Accounts of State Street Unit Trust Management Limited, December, 2000)

In summary, at the financial statement level, a related party relationship between a unit trust management company (a subsidiary) and its associated or parent companies result in abbreviated profit and loss accounts and potential transfer pricing practice. These practices are problematic in computing conventional business ratio such as return on equity and net margin ratio.

As an alternative approach, the subsequent empirical analysis applies the notion of efficiency to the performance measurement. More specifically, a ratio is constructed by a set of input and output variables that are less affected by the transfer pricing practice or by the abbreviated format. Subsequently, the multiple inputs and outputs form is processed by Data Envelopment Analysis (hereafter DEA). Before moving onto the next section describing DEA in depth, let us summarise a number of justifications for taking the efficiency approach.

On the conceptual side, efficiency can be viewed as a variant of performance measures. According to the directory of UK Industrial Performance Analysis, "*performance is usually measured through a series of business rations* (UK Industrial Performance Analysis 1997/1998, p.8)." In short, a performance measure is defined with a ratio format. From this point of view, the format of efficiency, which is usually expressed as outputs over inputs (or inputs over outputs) can be seen as an extension of performance measures.

There is another justification to use efficiency as the performance proxy in this chapter. It is debatable whether the conventional profitability ratios such as return on equity should be used as the performance proxy for the current analysis. The reason is that mutuals can be expected to exhibit lower profitability than the comparable stock companies because the mutuals' primary goal is to provide low-cost coverage to members, not to earn high profits (Swiss Re, 1999). If this is the case, it makes sense to compare the efficiency, e.g. revenue over costs between the mutuals and stock owned companies.

From the agency theory paradigm, the dimension of efficiency can fit the bill for testing the performance-ownership relationship. Agency theory and efficiency is connected in a way that the impact of agency costs on a corporate performance is central to agency theory. In the realm of efficiency literature, such costs can be treated as inputs in efficiency studies.

A typical agency cost emerges from a manager's short-term rent seeking behaviour. Referred to as expense preference behaviour in section 5.2.2, managers engage in activities that enhance their non-salary income or provide the forms of on the job consumption. Examples of this are unnecessarily expensive offices, business lunches, and travel expenses. This type of behaviour reduces corporate performance by increasing costs, leading to inefficiency of the company.

Given the agency theory perspective, the situation above can be summarised that *inefficiency is caused by conflict of interest* (Habib and Ljungqvist, 2000,p 2). Agency theory predicts that such conflicts of interest can be mitigated via incentive or monitoring schemes. Viewed in this way, it is evident that efficiency framework is suitable for studies based on agency theory.

From the perspective of empirical literature, studying demutualisation in the U.S, Masulis (1987) predicted that organisational change occurs when economic efficiencies are to be gained. In a similar vein, Cummins et al (1999) studied relative efficiency of mutual and stock organisational forms in the U.S property-liability insurance industry. Hence, in studying the UK unit trust industry where different ultimate ownership, e.g. mutual association and stock company co-exist, it is worth following Masulis and Cummins et al's approach.

5.4.2 Testable hypotheses

By taking into account the data constraints and the efficiency framework, the two general hypotheses in section 5.2 should be developed. Thus, the two broad hypotheses are rephrased as follows;

(H4) Higher efficiency of stock owned companies.

Unit trust management companies owned by stock companies show higher efficiency than those owned by mutual institutions.

(H5) Higher efficiency of market listed companies.

Unit trust companies owned by quoted companies show better efficiency than those owned by private companies or by mutual organisations.

5.5. Methodology

5.5.1 Measuring Efficiency

Efficiency is a function of inputs and outputs, broadly defined as the production of the most outputs using the least inputs. Let us define input and output variables that are suitable for the analysis in the current chapter.

On the output side, Chapter III revealed that the revenue is generated from annual management and initial fees in the U.K unit trust industry. The management fee increases as returns of invested assets are up whilst retaining the existing unit holders. The initial fee increases as the sales of new or existing unit trusts increase.

Based on the two different types of fee income, the company can have two strategic objectives, e.g. asset expansion by organic growth and by sales driven growth. For this reason, it is ideal to make a distinction between the two fee incomes. Nonetheless, the careful inspection of the audited financial accounts of the sample companies uncovered that not all of the companies disclose the income by fee segments. This is primary due to Generally Accepted Accounting Practice in the United Kingdom (UK GAPP). More specifically, Statement of Standard Accounting Practice 25 (SSAP 25) seems to account for such aggregated revenue information. Private company entities within certain business scales[7] are not subject to the full segmental requirement (Ernst & Young, 1999, p1247). Due to the limited segment information, the aggregated revenue after sales commissions and discounts is used as the output variable.

On the input side, two items based on the audited accounting statement are used as the input variables: (i) Capital employed including shareholders' fund, short and long term debt from the group undertakings and (ii) Administration expenses. The key emphasis is on the view from the parent or group company's

[7] In order to take advantage of the disclosure exemption, a company should not have any two of the following conditions. Turnover exceeding £112 million, total assets exceeding £56 million and average number of employees exceeding 2,5000.

interest in selecting the input variables that are essential to run the unit trust management business within the group.

Capital Employed

The basic situation is that a unit trust management company needs capital whereas the parent or group company provides their affiliated unit trust company with capital. Consistent with the standard investment appraisal framework (for example, Stead, 1995, p17), such a parent-subsidiary relationship can be evaluated with respect to the investment return that the unit trust management company achieves on the parent's capital involvement. Hence, capital should be treated as the primary choice for an input variable.

In certain circumstances[8], a parent company may decide to finance a unit trust management subsidiary with short or long term loan capital rather than equity share capital in providing financial support for the unit trust management subsidiary (Ernst & Young, 1999 p.614). Therefore, as the input variable, capital must include short and long term debts from the parent or group company. For this reason, the input variable should be referred to as capital employed.

From a pragmatic point of view, there are further justifications for using capital employed as the input variable. For instance, figures concerning capital employed are unlikely to be distorted by the inter-group accounting practice because shareholder fund is a requirement for the balance sheet. With regard to inter-company balances, the Company Act 1985 requires the financial statements

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[8] For example, there may be tax advantages, restrictions not on interest payments but on dividend payments. Further, it may be easier to collect money from loans than from equity in the event of nationalisation of the subsidiary.

to contain loans and amounts owed to and by group undertakings (the Company Act 1985, Schedules 4 and 5). Viewed in this light, information of capital employed should be straightforward and reliable.

The focus on capital employed should be informative in light of the demutualisation boom in the U.K. During the recent mutual-conversion boom in the U.K, it has often been argued that mutual organisations have limited flexibility in accessing to additional sources of capital. By contrast, quoted companies have more opportunities to raise their capital by issuing new shares or fixed interest corporate bonds. On the basis of the capital constraint, the argument for demutualisation is that aiming at business expansion and competing against the quoted company counterpart, mutual associations should be converted into public limited companies.

Moreover, it is worth asking which type of organisations are good at capital utilisation. One can argue that because of easy access to capital, quoted companies are likely to be overcapitalised. In the same spirit, mutuals may be good at managing capital because capital is a scarce resource for them. The completely opposite view can be also supported. Quoted companies can show efficient capital management because of monitoring activities by shareholders and debt holders providing their money for the company. On the other hand, mutuals have little pressure from external forces so that their capital management is loosely. All in all, capital employed should be an indispensable input item in the current efficiency analysis.

Administration expense

Administration expense is likely to be sensitive to transfer pricing practice within a financial group, however the key arguments for using the administration expense as the next input variable are twofold. Primarily, regardless of which group company pays, the administration expense is a necessary cost incurred to the group in running their unit trust business. Second and more importantly, administration expense can be a good proxy of agency costs in that managers generate unnecessary costs through non-salary consumption as described in the previous section 5.2. It is believed that the benefits of using the administration expense as the input variable appear to outweigh the potential transfer pricing problem, which can not be completely eliminated. For these practical reasons, the present empirical analysis adds the administration expense to the input factor in the form of efficiency.

5.5.2 Overview of the hypothesis testing procedure

Similar to the first empirical analysis in Chapter IV, the objective of this empirical analysis is to contrast efficiency levels across different ultimate ownership of unit trust management companies. The first hypothesis testing is to compare efficiency between mutual and stock owned unit trust companies. The second hypothesis tests whether unit trust management companies owned by listed company groups are more efficient than those owned by non-listed company groups. In order to achieve this, the research design is based in a cross-sectional comparison in a similar fashion to the previous empirical analysis.

Another important factor to employ the cross-sectional design is the cost of data collection[9].

The procedure for the current chapter is generally consistent with that of the previous chapter. The statistical tests used are independence tests and Tobit regression models where a performance variable is regressed on ultimate ownership variables whilst controlling for influential factors. However, one important distinction should be noted at the stage of the dependent variable formation. This chapter uses Data Envelopment Analysis (DEA), a linear programming technique in order to obtain a score for a company's efficiency whilst the preceding analysis simply used the Herfindahl indices and the standard deviation framework in computing the risk taking proxies.

The procedure for the current empirical analysis consists of three stages. The first stage involves the estimation of the relative efficiency by conducting DEA. Specifically, given the data constraints described in section 5.4, the efficiency variable is clarified and operationalised together with DEA. The second stage is to explore the difference between the efficiency scores on two ownership groups by independence tests. The third stage employs Tobit regression models to assess the efficiency-ownership relationship whilst adding several controlling variables such as size and the product mix of the sample companies. Finally, as the analyses proceed, small credibility checks are conducted, resulting in some interesting insights concerning potential causes of the primary results of the hypothesis testing.

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9 Purchasing a single annual audited financial statement from the *Companies House Direct* via online costs two pounds.

5.5.3 First Stage: Computation of the efficiency score by DEA

In order to compute efficiency scores for individual companies, this thesis employs DEA that was originally developed by Charnes, Cooper, and Rhodes (1978). According to Molinero and Woracker' s definition (1996), DEA is a linear programming based on technique for the analysis of efficiency of organisation with multiple inputs and outputs (Molinero and Woracker, 1996,p.22). The basic mathematical computation is showed in Appendix 5-a whilst the following section illustrates the underlying estimation technique.

An example[10]

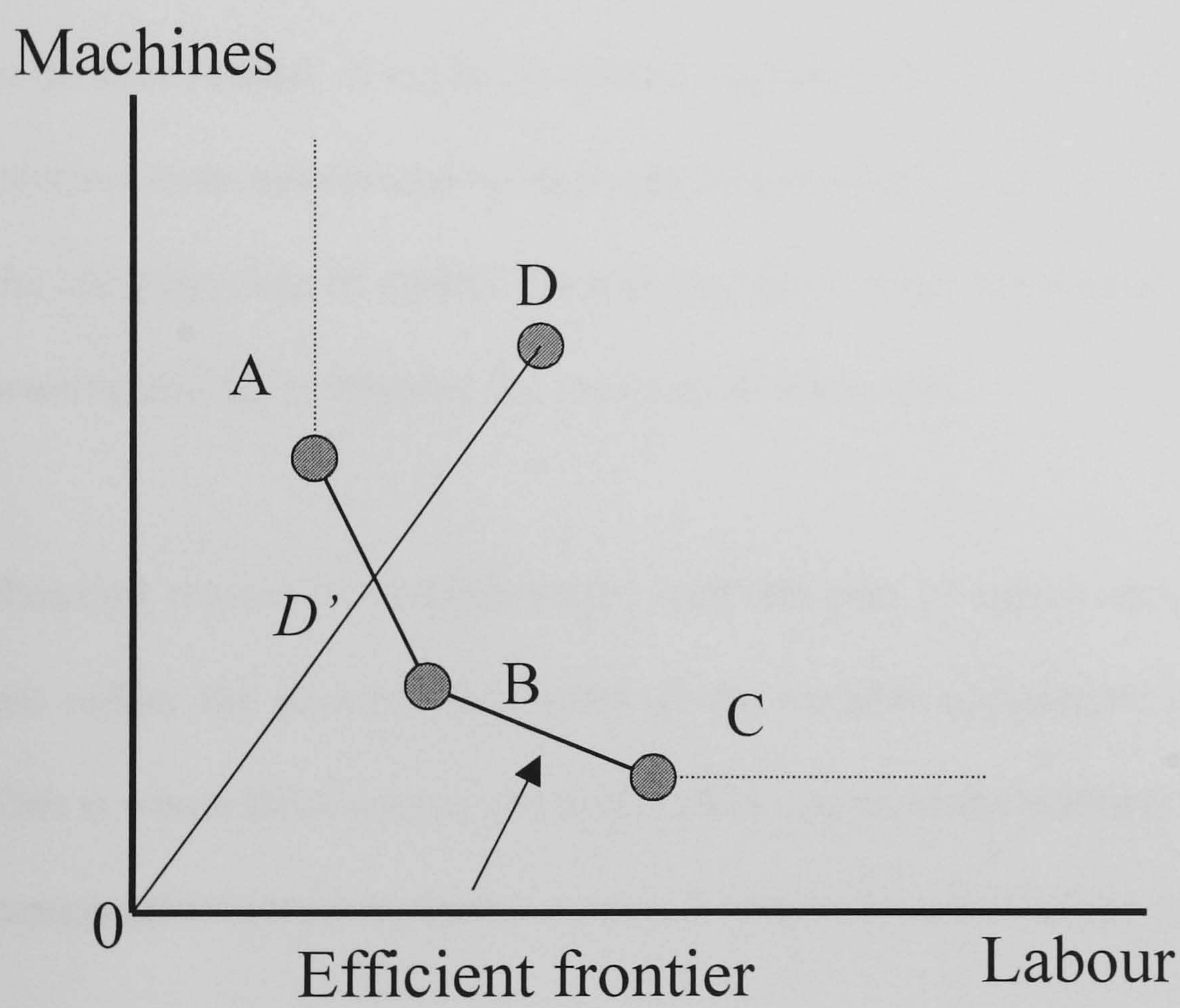
Figure 5.1 shows the efficient frontier for a sample of four car manufactures (A to D) that are assumed to produce a given level of output (a standard amount of cars) using two inputs (labour and machines). Companies A, B, and C make up the frontier because a linear combination of adjacent pairs generates the shortest distance to the origin. Joining points A, B, and C gives rise to the line segments AB and BC, which represent combinations of the three best practice manufactures and form part of the efficient frontier.

DEA recognises the possibility of using a different combination of resources to achieve the same level of output. The frontier formed by connecting points A, B and C indicates such substitution possibilities. The respective partial productivitis of labour and machines vary between A, B and C. Labour productivity decreases and machine productivity increases from A to B to C. Company D is inefficient because it uses more labour and machines than a liner

[10] This illustration is based on *Progress in Rail Reform*, (the Production Commission, 2000)

combination of A and B to produce the same level of output. D is compared with a linear combination of companies A and B (D's peer group), denoted D'. The input mix of these three companies (that is the ratio of labour to machines) is comparatively similar. Company C is in a separate peer group as its input structure (high labour intensity) differs from A, B and D. Consequently, it is not used to evaluate D.

Figure 5.1: A Simple Illustration of Efficiency frontier



For each company in a peer group, the DEA score is estimated as a relative measure. The efficiency score of A and B is one in this exmple whilst the efficiency score of company D is given by the ratio OD'/OD, taking the measurement along the radial line connecting the company and origin. The score of D' means that it could produce the same level of output using less resources company D currently uses, according to the best practice in the industry, e.g. companies A and B.

In the context of the current analysis, there are several justifications for using DEA.

Multiple inputs and outputs

Given the efficiency framework with two inputs and one output, the model should reflect the multiple input–output dimension where each variable is likely to be inter-related. It is vital to take into account the interrelation as a company's decision over administration and capital management can be inefficient because the company fails to control the administration costs, or because the company is wasting capital, or because the company is doing both.

Standard regression methodologies with one pair of output-input at a time can not reflect the multiple dimension of the variable components simultaneously. This is where DEA comes into play. DEA can solve the problem by generating a comparative ratio of weighted outputs to inputs for each sample company.

Potential improvements

A further related advantage is that DEA can show how all inputs could be proportionally reduced without reduction in output. In other words, whilst the efficiency score ranges between nil and one (=100%), DEA indicates the extent to which each input can be reduced to achieve a relative efficiency of one and this is usually expressed in percentage terms. Clearly, such indications are meaningful in considering the optimal cost management.

In the context of this thesis, the analysis with DEA attributes a company's relative efficiency to two components associated with agency problems: (i) revenue relative to administration expenses that a unit trust management company require, and (ii) revenue relative to capital employed that a unit trust management company require. DEA has been used in order to estimate such input attributes simultaneously.

No priori functional form

DEA as a non-parametric method does not require explicit specification regarding the form of the functions that are supposed to prescribe how inputs used are related to outputs produced (Murthi et al, 1997; Brockett et al 1998; and Avkiran 2002). On the other hand, parametric methods such as those based on a regression relied on the specified cost or production function. Consequently, the parametric technique is likely to suffer from potential specification errors unless the true function is known. In this respect, DEA has a considerable advantage in conducting efficiency analysis with regard to the UK unit trust management companies because the cost function is yet unknown.

DEA versus SFA

To the extent that both DEA and stochastic frontier analysis (hereafter SFA) have constructed similar frontiers from data, there is on-going debate amongst researchers about the appropriate nature and usefulness of the DEA approach versus the stochastic frontier approach (for instance, Huang and Wang, 2002). Nevertheless, apart from the model specification problem, the SFA approach has a few limitations in the context of the current research. The simple model is written as follows (Cebenoyan et al 1993).

$$TC = f(Q_j, P_j) + \varepsilon_j \qquad (5.1)$$

where TC represents total costs; Qj, outputs; Pj, input prices; and ε_j a disturbance term:

$$\varepsilon_j = u_j + c_j \quad j=1,\ldots,n, \qquad (5.2)$$

From the computation perspective, although SFA is similar to a traditional regression model, the noise is composed of two terms, a one-side (in)efficiency term, c_j, and a two sided noise term, u_j. The common assumptions for the distribution are a normal for u. However, it is argued that the selection of these distributions for c_j and u_j is problematic because of the relatively inflexible nature, leading to significant error in estimating individual company's efficiency (Drake and Hall, 2003).

Furthermore, from the data collection perspective, it is evident from the model specification that the cost function requires data on input prices. In this regard, data on the number of employees is not available, however the aggregated administration expense is disclosed. This is partially due to the fact that working as a quasi nominee company within the group structure, a unit trust management company often has no employees, outsourcing as described in preceding section 5.4.2. Hence, it is difficult to compute an accurate figure of the input prices. For these reasons, the current analysis employs the DEA approach.

5.5.4 Assumptions and drawbacks

Assumptions

In contrast to SFA, DEA can handle the model specification problem by imposing little restrictions on the assumed model. The minimum assumptions required for DEA are monotonicity, convexity, and return to scale. Often defined as free disposability, monotonicity refers to the ability to produce less outputs using less inputs. Convexity means that it is possible to make weighted averages of production plans. In other words, all inputs and outputs are divisible. Finally, there are two return-to-scale models in the DEA approach; constant and variable return to scale. The issue of the return to scale is addressed in the next section concerning model specifications.

It is worth commenting on the specific assumptions of DEA with respect to measurement of efficiency in this thesis. First, in general, DEA focuses on productive efficiency rather than economic efficiency. For the purpose of analysis, the DEA model focuses on levels of inputs, e.g. administration expenses and the capital employed to levels of outputs, e.g. management and initial fees. Accordingly, the type of efficiency to be measured is economic or value-based rather than unit based or technological one, which is often used in non-financial service studies (Diacon et al, 2003). This is because inputs like the capital employed can only exist in value terms. A few of administrative features such as the number of employees may be obtainable. However, not all companies in the sample provide such details. Moreover, the output of financial services is intangible in nature so that no unit of output can be identified (Diacon et al, 2003).

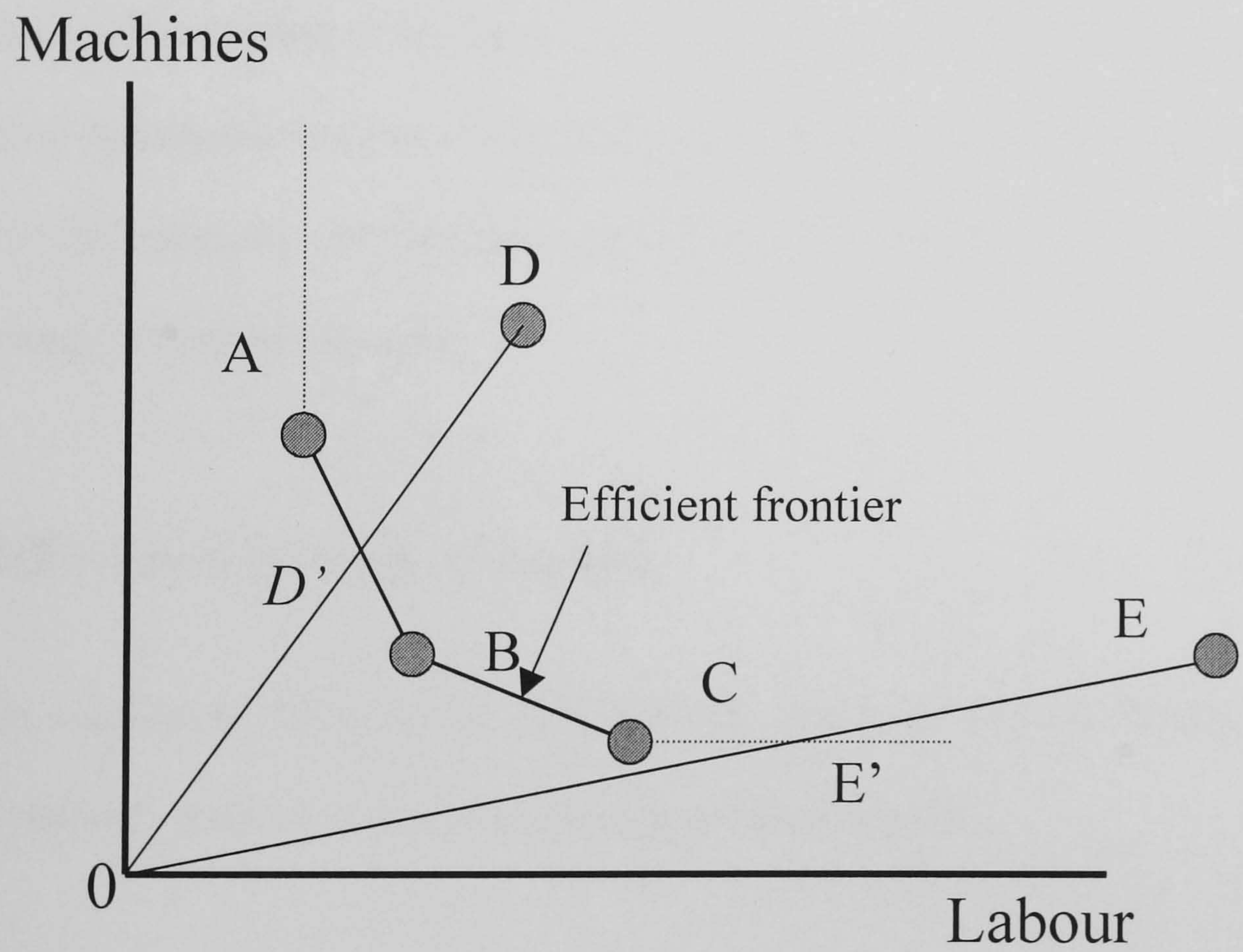
Second, DEA used in this thesis is based on a pooled frontier approach, which evaluates the efficiency of each company regardless of their ultimate organisational form. The pooled frontier approach may be limited if the following efficiency hypothesis holds. Cummins, Weiss and Zi (1999) and Cummins, Rubio-Misas and Zi (2003) argue that mutual organisations and stock companies use different production technique that are more efficient for that particular organisational form (Cummins et al 1999) or enter market segments where they have competitive advantages in production costs (Cummins, et al 2003). Hence, it is necessary to separate the mutual and stock owned companies into two distinct classes and estimate own-group frontier for the mutual and stock companies. Nonetheless, given the homogeneity of the U.K unit trust industry in terms of the scope of the company' activity, and the regulations, it seems acceptable to assume that production technology, costs and revenue structures are identical across the industry. For this reason, the present thesis employs the pooled frontier approach.

Some Caveats

Despite the fact that DEA has advantages for assessing efficiency, DEA is not a panacea. The most serious limitation for using the DEA is that data measurement error can distort the estimated efficient frontier, affecting the accuracy of the DEA scores. Unlike SFA that deals with measurement errors by containing a random error term (see the previous section), DEA is an extreme point technique, not allowing for any random errors. As a result, observations with very unique input and output combinations, which may be due to measurement errors or variable misspecifications, are likely to be put on the efficient frontier. At the same time, any deviation from the (inaccurate) frontier is forced to be attributed to inefficiency. Hence, it is vital to involve careful data collection in conducting DEA. In the current empirical analysis, a degree of data erroneous is minimised on the ground that the data is collected from the audited financial statements, which are filed to the government agency for their record.

The next drawback is "slacks". The problem of slack arises when efficient frontier runs parallel to the axes. To illustrate the problem, look at several points in Figure 5.2, showing one input-one output universe. It is debatable whether the point E' is an efficient point because there is more input than what is needed in maximising the output. Another way of saying this is the input of E does not contribute to the efficiency score.

Figure 5.2 DEA Scores and input slack



Notwithstanding, from the DEA modelling viewpoint, Coelli et al (1998) point out that the importance of slacks can be overstated. Their core argument is that the slack is just as a modelling issue or "*an artefact* (p.176)" arising from a limited sample. If an infinite sample size were available, the slack issue would disappear because of a smooth function surface.

The final limitation is that the efficiency measure generated from DEA does not take account into any risk factors. In an attempt to consider the risk factor, the Tobit regression models used in this thesis include a risk-related factor, e.g. the company's product mix consisting of unit trusts with various investment objectives. Nonetheless, the fundamental limitation still remains regarding the distribution of investment and business risk associated the various investment categories, which are used as the risk proxy. This is mainly due to the frequent changes of product categories in the unit trust industry. As a consequence, there is no sufficient data available to estimate the precise risk distribution for each fund investment category. This thesis uses only the return and money flow data for each category over the three year period (1996 to 1999) when no major category changes occurred.

5.5.5 The first stage of analysis

In conducting DEA as the first analysis, there are two modelling issues to consider: Input or output orientation and return of scale.

Input and Output orientation

DEA can evaluate efficiency from two perspectives: Input contraction and Output expansion. Input contraction models provide us with information on how much the sample company can reduce its inputs without any output reductions. The input oriented approaches can be referred to as "input execution" models. Output expansion models inform us of how much output could be produced with a given amount of inputs. Hence, results from the output oriented model can be viewed as "output-deficient" models.

The choice of which types of model should be employed depends on "*which quantities (inputs or outputs) the managers have most control over* (Coelli, 1998, p158)." The current empirical analysis selects the input contraction because the primary focus of this thesis is on agency problems in the form of excess costs incurred by a company and ultimately their owners. Another reason is that the output variable that comprises annual management and initial fees is largely subject to underlying equity markets where the company's unit trusts invest. The following sentence justifies the point of this reasoning: "*As revenue are highly correlated with market performance and hence difficult for the manager to control* (PricewaterhouseCoopers, 1998, p.4)"

Return to Scale

In view of returns to scale, there are two efficiency measures derived from different rescale models: Constant Return to Scale (CRS) in Appendix 5.a and Variable Return to Scale (VRS) in Appendix 5.b. The efficiency score based on the CRS reflects technical efficiency[11] that measures inefficiencies not only due to the input and output composition but also due to the size of operations. In this sense, the efficiency based on the CRS is referred to as the total or overall technical efficiency.

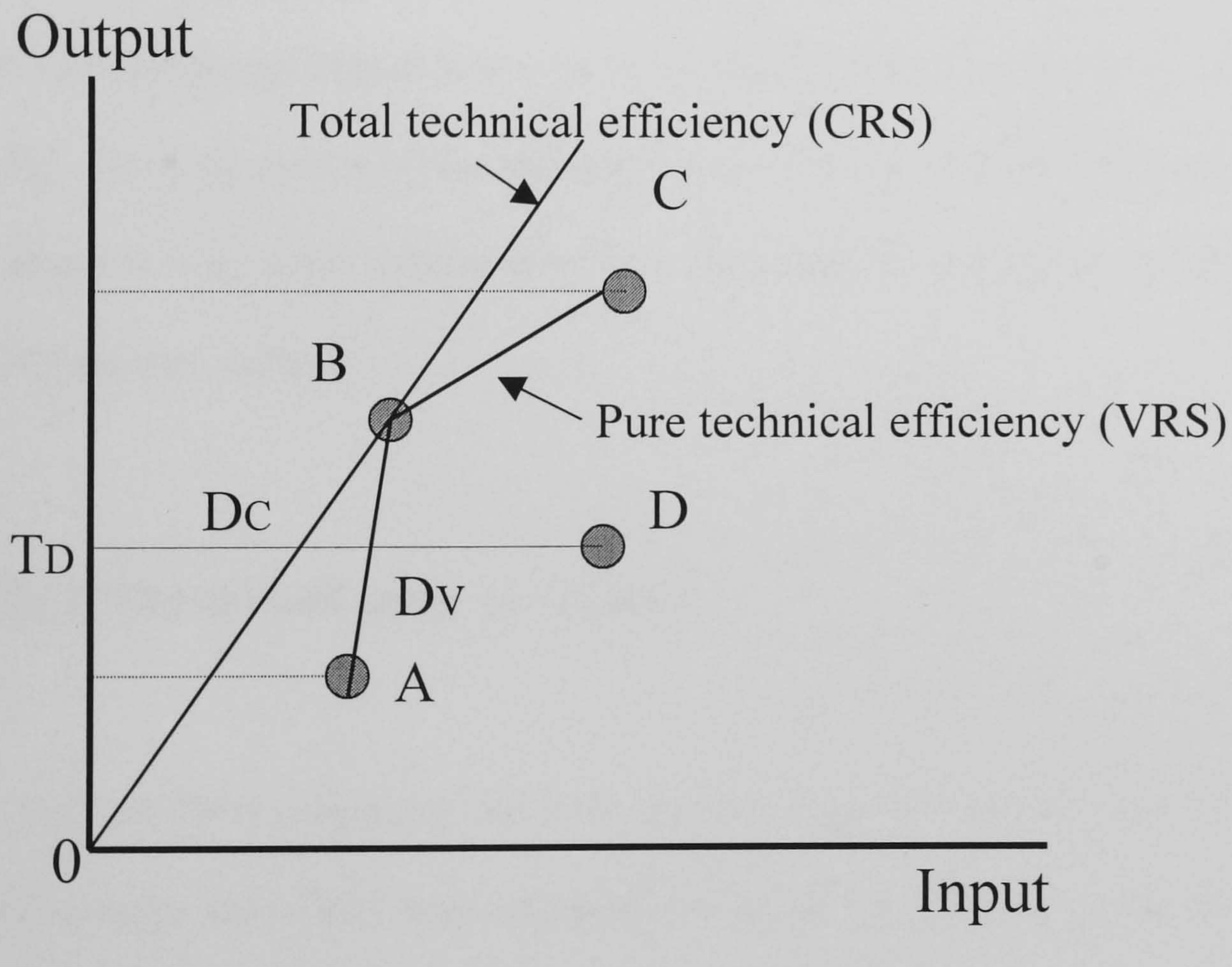
As implied in the paragraph above, it is possible to separate the total technical efficiency into measures of technical and scale efficiency. This is where the VRS comes into play. The VRS is computed by adding a convexity condition to the CRS form. The efficiency based on the VRS is often referred to as the pure

[11] In general, *technical efficiency is defined as the efficiency of a production process in converting inputs into outputs that is calculated independent of prices and costs.* (Avkiran, 2002, p.xii)

technical efficiency because it excludes inefficiencies that occur due to the scale factors by allowing variable-return-to-scale. Consequently, the scale efficiency is calculated as the ratio of the total technical efficiency (CRS) over the pure technical efficiency (VRS).

Figure 5.3: the total technical efficiency (CRS) and the pure technical efficiency (VRS).

(Note: Total technical efficiency (CRS) of D is given by $T_D D_C / T_D D$ and pure technical efficiency (VRS) of D is given by $T_D D_V / T_D D$ and the scale effect is $T_D D_C / T_D D_V$.



In brief, the key distinction between the CRS and the VRS is whether or not the efficiency is influenced by the scale of a company' operation. Hence, before conducting the DEA, the question of constant versus variable returns of scale needs to be answered given the research objectives (Avkiran, 2002).

Nonetheless, the current analysis is to run the efficiency models under the CRS and the VRS and to compute the scale efficiency for the following reasons.

Firstly, the approach with the multiple efficiency measures has become the norm among recent DEA studies. More specifically, the multiple measure approach can avoid a lengthy discourse on return to scale in financial service industries. As Chapter III described, the topic of scale effects in the fund management industries has attracted academic interest in the U.S. However, to date there is no academic work on the UK unit trust industry about the scale effects. Only a few consultation papers indicated the relatively weak effect of scale (See PriceWaterhouseCoopers and City of London Report in section 3.3.3 of Chapter III). The comparison of the efficiency score by the CRS with that of the VRS should provide some indication of how the return of scale might be in effect in the unit trust industry.

5.5.6 The second stage of analysis

Using the DEA scores derived from the first stage, the second stage is to detect differences across unit trust companies with various ultimate ownership. More precisely, the aim of the second stage is to test out the two hypotheses, e.g. the hypothesis of mutual versus stock owned groups, and the hypothesis of quoted versus non-quoted ownership groups. For this purpose, the non-parametric Mann-Whitney test is used. The key reason for the Mann-Whitney test is that the DEA scores are not normally distributed.

5.5.7 The third stage of analysis

The final stage is to check the robustness of the preceding results. The check is accomplished through the Tobit regressions, taking into account environmental factors. In the context of DEA, the environmental factors refer to elements that influence efficiency but are uncontrollable by managers. Examples of these factors are ownership, location characteristics, labour union power, and government regulations.

In order to accommodate such environmental factors, Coelli et al (1998) and others[12] recommend that the two-step approach is of use in most cases. Advantages that Coelli et al (1998,p.171) argue are as follows.

- It can accommodate more than one variable, which are continuous and categorical.
- It does not make prior assumptions regarding the direction of the influence of the categorical variable.
- It is convenient to conduct hypothesis tests to see if the variables have a significant influence upon efficiencies.
- It is easy to calculate and the method is simple and subsequently transparent.

The primary focus of the current chapter is the efficiency of a unit trust management company and this efficiency is measured in terms of the configuration of a company's net revenue, administrative expenses and capital

12 See Henry Burley "Dealing with environmental factors-Public Hospitals" Chapter 7, (Avkiran, 2002)

employed. However, the following may be important business considerations that could affect the company's efficiency. It is debatable whether these environmental factors are treated as inputs or outputs and for this reason, the following are entered into the Tobit models as control variables: Asset under management, age, number of funds, sectors, and the Herfindahl index.

Asset under management

The first control variable accounts for the company's size. The size refers to a company's assets under management and converted into the logarithm based numbers. The heart of the size effect is economies of scale. As Chapter III discussed, this subject has received attention with regard to the U.S and French fund industries. On the other hand, there has been little research on this issue concerning the U.K unit trust industry. Therefore, to get a sense of the size effect from the managed assets, the size variable is of use.

Age

Age measures the number of years since a company started their unit trust management business in the U.K. The age variable can represent economies of experience. The economies of experience refers to "cost advantages that result from accumulated experience over an extended period of time (Besanko and Braeutigam, 2002, p.334)." Apart from the potential benefits of experience, new companies may show inefficiencies for a short period of time. Such a situation may occur when the new companies are not yet collecting a sufficient amount of assets under management, which generate management fee incomes to cover their fixed costs. For these reasons, it is worthwhile to include the age variable in the models.

Number of funds, sectors, and the Herfindahl index

These are proxies for a company's product line breadth whilst capturing economies of scope. Controlling for the company's product mix is important because cost inefficiency may be contaminated by the composition of output. One should recall that the output refers to the net revenues in this analysis and the revenues are generated from various unit trusts that the company offers.

Interactions

The interaction terms such as "(*the mutual dummy variable*) x (*the number of unit trusts*)" serve to explore the product mix effects that may differ by ownership form. Such potential interactions between the type of ultimate ownership and their product mix should be valuable in the context of agency theory. It is important to note the managerial discretion hypothesis (e.g. Mayers and Smith, 1988, see section 4.2.1 of Chapter IV) that stock owned companies are more successful in more complex and heterogeneous lines of business.

Provided that the product mix variables capture such complexity and diversity of a company's business line, the interaction terms can pick up any effects of the managerial discretion hypothesis. For example, if the hypothesis holds, the coefficient of the interaction term, "(*the mutual dummy variable*) x (*the number of sectors*)" should be negative. The reason for the prediction is that compared with a stock owned company, a mutual owned company requires more money to manage such a complex product line, resulting in the reduction of efficiency.

5.5.8 Data collection

Data sources for input and output variables are the Companies House Direct[13], and Financial Analysis Made Easy (FAME). Both of these sources provide accounting information of unit trust management companies in the U.K. However, there is a key difference between the two sources. The Companies House Directs delivers the original annual reports with the PDF file format. On the other hand, certain account items in FAME are often refined in order to conduct comparative analysis easily. Consequently, the current analysis draws the data mainly from the Companies House Direct data whereas the FAME serves as a cross-check.

The period of the current analysis is the accounting year ending in the year 2000, covering from the end of 1999 to the end of 2000[14]. There are three reasons for looking at the year 2000. First and the foremost, as the analysis in the previous chapter focused on risk-taking of the unit trust companies at the end of 1999, it is worthwhile to see the impact of the risk-taking in the subsequent year from an efficiency perspective. Chapter VII, the last chapter about implications and conclusions, will elaborate on the issue of the risk-return connection.

[13] www.direct.companieshouse.gov.uk

[14] By and large, most of the sample companies have 12-month accounting periods during the year 2000. If there are longer or shorter accounting periods than the 12-month because of change of the accounting year-end, inputs and output variables are adjusted by averaging.

Secondly, only one de-mutualisation occurred during the year 2000. Thus, selection of this period largely avoids problems caused by changes in ultimate ownership occurring part way through the analysis period.

Finally, from an empirical perspective, it is argued that "*efficiency estimates are fairly stable from year to year, showing persistence*" (Berger and Humphrey, 1997, p.205). As an empirical example to support the notion, Cummins et al (1999, p.1264) presented evidence that the difference of the relative efficiency between mutual and stock owned insurers do not change considerably over time. Given the empirical justification, the year-specific factor should not pose a serious problem.

Recall that a set of hypotheses exist concerning the mutual versus stock owned groups (H4) and the quoted versus non-quoted company ownership groups (H5). For the purpose of testing the hypotheses, a small number of companies which ownerships are uncommon[15] or not identified were excluded from the sample. After deletion of such cases, 131 companies remained in the sample. The sample accounts for 99.38 % in terms of the total managed assets and 83.65% in terms of the number of companies in the industry.

Notwithstanding the removal of companies with unknown or uncommon ownership, no sample bias arises in terms of the proportion of different ownership groups. However, companies excluded from the sample are rather small in relation to the average company so that the sample can be size-biased.

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[15] For example, ultimate owners are a labour union (TU), investment trusts (Discretionary Unit Trust Managers).

This problem is hard to avoid because exceptionally small companies often fail to provide their background information to industry directories such as the FT unit trust & OEIC's directory, resulting in limited data availability and ambiguous ownership information. This is one potential limitation regarding the sample selection. Nonetheless, for the main purpose of the present analysis, no significant bias with regard to ownership types outweighs the potential size bias. Furthermore, with hindsight, the small size bias appears less serious on the ground that no significant correlation is present between the size and the efficiency scores of a company (See Table 5.17) .

5.6 Results

5.6.1 Descriptive Statistics for inputs and output variables.

Table 5.1 provides a simple overview of one output, two inputs, and other control variables. Note that the control variables are almost the same as the data in Chapter IV, showing the repetitive pattern so that details of the control variables are not described in full in this section.

Other than the control variables, the most striking is that each variable has a considerable range, reflecting the fact that small and large companies coexist in the U.K unit trust industry. The observation indicates that the degree of economies of scale is marginal in the industry.

Furthermore, from the comparative tabulation in Table 5.1, it is evident that on average, the quoted company group is the largest in terms of net revenue, administrative expenses, and capital employed. By contrast, the private owned company group is the smallest whereas the mutual group lies somewhere between the quoted and privately owned company groups concerning the level of the input and output variables.

Table 5.1 Descriptive Statistics for Output, Inputs and Control variables

	Total Sample n = 131	Mutual n = 23	Quoted n = 81	Private n = 27
Output *Net revenue* (unit: £1,000)				
Mean	17,154.51	9,866.89	22,863.68	6,234.97
Std. Deviation	27,375.34	10,231.79	31,878.84	16,098.46
Minimum	12.50	92.36	12.50	62.51
Maximum	140,330.00	36,359.00	140,330.00	79,577.00
Input *Admin Costs* (unit: £1,000)				
Mean	13,586.53	9,842.72	17,607.50	4,712.78
Std. Deviation	23,805.40	10,885.71	27,967.14	13,491.74
Minimum	12.09	112.38	12.09	25.00
Maximum	135,633.00	35,564.71	135,633.00	70,295.00
Input *Capital Employed* (unit: £1,000)				
Mean	10,220.68	6,346.88	13,715.65	3,035.64
Std. Deviation	18,811.57	8,082.22	22,134.95	10,080.03
Minimum	14.41	49.83	36.12	14.41
Maximum	108,585.50	32,063.00	108,585.50	52,563.50
Control Variable *Lg_Assets_1999*				
Mean	2.71	2.69	2.94	2.05
Std. Deviation	0.88	0.87	0.76	0.90
Minimum	0.22	0.92	0.22	0.60
Maximum	4.18	3.92	4.16	4.18
Control Variable *Herfindahl Index_1999*				
Mean	3,566.05	4,466.91	2,774.95	5,171.97
Std. Deviation	3,002.78	3,150.47	2,317.34	3,849.16
Minimum	467.14	971.52	563.51	467.14
Maximum	10,000.00	10,000.00	10,000.00	10,000.00
Control Variable *Number of Sectors*				
Mean	8.47	6.57	10.14	5.11
Std. Deviation	5.96	5.53	5.77	5.09
Minimum	1	1	1	1
Maximum	22	21	22	18
Control Variable *Number of Funds*				
Mean	12.41	8.83	14.72	8.56
Std. Deviation	10.60	9.04	10.59	10.19
Minimum	1	1	1	1
Maximum	50	35	50	36
Control Variable *Age of Company*				
Mean	16.47	15.13	18.22	12.37
Std. Deviation	12.84	9.88	13.05	13.78
Minimum	1	2	1	1
Maximum	69	40	69	66

Table 5.2 indicates the correlation matrix across variables of inputs, output. and controlling factors. The matrix shows a strong positive correlation ($r = 0.96$, $p<0.01$) between revenues (output), and administration expenses (input), suggesting that companies with larger revenues tend to have more administration expenses. Similarly, the two inputs, e.g. administrative expenses and capital employed are moderately correlated ($r = 0.76$, $p<0.01$). This implies that the input variables can be measuring a similar facility.

From a technical perspective, McMullen and Strong (1998, p2) stated that such high correlations would be problematic in multiple regression or factor analysis. However, the authors emphasised that in computing DEA scores, it makes no difference because DEA will find the best way to maximise the aggregated utility with other input and output variables.

Table 5.2 also shows that several controlling variables are considerably correlated with each other. Therefore, at the third analysis stage where the Tobit regression is used with these control variables, the problem of multicollinearity needs to be addressed (see section 5.6.4)

Table 5. 2 Correlations between output, inputs and control variables

Correlations

		REVENUE	ADMIN	CAPE	LG_assets_1999_	HI_99	SECTORS	FUNDS	AGE
REVENUE	Pearson Correlation	1	.960**	.748**	.623**	-.345**	.615**	.724**	.373**
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000
	N	131	131	131	131	131	131	131	131
ADMIN	Pearson Correlation	.960**	1	.760**	.576**	-.310**	.583**	.691**	.322**
	Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000	.000
	N	131	131	131	131	131	131	131	131
CAPE	Pearson Correlation	.748**	.760**	1	.530**	-.276**	.531**	.596**	.305**
	Sig. (2-tailed)	.000	.000	.	.000	.001	.000	.000	.000
	N	131	131	131	131	131	131	131	131
LG_assets_1999_	Pearson Correlation	.623**	.576**	.530**	1	-.649**	.766**	.724**	.452**
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000	.000
	N	131	131	131	131	131	131	131	131
HI_99	Pearson Correlation	-.345**	-.310**	-.276**	-.649**	1	-.736**	-.678**	-.408**
	Sig. (2-tailed)	.000	.000	.001	.000	.	.000	.000	.000
	N	131	131	131	131	131	131	131	131
SECTORS	Pearson Correlation	.615**	.583**	.531**	.766**	-.736**	1	.924**	.542**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000	.000
	N	131	131	131	131	131	131	131	131
FUNDS	Pearson Correlation	.724**	.691**	.596**	.724**	-.678**	.924**	1	.536**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.	.000
	N	131	131	131	131	131	131	131	131
AGE	Pearson Correlation	.373**	.322**	.305**	.452**	-.408**	.542**	.536**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.
	N	131	131	131	131	131	131	131	131

**. Correlation is significant at the 0.01 level (2-tailed).

Notation: Revenue = Revenue (Output), ADMIN = Administrative Costs (Input), CAPE = Capital Employed (Input), LG_assets_1999 = Log based assets under management in 1999, HI = the Herfindahl index in 1999, SECTORS = the number of fund sectors, FUNDS = the number of unit trusts, and AGE = the number of years since the company started the unit trust business.

5.6.2 The DEA scores

Table 5.3 provides a summary of the DEA scores, categorising the sample companies into three ownership groups. Panel A in Table 5.3 reports the total technical efficiency based on the CRS. Panels B and C provide a breakdown of the total technical efficiency into the pure technical efficiency derived from the VRS and the scale efficiency respectively.

The first general observation from Panels A and B is that the U.K unit trust industry is characterised with a large disproportion between companies concerning the efficiencies. Only 2 out of 131 companies for the CRS model (1.53%) and 13 out of 131 companies for the VRS (9.92%) were efficient. The average level of the total technical efficiency for the unit trust company is estimated at 36.87% for the CRS and at 47.28% for the VRS. This means that the average unit trust company in the U.K would have needed less than half of the inputs currently being used. Such overall inefficiencies may not be surprising in the sense that the similar asymmetric patterns have been reported in the DEA studies on the banking systems in Japan (Fukuyama, 1995), and in Croatia (Jemric and Vujcic, 2002) and on the Canadian health insurance (Paradi, 2002).

Another important finding is that the pure technical "inefficiency" accounts for 52.73% (=1-0.4728) in Panel B whereas the scale "inefficiency" accounts for 17.52% (= 1-0.8248) in Panel C. A different way of paraphrasing this finding is that the major source of the total inefficiency is due to the pure technical inefficiency as opposed to the scale inefficiency. Therefore, if the efficiency of the UK unit trust companies is to be improved, betterment in the pure technical efficiency is much more important than pursuing the scale efficiency.

Comparative tabulations of Panel A in Table 5.3 reveal that, on average, the total technical efficiency of the mutual owned group (= 28.57%) is smaller than other two counterparts; quoted company owner group (=37.97%), and privately owned company group (=40.64%). With regard to the pure technical efficiency, the situation is the same as the total technical efficiency as shown in the tabulations of Panel B in Table 5.3.

Notwithstanding the total and pure inefficiency of the mutual owned companies, the mutual company group seems to be slightly more efficient than the other groups in terms of the scale efficiency. The tabulations in Panel C presents such a propensity, implying that for the mutual owned group, there is relatively little scope for improving the scale efficiency.

It is of interest to explore the characteristics of the efficient companies because there may be certain factors that account for their relative high efficiency. At this point, the analysis produces a framework that can be used to help follow the narrative details of controlling and environmental variables that are used in the Tobit regression models.

Table 5.3 Summary Statistics for Efficiency Measures of the sample companies

	Total Sample N = 131	**Mutual** n = 23	**Quoted** n = 81	**Private** n = 27
Panel A				
CRS: Overall Technical Efficiency Score (%)				
Number of Efficient Companies	2	0	1	1
Mean	36.87	28.57	37.97	40.64
Std. Deviation	18.34	12.67	18.85	19.30
Minimum	3.75	6.43	3.75	13.41
Maximum	100.00	72.83	100.00	100.00
Panel B				
VRS: Pure Technical Efficiency Score (%)				
Number of Efficient Companies	13	0	10	3
Mean	47.28	34.01	50.14	50.00
Std. Deviation	24.77	15.14	26.49	22.94
Minimum	3.83	6.61	3.83	20.78
Maximum	100.00	77.29	100.00	100.00
Panel C				
Scale Efficiency (%)				
Number of Efficient Companies	2	0	1	1
Mean	82.48	86.17	81.16	83.30
Std. Deviation	17.06	12.57	18.14	17.04
Minimum	22.41	42.61	22.41	34.48
Maximum	100.00	99.97	100.00	100.00

The characteristics of the efficient companies are summarised in Table 5.4 for the total technical efficiency (CRS) and in Table 5.5 for the pure technical efficiency (VRS). From a quick inspection, it can be noticed that that the controlling factors vary considerably within a set of the efficient companies. Hence, a causal glance suggests that there is no clear linkage between the DEA scores and the controlling variables.

In contrast to the controlling variables, a clear pattern seems be present for the ultimate ownership type. Four out of the bottom ten companies are those ultimately owned by mutual organisations both for the total technical efficiency and for the pure technical efficiency. On the other hand, there is only one mutual owned company, i.e. *Reliance* ranked in the top-ten company list. The observation in Tables 5.4 and 5.5 imply the relative inefficiency for the mutual owned companies in comparison with the stock owned counterparts.

Nonetheless, as these remarks are merely indicative, statistical analyses in the subsequent sections try to give a more precise account of the influences of the controlling variables. Furthermore, the Mann-Whitney test determines whether the differences of the DEA scores between the mutual and stock owned groups are statistically significant.

Table 5.4 Companies with high and low efficiency scores under constant return of scale

Company	Total Technical Efficiency	Pure Technical Efficiency	Scale Efficiency	Organisational Form	Assets under Management (1999)	Age as of 2000	Herfindahl Index	the number of Sectors	the number of Funds	the number of Accounts
Duncan Lawne	100	100	100.00	Quoted	17,800,000	6	10,000.00	1	1	na
Thornhill	100	100	100.00	Private	97,200,000	11	7,441.37	2	2	512
Woolwich	93.58	100	93.58	Quoted	2,055,700,000	9	4,792.84	3	3	289775
HSBC Inv	88.12	100	88.12	Quoted	3,326,350,000	6	1,822.05	8	12	429904
Foreign & Colonial	84.63	100	84.63	Quoted	834,590,000	17	2,840.16	11	11	53904
Abbey national	80.56	99.86	80.67	Quoted	2,839,240,000	6	5,454.99	7	9	432762
Alliance & Leicester	80.23	93.76	85.57	Quoted	502,360,000	4	5,771.49	3	5	90610
Investec	80.15	99.05	80.92	Quoted	411,350,000	10	1,240.59	10	18	19386
Gresham	78.86	100	78.86	Private	8,360,000	5	5,601.66	2	2	2
Reliance	72.83	77.29	94.23	Mutual	305,030,000	40	10,000.00	1	1	286
ACM	17.9	18.08	99.00	Quoted	69,610,000	13	2,379.33	4	6	3543
Direct Line	17.73	18.08	98.06	Quoted	142,070,000	5	10,000.00	1	1	16188
Leggmason (Johnson Fry)	17.49	18.12	96.52	Quoted	337,220,000	5	4,020.44	7	8	48583
CIS	16.97	18.5	91.73	Mutual	2,545,140,000	11	6,137.96	3	3	557959
MGM	16.31	18.43	88.50	Mutual	343,040,000	18	4,394.00	5	6	2196
Stan_Life_Inv (Mutual)	15.86	19.07	83.17	Mutual	1,463,700,000	10	3,171.91	13	15	183119
Belvin Frank	13.41	22.06	60.79	Private	6,230,000	8	6,136.34	2	2	24
Eagle Star	7.53	8.21	91.72	Quoted	188,340,000	15	2,216.69	6	7	na
Liverpool	6.43	6.61	97.28	Mutual	48,600,000	2	5,002.38	2	2	na
Norwich Union	3.75	3.83	97.91	Quoted	3,050,200,000	15	1,354.42	16	21	75028

Table 5.5 Companies with high and low efficiency scores under variable return of scale

Company	Pure Technical Efficiency	Total Technical Efficiency	Scale Efficiency	Organisational Form	Assets under management (1999)	Age as of 2000	Herfindahl Index	the number of Sectors	the number of Funds	the number of Accounts
Arbuthnot	100	22.41	22.41	Quoted	1,660,000	16	10.00	1	1	15
Duncan Lawne	100	100	100.00	Quoted	17,800,000	6	10.00	1	1	na
Foreign & Colonial	100	84.63	84.63	Quoted	834,590,000	17	2.84	11	11	53904
Framlington	100	69.48	69.48	Quoted	1,227,540,000	31	0.68	18	22	97665
Gartmore	100	45.55	45.55	Quoted	9,101,790,000	26	0.60	21	50	480190
Gresham	100	78.86	78.86	Private	8,360,000	5	5.60	2	2	2
HSBC Inv	100	88.12	88.12	Quoted	3,326,350,000	6	1.82	8	12	429904
Jupiter	100	55.73	55.73	Quoted	4,321,700,000	14	2.13	12	17	845371
M&G	100	28.65	28.65	Quoted	13,271,720,000	69	0.56	21	41	857571
Saracen	100	34.48	34.48	Private	4,360,000	1	10.00	1	1	6
Schroder	100	35.89	35.89	Quoted	14,581,020,000	11	0.71	20	40	390569
Thornhill	100	100	100.00	Private	97,200,000	11	7.44	2	2	512
Woolwich	100	93.58	93.58	Quoted	2,055,700,000	9	4.79	3	3	289775
Abbey National	99.86	80.56	80.67	Quoted	2,839,240,000	6	5.45	7	9	432762
Investec	99.05	80.15	80.92	Quoted	411,350,000	10	1.24	10	18	19386
Alliance & Leicester	93.76	80.23	85.57	Quoted	502,360,000	4	5.77	3	5	90610
Burrage	92.71	52.29	56.40	Quoted	5,060,000	13	10.00	1	1	157
Stan_Life_Inv (Mutual)	19.07	15.86	83.17	Mutual	1,463,700,000	10	3.17	13	15	183119
CIS	18.5	16.97	91.73	Mutual	2,545,140,000	11	6.14	3	3	557959
MGM	18.43	16.31	88.50	Mutual	343,040,000	18	4.39	5	6	2196
Leggmason (Johnson Fry)	18.12	17.49	96.52	Quoted	337,220,000	5	4.02	7	8	48583
ACM	18.08	17.9	99.00	Quoted	69,610,000	13	2.38	4	6	3543
Direct Line	18.08	17.73	98.06	Quoted	142,070,000	5	10.00	1	1	16188
Eagle Star	8.21	7.53	91.72	Quoted	188,340,000	15	2.22	6	7	na
Liverpool	6.61	6.43	97.28	Mutual	48,600,000	2	5.00	2	2	na
Norwich Union	3.83	3.75	97.91	Quoted	3,050,200,000	15	1.35	16	21	75028

5.6.3 Results of the rank tests

For testing the hypothesis (H4), the sample is portioned into the mutual owned company group (n=23) and the stock owned company group (n=108). Table 5.6 reports the results of the Mann-Whitney test. Supporting the hypothesis (H4), the results in the first and second columns confirm that the mutual and the stock owned company groups statistically differ in terms of the total and pure technical efficiency measures. Both of the significant levels are less than 1 %; p = 0.005 for the total technical efficiency and p = 0.003 for the pure technical efficiency. Nonetheless, as shown in the third column in Table 5.6, the difference between the two groups is not statistically significant for the scale efficiency. The interpretation of the results is that the mutual group's inefficiency is attributable not to the scale inefficiency, but to the pure technical inefficiency. Hence, the results provide some degree of support for hypothesis (H4) that unit trust management companies owned by stock companies show higher efficiency than those owned by mutual institutions.

Table 5.6 Rank Tests
between Efficiency Measures of mutual and stock owned company groups

Grouping Variable: Mutual_Dummy for testing H4

	Overall Technical Efficiency	*Pure Technical Efficiency*	*Scale Efficiency (%)*
Mann-Whitney U	777	745	1,111
Wilcoxon W	1,053	1,021	6,997
Z	-2.813	-3.008	-0.793
Asymp. Sig. (2-tailed	0.005	0.003	0.428

The next hypothesis testing concerns the "quoted" versus "non-quoted" company ownership. The sample is grouped into the quoted company ownership (n=81) and the non-quoted company ownership (n=50), including mutual and privately owned companies.

The result in Table 5.7 cannot reject the null hypothesis that the quoted company ownership group is identical to the non-quoted company ownership (p>0.05). Combined with the result of the hypothesis test (H4), a consequence of the hypothesis test (H5) may be partially driven by no significant difference between the quoted company and privately owed company groups. To rule out the possibility, the additional rank test is run in the subsequent section.

Table 5.7 Rank Tests
between Efficiency Measures of quoted and non-quoted company owned groups

Grouping Variable: Quoted_Dummy for testing H5

	Overall Technical Efficiency	*Pure Technical Efficiency*	*Scale Efficiency (%)*
Mann-Whitney U	1,753.5	1,708	1,797.5
Wilcoxon W	3,028.5	2,983	5,118.5
Z	-1.286	-1.503	-1.078
Asymp. Sig. (2-tailed	0.198	0.133	0.281

5.6.4 Results from the Tobit models

The final analysis employs a Tobit regression whilst controlling environmental factors on which managers have less influential impact. Model 1 refers to the basic stage where only the mutual dummy variable is used as an independent variable. Model 2 refers to the use of the mutual dummy variable and the size of assets under management as the independent variables. Model 3 allows an age factor as a proxy of the company's experiences. Model 4 a, b and c include not only the mutual dummy variable but also the product mix variables. These variables are the Herfindhal Index, the number of funds and the number of sectors for Model 4 a, b and c respectively. Each controlling variable is entered into the Tobit regression model separately in order to avoid the multicolinearity problem discussed in the prior section.

5.6.5 Hypothesis testing (H4) with controlling factors

Inspection of Tables 5.8 and 5.9 where the efficiency is based on the total technical efficiency, and the pure technical efficiency respectively reveal that the coefficients of the mutual dummy valuables in most of the models except 4-a are negative and statistically significant at 1 % level ($p<0.05$)[16]. This means that the mutual owned unit trust companies are on average less efficient than the stock owned company group after controlling business characteristics. Hence, the basic results hold from the preceding tests.

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16 The models with the interaction variables lost explanatory power because of the multicolinearity problem.

Table 5.8. Regression results (Tobit model) with a dummy variable of the mutual owned company.

Model 1: Score $_i = \alpha + \beta_1$ (Mutual Dummy) + ε_i
Model 2: Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Log Asset $_i$) + ε_i
Model 3: Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Age $_i$) + ε_i
Model 4: Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Mix $_{k\ i}$) + ε_i
Model 4 (interaction): Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Mix $_{k\ i}$)
β_3 {(Mix $_{k\ i}$) x (Log Asset $_i$)} + ε_i
where
Score i = *Company i's efficiency score under constant return of scale (CRS)*
Mutual Dummy = 1 if company I belongs to a mutual group, otherwise 0
Log Asset $_i$ = Company i's asset under management
Age i = years since Company i' was established
Mix $_{k\ i}$ = Product mix defined by category k

	Model 1		Model 2		Model 3	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	38.662	22.00 (0.000)***	39.063	7.42 (0.000)***	37.89	13.87 (0.000)***
Mutual Dummy	-10.098	-2.41 (0.017)**	-10.101	-2.41 (0.017)**	-10.022	-2.39 (0.018)**
Assets Under Management (log)			-0.147	-0.08 (0.936)		
Company's Age					0.046	0.37 (0.712)
Log Likelihood	-558.253		-558.25		-558.186	
Probability > Chi-Square	0.017		0.0583		0.0547	

	Model 4a (H-index)		Model 4a' (Interactiuon)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	37.129	14.72 (0.000)***	37	13.85 (0.000)***
Mutual Dummy	-10.596	-2.51 (0.013)**	-9.753	-1.35 (0.178)
Herfindah Index	0.455	0.85 (0.399)	0.493	0.82 (0.412)
(Herfindah Index) X (Mutual Dummy)			-0.198	-0.14 (0.885)
Log Likelihood	-557.897		-557.886	
Probability > Chi-Square	0.041		0.0932	

	Model 4b (Sectors)		Model 4b' (interaction)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	40.921	13.75 (0.000)***	41.614	13.27 (0.000)***
Mutual Dummy	-10.686	-2.53 (0.013)**	-14.311	-2.13 (0.036)**
Number of Sectors	-0.254	-0.94 (0.35)	-0.332	-1.13 (0.259)
(Number of Sectors) X (Mutual Dummy)			0.525	0.69 (0.491)
Log Likelihood	-557.814		-557.576	
Probability > Chi-Square	0.038		0.0709	

	Model 4c (Funds)		Model 4c' (Interaction)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	40.094	15.01 (0.000)***	40.528	14.60 (0.000)***
Mutual Dummy	-10.57	-2.49 (0.014)**	-13.008	-2.16 (0.033)**
Number of Funds	-0.109	-0.71 (0.479)	-0.142	-0.87 (0.388)
(Number of Funds) X (Mutual Dummy)			0.26	0.57 (0.572)
Log Likelihood	-558.001		-557.842	
Probability > Chi-Square	0.046		0.0896	

*, **, *** Significant at 0.10, 0.05, and 0.01 level respectively

Table 5.9: Regression results (Tobit model) with a dummy variable of the mutual owned company.

Model 1: Score $_i = \alpha + \beta_1$ (Mutual Dummy) + ε_i
Model 2: Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Log Asset $_i$) + ε_i
Model 3: Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Age $_i$) + ε_i
Model 4: Score $_i = \alpha + \beta_1$ (Mutual Dummy $_i$) + β_2 (Mix $_{k\,i}$) + ε_i
Model 4 (interaction): Score $_i = \alpha + \beta 1$ (Mutual Dummy $_i$) + β_2 (Mix $_{k\,i}$)
β_3 {(Mix $_{k\,i}$) x (Log Asset $_i$)} + ε_i

where
Score i = *Company i's efficiency score under variable return of scale (VRS)*
Mutual Dummy = 1 if company I belongs to a mutual group, otherwise 0
Log Asset $_i$ = Company i's asset under management
Age i = years since Company i' was established
Mix $_{k\,i}$ = Product mix defined by category k

	Model 1 coeff.	Model 1 t-ratio (p>t)	Model 2 coeff.	Model 2 t-ratio (p>t)	Model 3 coeff.	Model 3 t-ratio (p>t)
Constant	51.256	19.92 (0.000)***	46.833	6.06 (0.000)***	45.947	11.62 (0.000)***
Mutual Dummy	-17.249	-2.83 (0.005)***	-17.197	-2.83 (0.005)***	-16.716	-2.78 (0.006)***
Assets Under Management (log)			1.626	0.61 (0.545)		
Company's Age					0.316	1.74 (0.084)*
Log Likelihood	-568.428		-568.244		-566.927	
Probability > Chi-Square	0.0052		0.017		0.005	

	Model 4a (H-index) coeff.	Model 4a (H-index) t-ratio (p>t)	Model 4a' (Interactiuon) coeff.	Model 4a' (Interactiuon) t-ratio (p>t)
Constant	48.8	13.24 (0.000)***	48.814	12.5 (0.000)***
Mutual Dummy	-18.052	-2.94 (0.004)***	-18.158	-1.74 (0.085)*
Herfindah Index	0.73	0.93 (0.356)	0.725	0.83 (0.41)
(Herfindah Index) X (Mutual Dummy)			0.025	0.01 (0.99)
Log Likelihood	-567.1		-568	
Probability > Chi-Square	0.013		0.0343	

	Model 4b (Sectors) coeff.	Model 4b (Sectors) t-ratio (p>t)	Model 4b' (interaction) coeff.	Model 4b' (interaction) t-ratio (p>t)
Constant	46.772	10.78 (0.000)***	46.25	10.09 (0.000)***
Mutual Dummy	-16.078	2.63 (0.010)***	-13.34	-1.37 (0.172)
Number of Sectors	0.504	1.27 (0.205)	0.563	1.31 (0.192)
(Number of Sectors) X (Mutual Dummy)			-0.387	-0.35 (0.726)
Log Likelihood	-567.621		-567.56	
Probability > Chi-Square	0.01		0.023	

	Model 4c (Funds) coeff.	Model 4c (Funds) t-ratio (p>t)	Model 4c' (Interaction) coeff.	Model 4c' (Interaction) t-ratio (p>t)
Constant	44.39	11.56 (0.000)***	43.547	10.91 (0.000)***
Mutual Dummy	-14.965	-2.48 (0.014)**	-10.621	-1.24 (0.219)
Number of Funds	0.524	2.36 (0.02)**	0.585	2.46(0.015)**
(Number of Funds) X (Mutual Dummy)			-0.462	-0.71 (0.481)
Log Likelihood	-565.683		-565.433	
Probability > Chi-Square	0.001		0.0032	

*, **, *** Significant at 0.10, 0.05, and 0.01 level respectively

One interesting finding is that the coefficient of the number of funds variable in the first column (model 4-c) in Table 5.9 is positive (=0.524) and statistically significant at 5% level ($p<0.05$). This means that unit trust management companies are likely to improve their efficiencies by increasing the number of unit trusts they offer. In reality a potential situation might be that one fund manager looks after several unit trusts concurrently whilst the company does not necessarily increase the fund manager's salary in proportion to the number of unit trusts he or she looks after. Hence, the potential interpretation of this finding is that economies of scope are present.

By contrast other business characteristics seem to have little impact on the efficiency scores. Notably coefficients of the assets under management variables are not statistically significant. This finding can be interpreted as evidence of weak economies of scale and experience in the industry as the previous section addressed (see section 3.3.3 in Chapter III). Moreover, no interaction terms in the series of model 4a, b and c have significant coefficients, rejecting the managerial discretion hypothesis.

5.6.6 Hypothesis testing (H5) with controlling factors

In an attempt to capture controlling mechanisms associated with stock markets, the preceding mutual dummy variable is replaced with the quoted company dummy variable. The results for the total technical efficiency and the pure technical efficiency are shown in Table 5.10 and 5.11 respectively. The coefficients of the quoted company dummy variable in most of the models are insignificant. Exceptions are model 1 in Table 5.11 where no controlling variables are added and model 4-a in Table 5.11 where the concentration measure for the product line, the Herfindahl index, is included. According to Table 5.11, the coefficients of the quoted company dummy variable appeared to be positive, 8.095 for model 1 and 10.067 for model 4-a. Nevertheless, both of the significant levels are rather low ($p>0.05$). Given the results, it is hard to accept the tenets of hypothesis H5 that the quoted company owned group differs from the non-listed company groups.

Table 5.10 and 5.11 also indicate that coefficients of the controlling variables, except the number of funds, are insignificant, rejecting the effects of economies of scale and experience. Furthermore, there exists no evidence for the managerial discretion hypothesis because no coefficients of the interaction terms were found statistically significant. This may be due to the multicolinearity problem. Hence, in terms of the effects of the controlling factors, the preceding and current analyses of the hypothesis testing are consistent.

Summarising the results from the Tobit models, it is possible to conclude that on average the mutual owned unit trust management companies have the lowest efficiency, supporting hypothesis (H4). On the contrary there is no evidence that the unit trust companies with quoted company owners differs from other ultimate ownership groups, rejecting the hypothesis (H5).

Table 5.10. Regression results (Tobit model) with a dummy variable of the quoted company ownership.

Model 1: Score $_i = \alpha + \beta_1$ (Quoted Dummy) + ε_i
Model 2: Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Log Asset $_i$) + ε_i
Model 3: Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Age $_i$) + ε_i
Model 4: Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Mix $_{k\,i}$) + ε_i
Model 4 (interaction): Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Mix $_{k\,i}$)
β_3 {(Mix $_{k\,i}$) x (Log Asset $_i$)} + ε_i

where
Score i = *Company i's efficiency score under constant return of scale (CRS)*
Quoted I Dummy = 1 if company i belongs to a listed company group, otherwise 0
Log Asset $_i$ = Company i's asset under management
Age i = years since Company i' was established
Mix $_{k\,i}$ = Product mix defined by category k

	Model 1		Model 2		Model 3	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	35.18	13.36 (0.000)***	36.77	6.91 (0.000)***	34.584	0.75 (0.452)
Quoted Dummy	2.764	0.83 (0.411)	3.168	0.89 (0.347)	2.563	0.75 (0.452)
Assets Under Management (log)			-0.679	-0.34 (0.731)		
Company's Age					0.0436	0.34 (0.736)
Log Likelihood	-560.752		-560.693		-560.67	
Probability > Chi-Square	0.41		0.6712		0.6727	

	Model 4a (H-index)		Model 4a' (Interactiuon)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	32.884	8.57 (0.000)***	35.4	7.91 (0.000)***
Quoted Dummy	3.746	1.06 (0.293)	-0.829	-0.15 (0.881)
Herfindah Index	0.474	0.82 (0.413)	-0.046	-0.06 (0.951)
(Herfindah Index) X (Quoted Company Dummy)			1.262	1.08 (0.282)
Log Likelihood	-560.416		-559.834	
Probability > Chi-Square	0.5087		0.4725	

	Model 4b (Sectors)		Model 4b' (interaction)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	36.729	11.76 (0.000)***	36.01	9.21 (0.000)***
Quoted Dummy	3.93	1.1 (0.274)	5.298	0.92 (0.357)
Number of Sectors	-0.268	-0.92 (0.361)	-0.144	-0.29 (0.775)
(Number of Sectors) X (Quoted Company Dummy)			-0.188	-0.31 (0.761)
Log Likelihood	-560.333		-560.287	
Probability > Chi-Square	0.4684		0.6571	

	Model 4c (Funds)		Model 4c' (Interaction)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	35.973	12.09 (0.000)***	34.519	9.7 (0.000)***
Quoted Dummy	3.315	0.95 (0.343)	6.007	1.2 (0.234)
Number of Funds	-0.091	-0.57 (0.569)	0.076	0.27 (0.784)
(Number of Funds) X (Quoted Company Dummy)			-0.251	-0.74 (0.46)
Log Likelihood	-560.59		-560.315	
Probability > Chi-Square	0.6052		0.67	

*, **, *** Significant at 0.10, 0.05, and 0.01 level respectively

Table 5.11. Regression results (Tobit model) with a dummy variable of the quoted company ownership.

Model 1: Score $_i = \alpha + \beta_1$ (Quoted Dummy) + ε_i
Model 2: Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Log Asset $_i$) + ε_i
Model 3: Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Age $_i$) + ε_i
Model 4: Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Mix $_{k\,i}$) + ε_i
Model 4 (interaction): Score $_i = \alpha + \beta_1$ (Quoted Dummy $_i$) + β_2 (Mix $_{k\,i}$)
β_3 {(Mix $_{k\,i}$) x (Log Asset $_i$)} + ε_i

where
Score i = *Company i's efficiency score under variable return of scale (VRS)*
Quoted I Dummy = 1 if company i belongs to a listed company group, otherwise 0
Log Asset $_i$ = Company i's asset under management
Age i = years since Company i' was established
Mix $_{k\,i}$ = Product mix defined by category k

	Model 1		Model 2		Model 3	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	43.232	11.26 (0.000)***	42.637	5.44 (0.000)***	39.172	8.54 (0.000)***
Quoted Dummy	8.095	1.66 (0.10)*	7.947	1.53 (0.127)	6.758	1.38 (0.171)
Assets Under Management (log)			0.253	0.09 (0.931)		
Company's Age					0.296	1.57 (0.118)
Log Likelihood	-570.967		-570.963			
Probability > Chi-Square	0.0995		0.2565			

	Model 4a (H-index)		Model 4a' (Interactiuon)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	38.606	6.91 (0.000)***	39.686	6.09 (0.000)***
Quoted Dummy	10.067	1.95 (0.054)*	8.074	1.00 (0.319)
Herfindah Index	0.958	1.13 (0.259)	0.734	0.67 (0.504)
(Herfindah Index) X (Quoted Company Dummy)			0.554	0.32 (0.748)
Log Likelihood	-570.326		-570.273	
Probability > Chi-Square	0.136		0.25	

	Model 4b (Sectors)		Model 4b' (interaction)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	40.413	8.88 (0.000)***	45.404	8.04 (0.000)***
Quoted Dummy	6.01	1.16 (0.25)	-3.591	-0.43 (0.666)
Number of Sectors	0.485	1.13 (0.26)	-0.376	-0.52 (0.603)
(Number of Sectors) X (Quoted Company Dummy)			1.326	1.47 (0.143)
Log Likelihood	-570.33		-569.25	
Probability > Chi-Square	0.1361		0.105	

	Model 4c (Funds)		Model 4c' (Interaction)	
	coeff.	t-ratio (p>t)	coeff.	t-ratio (p>t)
Constant	38.421	9.02 (0.000)***	42.809	8.48 (0.000)***
Quoted Dummy	4.849	0.98 (0.331)	-3.458	-0.48 (0.63)
Number of Funds	0.549	2.36 (0.02)**	0.045	0.12 (0.908)
(Number of Funds) X (Quoted Company Dummy)			0.772	1.59 (0.114)
Log Likelihood	-568.226		-566.964	
Probability > Chi-Square	0.017		0.0133	

*, **, *** Significant at 0.10, 0.05, and 0.01 level respectively

5.6.7 Additional tests

The two principal findings raise two intriguing issues. The first issue is the need to explore sources of inefficiency that the mutual group shows. The second issue is whether the failure to reject the hypothesis (H5) test is attributable to the similarity between the quoted and private owned company groups.

Sources of inefficiency

One must recall that the efficiency is a ratio of weighted inputs to outputs for each company and defined by its position relative to the frontier of best performance companies. The distance between one company and the frontier is referred to the company' s inefficiency. Correspondingly, the distance between a company's original inputs and (weighted) inputs in the efficient frontier is defined as a potential improvement or a target in DEA.

The DEA software conveniently indicates such targets as the inefficiency sources whilst computing the DEA scores. Taking advantage of such a software function, identification of sources of inefficiency is vital in the agency theoretic view as described in sections 2.1 and 5.2. Focusing on diverged interests between owners and managers of a company, agency theory often addresses excess consumption that results in higher costs and over-diversification that requires excess capital employed. Clearly such management lowers the efficiency of the company, reducing the value of the company.

Table 5.12 and 5.13 provide the summary of statistics for potential improvements for the total technical efficiency and for the pure technical efficiency respectively. It is obvious that on average the mutual owned group has more administrative expenses and more capital employed than other two ownership groups.

Table 5.12 Summary of potencial reductions in Overall Technical Efficiency (CRS)

	Mutual n = 23	**Quoted** n = 81	**Private** n = 27	**Total Sample** N = 131
Administration Costs %				
Mean	-72.57	-62.03	-60.20	-63.5
Std. Deviation	9.24	18.85	19.00	17.99
Minimum	-93.6	-96.3	-86.6	-96.3
Maximum	-53.1	0	0	0
Capital Employed %				
Mean	-75.23	-70.13	-66.68	-70.32
Std. Deviation	13.98	19.51	20.65	18.97
Minimum	-95.00	-98.20	-97.30	-98.2
Maximum	-27.2	0	0	0

Table 5.13 Summary of potencial reductions in Pure Technical Efficiency (VRS)

	Mutual n = 23	**Quoted** n = 81	**Private** n = 27	**Total Sample** N = 131
Administration Costs %				
Mean	-67.33	-49.97	-51.01	-53.24
Std. Deviation	12.16	26.38	22.83	24.50
Minimum	-93.4	-96.20	-79.2	-96.2
Maximum	-45.9	0	0	0
Capital Employed %				
Mean	-68.52	-58.43	-52.16	-58.91
Std. Deviation	15.93	28.33	23.28	25.91
Minimum	-93.4	-97.8	-84.9	-97.8
Maximum	-22.7	0	0	0

Tables 5.14 and 5.15 report the results of the Mann-Whitney test, showing whether such differences between the mutual and the stock ownership groups are statistically significant.

Table 5.14 Rank Tests of potencial improvements of *overall technical efficiency* between mutual and stock owned company groups

	Administration Costs %	*Capital Employed %*
Mann-Whitney U	766.5	993
Wilcoxon W	1,042.5	1,269
Z	-2.877	-1.506
Asymp. Sig. (2-tailed)	0.004	0.132

Table 5.15 Rank Tests of potencial improvements of *pure technical efficiency* between mutual and stock owned company groups

	Administration Costs %	*Capital Employed %*
Mann-Whitney U	735.5	935.5
Wilcoxon W	1,011.5	1,211.5
Z	-3.066	-1.855
Asymp. Sig. (2-tailed)	0.002	0.064

The first columns in both of the Tables indicate that administrative expenses differ between the mutual and stock owned groups at the 1% significant level (0.004 for the total technical efficiency model and 0.002 for the pure technical efficiency model). In contrast to the administrative expenses, capital employed is not statistically different between the mutual and stock groups at the 5% significant level (0.132 for the total technical efficiency model and 0.064 for the pure technical efficiency model). Therefore, these additional analyses attribute the relative inefficiency of the mutual owned group to excess administrative expenses. The finding supports the agency theoretic view that companies owned by shareholders face stronger incentive or pressure from the shareholders' monitoring to control costs in comparison with the mutual counterpart where depositors and policy holders own the mutuals (Berger and Humphery, 1997)

Similarity between the quoted and private owned company groups.

The failure to reject the null hypothesis of the quoted versus non-quoted company ownership groups may be attributable to the homogeneity between the public and private company groups. To rule out the possibility, the Mann-Whitney test is conducted on the two groups with regard to three efficiency measures. The results are presented in Table 5.16. It is clear that there are no statistical differences between the two groups regardless of the efficiency measures, e.g. the total technical, the pure technical and scale efficiency. Thus, the lack of support for the hypothesis (H5) is due to the similar degree of the efficiencies between public and privately owned company groups.

Table 5.16 Rank Tests
between Efficiency Measures of quoted and privately owned company groups

	Overall Technical Efficiency	*Pure Technical Efficiency*	*Scale Efficiency (%)*
Mann-Whitney U	1,025.5	1,053	987.5
Wilcoxon W	4,346.5	4,374	4,308.5
Z	-0.482	-0.288	-0.752
Asymp. Sig. (2-tailed)	0.629	0.774	0.452

Table 5.17 Correlation matrix between output, inputs and control variables

Correlations

		Overall Technical Efficiency	Pure Technical Efficiency	Scale Efficiency	LG_assets_1999_	HI_99	SECTORS	FUNDS	AGE
Overall Technical Efficiency	Pearson Correlation	1.000	.793**	.084	.003	.035	-.041	-.022	.045
	Sig. (2-tailed)	.	.000	.341	.971	.694	.640	.806	.614
	N	131	131	131	131	131	131	131	131
Pure Technical Efficiency	Pearson Correlation	.793**	1.000	-.507**	.068	.034	.154	.242**	.170
	Sig. (2-tailed)	.000	.	.000	.443	.700	.080	.005	.052
	N	131	131	131	131	131	131	131	131
Scale Efficiency	Pearson Correlation	.084	-.507**	1.000	-.141	-.009	-.327**	-.436**	-.249**
	Sig. (2-tailed)	.341	.000	.	.108	.922	.000	.000	.004
	N	131	131	131	131	131	131	131	131
LG_assets_1999_	Pearson Correlation	.003	.068	-.141	1.000	-.649**	.766**	.724**	.452**
	Sig. (2-tailed)	.971	.443	.108	.	.000	.000	.000	.000
	N	131	131	131	131	131	131	131	131
HI_99	Pearson Correlation	.035	.034	-.009	-.649**	1.000	-.736**	-.678**	-.408**
	Sig. (2-tailed)	.694	.700	.922	.000	.	.000	.000	.000
	N	131	131	131	131	131	131	131	131
SECTORS	Pearson Correlation	-.041	.154	-.327**	.766**	-.736**	1.000	.924**	.542**
	Sig. (2-tailed)	.640	.080	.000	.000	.000	.	.000	.000
	N	131	131	131	131	131	131	131	131
FUNDS	Pearson Correlation	-.022	.242**	-.436**	.724**	-.678**	.924**	1.000	.536**
	Sig. (2-tailed)	.806	.005	.000	.000	.000	.000	.	.000
	N	131	131	131	131	131	131	131	131
AGE	Pearson Correlation	.045	.170	-.249**	.452**	-.408**	.542**	.536**	1.000
	Sig. (2-tailed)	.614	.052	.004	.000	.000	.000	.000	.
	N	131	131	131	131	131	131	131	131

**. Correlation is significant at the 0.01 level (2-tailed).

Revenue = Revenue LG_assets_1999 = Log based assets under management in 1999, HI = the Herfindahl index in 1999, SECTORS = the number of fund sectors, FUNDS = the number of unit trusts, and AGE = the number of years since the company started the unit trust business.

5.7 Chapter Summary

Based on a comparison of the results between the Mann-Whitney test and the Tobit regression estimation, the two analyses are generally united in the following findings. A unit trust management company owned by a mutual organisation tend to be less efficient than those owned by the stock companies, supporting the hypothesis I. Furthermore, a few additional tests revealed that the inefficiency of the mutual owner group is attributable to their relatively large administrative expenses. This is consistent with agency theory that managers in stock owned companies are expected to face stronger cost-control incentives or pressures compared to those in mutual owned organisations.

For testing the hypothesis of the quoted versus non-quoted company ownership, no significant difference was found between the two groups, providing scant evidence for the hypothesis. This is possibly attributable to the fact that no clear distinction exists between the quoted and privately owned company groups. In this sense, effects associated with dispersed ownership and with institutional ownership are cloudy.

In addition to the main hypothesis tests noted above, the Tobit regression models also analysed how well the relative efficiency scores can be explained by factors that are not in the DEA computation. The results from the models indicate that most of the controlling variables, except for the number of funds, are not associated with the DEA scores. The findings in this light are inconsistent with economies of scale, and experience. Moreover, no significant coefficients of the interaction terms cast doubt on the managerial discretion hypothesis.

It is of fundamental importance that the current chapter focused on the efficiency at the company level. Given the approach of this chapter, there is a potential concern from the literature on efficiency of financial institutions. It may be the case that high-quality producers appear to the cost inefficient due to the extra expenses associated with producing the high quality output (Berger and Mester, 1997; Berger and Humphrey, 1997; and Mandos et al, 2002). Such a problem may be ameliorated by analysing the quality of products that the sample companies offer. Clearly, in the context of this thesis, the quality of products refers to the investment performance of unit trusts that the companies manage. The following chapter, the last empirical analysis of the present thesis, will explore potential effects of ultimate ownership on their products.

Chapter VI
Analysis of Unit Trust Performance

6.1 Introduction

Having dealt with the issues of the risk-taking and the efficiency of unit trust management companies in the U.K, Chapter VI, the final chapter will address the area of the individual unit trusts that the companies offer. In principle this chapter shifts its focus to risk and performance of the companies' products.

This chapter serves as a supplement to Chapter V where the efficiency of the company is investigated for the following reason: The data set used in Chapter V does not fully capture the quality of their output, i.e. performance of unit trusts. Expanding the line of this reasoning, this chapter starts with a number of justifications for why the study of unit trusts is indispensable.

6.1.1 Supplement to the previous analysis

The previous chapter elaborated on the corporate efficiency across the unit trust management companies with different ultimate ownership. The DEA for computing the efficiency scores incorporates administrative expenses and capital employed as inputs and revenues as output for a sample company. The computation technique for the DEA was based on the input minimisation, showing how much the company could reduce its inputs without lowering its output. A key justification for the input minimisation approach is that given the nature of the unit trust business described in Chapter III, managers are considered to have managerial decision-making not on revenues but on the costs of their companies. At its heart such an input orientation is parallel to "cost efficiency". The term "cost efficiency" refers to the ratio between the minimum cost at which it is possible to attain a given volume of production and the realised cost (Maudos et al, 2002, p34). The topic is often addressed in literature on efficiency of financial institutions.

However, researchers have recently raised a concern with the essence of the cost efficiency (Berger and Mester, 1997 and Berger and Humphrey, 1997). These authors pointed out that it is always dangerous to exclude the quality of some financial services that are not captured in the output measures (Berger and Humphrey, 1997). If this is the case, cost inefficiency might be overstated due to differences in service quality. In order to solve such a problem, it is indispensable to analyse the quality of individual unit trusts that sample companies offer.

6.1.2 A conflict of interest between owners and customers

The next motivation for the unit trust analysis stems from prior agency literature on financial service institutions. The literature has addressed that a conflict of interest exists between company's owners and their clients or customers in stock owned companies (Mayers and Smith, 1986 and 1988). Such a conflict of interest leads to the claim that stock companies are inclined to charge higher fees and take excess risk for the product that they offer. By contrast, the mutual counterparts are unlikely to suffer from such problems because the owners are the policyholders or depositors themselves. Hence, financial products that the mutual organisations offer are highly competitive with those of the stock companies offer. Within the context of the conjecture, the analysis of individual unit trusts should provide valuable information. Section 6.2 describes the Mayers and Smith' argument in detail and develops the basic hypothesis for this chapter.

6.1.3 A degree of curiosity

There has been a degree of curiosity about the effects of the recent demutualisation on financial products. Industry associations and newspaper articles have enquired whether financial products provided by mutual institutions or demutualised companies remain competitive with the existing stock owned rivals.

To date, a number of recent statistics seem to support the positive view of financial products that mutual organisations offer. For example, the Financial Times[1] reveals that the average difference between mortgage and saving rates is 2.1% for stock owned banks and 1% for the building societies. Similarly, twelve out of the 15 cheapest lenders over the past 10 years have been building societies despite the fact that two-thirds of the financial service sector consists of stock owned banks. The same article in the Financial Times also reports that 11 of the top 15 Tessa providers have been mutual institutions.

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[1] Peter Martin "Our mutual demise" The Financial Times, 29 June 1999

Nonetheless, to my knowledge, there is no research on performance difference of unit trusts between the mutual and proprietary owned groups. The lack of research in this area is rather peculiar given the fact that the UK unit trust industry has 17.8 million unit holders whose unit assets totalled 236 billion pounds at the end of 2001 (the Investment Management Association, 2001).

6.1.4 Implication for financial theory

From a perspective of the efficient market hypothesis (EMH), one can ask whether unit trusts managed by the mutual owned companies are better than those by the stock owned counterparts. To put the argument in perspective, one must recall the literature on the EMH cited in Chapter II that persistency of fund performance is investigated as a proof of the market inefficiency. Extended from such a research interest, various attempts are made to distinguish what factors are the sources of the performance with abnormal returns[2]. The approach is often referred to as attribution analysis. Popular tools for the attribution analysis are factor models developed by Fama and French (1993) for stock returns and by Carhart (1997) for mutual fund returns. These models are briefly noted in Chapter II.

More recently, the attribution analysis is extended by taking up the issue of characteristics of fund managers and their companies, which may contribute to their fund performance. Initially, it seems at odds to search for managerial or

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[2] In general, abnormal returns are defined as
the intercepts from excess return regressions calculated with a benchmark that is mean-variance efficient. (Grinblatt and Titman, 1989, p. 395).

corporate factors that could account for differential performance of funds under the efficient market hypothesis. The hypothesis states that stock prices already reflect all available information so that no one can beat the market continuously by using publicly available data. Nonetheless, Chevalier and Ellison (1999) and Atkinson et al (2003) argue that managers with certain characteristics can perform better than others in a world where capital markets are informationally efficient. Chevalier and Ellison (p.897) suggest the following explanation for the view:

If the jobs of a fund manager is to gather and analyse information in a nearly efficient market, the claim that some managers are better than others need not be any more surprising than a claim that some physicians and economists are better than others.

Viewed from the similar but not the exactly same perspectives, scholars have investigated potential attribution factors. Examples are; incentive fees (Golec, 1988; Elton et al 2003); mangers' gender (Bliss and Potter, 2002; Atkinson et al, 2003); managers' age, tenure, and educational degree (Golec, 1996; Chevalier and Ellison 1999); team management (Prather and Middleton, 2002); and company ownership (Frey 2001, Berkowitz and Qiu, 2003). Some studies indicate that personal characteristics have impact on the fund performance in a manner contrary to the EMH. Extending this line of research to the present thesis suggests that it is acceptable to expect ultimate ownership of unit trust management companies to account for performance differences across their managed unit trusts. With regard to this, the final analysis of the present thesis makes a contribution to the literature on performance attribution.

Given these reasons, this chapter calls attention to the effect of ultimate ownership on risk and performance at the product offering level. To this end, the final chapter sets out to contrast performance of unit trusts run by the mutual owned groups with those run by their proprietary counterparts.

The remainder of Chapter VI is as follows. Section 6.2 provides further insight into the previous literature, leading to a key conjecture, the validity of which will be tested in this chapter. By summarising Mayers and Smith' agency perspective (1988 and 1992), the first half of section 6.2 specifically addresses a conflict of interest between owners and customers. The second half of section 6.2 provides several summaries of attribution studies on mutual fund from managerial perspective. The review of these studies ensures that the present research topic can make a contribution to the existing literature.

Section 6.3 outlines the methodology of this chapter. To begin with section 6.3.1 focuses on conventional measures of fund performance. It is important that one should not evaluate fund performance, i.e. return of fund investment without considering risk. The argument concerning traditional performance measures leads to the recent expansion of the DEA into fund performance. This is the subject of section 6.3.4 where advantages of using DEA method over the conventional measures of fund performance is highlighted. In concurrence with the DEA approach, section 6.3.4 also includes recent studies on fund performance with the DEA. Furthermore, section 6.3.5 discusses the model specification of the DEA methodology and provides details of the unit trust data. Section 6.4 presents results of the empirical investigations. The investigations include descriptive statistics of the DEA scores and statistical methods comparing the DEA scores between the mutual and stock owned groups. Section 6.5 presents summary remarks.

6.2 Review of literature and hypothesis development

This section consists of four subsections, the first of which begins by looking at the simple debate over the mutual versus stock owned companies from the perspective of their financial products. In comparing investment products such as unit trusts, the first section suggests that the simple focus on the product fees can be erroneous. The second sub-section reviews the most influential argument posited by Mayers and Smith (1988, 1994), addressing a conflict of interest between customers e.g. policyholders and shareholders. The second subsection leads to the basic proposition for the current analysis under the efficient market hypothesis. As the efficient market hypothesis is evidently controversial, the third section looks at studies whose implicit objectives are to challenge the hypothesis. To this end, these empirical works examine whether manager's characteristics are of great importance in terms of their fund performance. Given the second and third sub-sections, the final section attempts to develop the testable hypothesis for this chapter.

6.2.1 Non-dividend advantage

In considering the mutual versus proprietary ownership debate, Cook et al (2001) mentioned that mutuals are in a position to offer better products, i.e. saving accounts with higher interest rates, and mortgages with lower interest rates. It is argued that the advantage is derived from the mutual's non-dividend policy as opposed to dividend payable to shareholders in the stock owned company. All re-distributable profits are returned directly to the mutual members in the form of better products.

If this is the case, such an argument could be applied to the unit trusts in a manner that certeris paribus, fees of unit trusts run by mutual owner groups can be lower than those run by proprietary owner groups. As a testable hypothesis, however, the statement is incomplete because of the absence of quality of fund e.g. fund performance. McWilliams, (1997) posits that "*we should charge more for these high performers*" (McWilliams, 1997, p30). This should be particularly the case when comparing investment products such as unit trusts and pension funds because in general, the range of performance of such investment-linked products is far wider than that of saving and borrowing products. Thus for testing the hypothesis associated with fees, one should not ignore the importance of the quality of the product.

6.2.2. Risk-taking propensity

Both Meckling and Jensen (1976) and Mayers and Smith (1986, 1988) argue that different ownership structures have unique mechanisms to deal with incentive conflicts amongst stakeholders in modern organisations. By studying the U.S insurance industry where mutual and stock owned companies co-exist, the authors distinguish an incentive conflict between owners and managers from that between owners and their policyholders. As for the former type of conflict of interest, little need be said because the previous two chapters address the connection between ultimate ownership and risk and performance of a company.

The conflict of interest between policyholders and residual claimants, e.g. shareholders in stock owned insurance companies have not yet been investigated. An analogy that Mayers and Smith attempt to draw is the transfer effect from bond holders to shareholders. Policyholders face a risk of wealth transfer by stockholders whose residual claim value increases as the company's risk rises. The authors present the following as an example. If the stock owned company substitutes high risk for low risk assets, the value of shareholding is up whilst the value of policy holder claims decreases on the ground that if the investment in the high risk asset pays off, more of the gain goes to the shareholders than they lose if the investment fails.

In brief, Mayers and Smith's concept regarding the conflict of interest between owners and policyholders is to consider the payout of shareholders as a call option. If the subsequent analysis is to follow this line of reasoning, it is indispensable to clarify the following questions before proceeding to the empirical analyses. The first and more general question is whether the situation of the unit trust industry is applicable for the setting of the agency theory paradigm. Building on Mayers and Smith's idea, the second and more specific question is whether such an asymmetrical payout setting is present between owners of unit trust companies and unit holders, and subsequently increasing the owners' incentive to take excess risk.

The aftermentioned points have already been confirmed through the review of prior empirical studies in Chapter II. Section 2.1 in Chapter II revealed that a conflict of interest is likely to arise between owners and unit holders of unit trust management companies. Furthermore, studies in Chapter II reported evidence that such conflict of interests is more likely to occur because of the asymmetrical payoff pattern given the fee structure and fund investors' reactions measured by their money flows into funds. Therefore, it is worthwhile to formulate a conjecture and validate it whilst assuming that a conflict of interest exists between shareholders and customers of a company.

The primary proposition

Mayers and Smith's prediction on a conflict of interest between owners and customers of a company leads to the following primary suggestion: Unit trusts managed by mutual organisations show lower risk-taking than those by stock owned companies.

Nonetheless, to test out the hypothesis is problematic with respect to the risk-expected return trade-off, an axiom of modern financial theory. Typically the risk-expected return relationship is captured in the Capital Asset Pricing Model (CAPM) and the security market line.

The essence of the CAPM is that the more (systematic) risk a fund carries, the greater the fund expected return. For this reason the risk analysis for individual funds without a return perspective should not be accepted at face value. Furthermore, the positive relationship between risk and return leads to the implication that unit trusts with lower risk result in yielding lower returns. As a result, the primary proposition should be rephrased thus, unit trusts run by the mutual ownership groups show lower risk tendency, resulting in lower return than those by the stock ownership counterparts. In a world of the efficient market hypothesis the hypothesis leads to the implication that there should be no difference of funds' risk-adjusted returns between the mutual and stock ownership groups (See hypothesis H6 in section 6.2.4).

6.2.3 Managerial effects on fund performance

A number of studies in Chapter II indicate that the efficient market hypothesis is controversial. In this respect, implicitly challenging the efficient market hypothesis, a number of recent studies examined the effect of manager's certain characteristics on their fund performance. This section provides a quick literature review on various factors that may explain differential performance of funds.

The main motivation for this review is to develop the hypothesis regarding the organisational effect on their fund product whilst establishing the connection between the empirical analysis in this chapter and early studies in the literature. More precisely, the review serves as a cross-reference to the primary proposition for this chapter noted in the preceding section.

Incentive fee effect

One of early studies in this subject is Golec's (1988) incentive effect on returns. From the agency theoretical perspective, his enquiry was whether funds with incentive fee schemes provide investors with superior returns. Based on monthly return data available over the period from 1982 to 1987, the data sample consisted of 387 funds.

Golec's main findings were that the difference between the average Jensen's alphas of the incentive fee funds and the full sample was 0.06 ($p > 0.05$) and therefore not statistically significant. On the risk side, the incentive funds exhibited significantly higher average betas and standard deviations of returns than the full sample whereas the average r-squared is higher for the incentive funds.

The result from the matching sample comparison is more noteworthy. The difference of the Jensen's alpha between 27 funds with incentive fees and the matching 27 funds without incentive fees was 1.59 ($p < 0.05$), which is statistically significant. On the other hand, the risk proxies such as beta, standard deviations showed no significant difference between the two groups. Golec, therefor, concludes that incentive fees appear to improve the relative fund performance.

A recent study (Elton et al 2003) with larger fund samples and for a longer period (from 1990 to 1999) supported Golec's positive view on the incentive fee effect. Their research found that on average the incentive-fee funds have higher risk adjusted performance. The authors also pointed out that the incentive fee funds were likely to take on more risk than the non-incentive fee funds when the averaged r-squared on the relevant benchmark was referred to as the fund risk. It is important to note that on average incentive fee funds have a beta less than one.

Given the combination of these observations, the authors argue that funds with incentive fees exhibited better stock selection skill than funds without incentive fees.

Based on these studies, it can be said that "*incentive fees attract managers who are more skilled or exert more effort than those who are attracted to funds without incentive fees*" (Elton et al, p. 802).

Effect of age, tenure, and MBA degree

Using data of fund managers' personal characteristics such as educational background, age, and tenure, Golec (1996) and Chevalier and Ellison (1999) examined the impact of a manager's characteristics on his or her fund performance. The fundamental reason for their approach is education, age and experience, e.g. tenure matter because the nature of their job is data collection and analysis like doctors and statisticians.

By and large, both studies agreed on the positive effect of certain characteristics of fund managers on their fund performance despite the fact that there are minor discrepancies between the two studies.

Golec (1996) found that better performance is to be expected from well-diversified funds[3], managed by younger, long-tenured managers with an MBA degree. Further, the systematic risk, e.g. beta was positively related to turnover,

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[3] Measured by a high R-squared (Golec, 1988).

fund age, and a possession of an MBA degree whereas the residual risk was negatively related to fund age and size. Overall, Golec concludes that a fund performance and risk-taking are significantly impacted by the managers' characteristics.

Chevalier and Ellison's study (1999) differed from Golec' study in three ways. First and foremost, Chevalier and Ellison included the university quality variable[4], which turned out positively related to risk-adjusted returns of funds. Secondly, and of methodologically importance, Golec's focus on three-year returns is likely to suffer from larger survivorship biases than Chevalier and Ellison's study (See Chevalier and Ellison, 1999. p.878, footnote 3). This results in stronger prediction power of explanatory variables in Golec' study. For instance, the positive effect of the MBA on the risk-adjusted return was 0.943 at the 10% significant level. The corresponding coefficient in the Chevalier and Ellison model was 0.04 but statistically indistinguishable.

Finally, by using a four-factor model in a manner similar to Carhart (1997)[5], Chevalier and Ellison revealed that some characteristics of fund managers were not related to fund performance but to investment styles. For example, managers with MBAs showed a significant tendency to invest in stocks with low book-to-market ratios. Another finding is the positive relationship between managers'

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[4] The variable is based on the average student's Scholastic Aptitude Test (SAT) score for a given college.

[5] The four factors are: (A) The return of the value weighted NYSE/AMEX/Nasdaq composite index minus the risk free rate (Referred to as the RMRF). (B) A zero investment portfolio constructed by subtracting the returns of low book-to market ratio stocks from the returns of high book to market ratio stocks (the HML portfolio) (C) A zero investment portfolio constructed by subtracting the stock returns of large market capitalisation firms from the stock returns of small market capitalisation firms (the SMB portfolio). and (D) A zero investment portfolio constructed as the spread between the performance of stocks that are in the top 30 % of returns in the prior 12 months and those that are in the bottom 30% (the PR1YR portfolio).

age and the momentum variable of the factor model. This means that senior managers employ the momentum strategy by buying “hot” stocks, rather than taking the contrarian strategy that buy unfashionable stocks.

Gender effect

Expanding upon prior research concerning the impact of certain managerial characteristics on performance, recent studies by Bliss and Potter (2002) and Atkinson et al (2003) investigated the role of fund managers’ gender on their funds’ performance. The main reason for their studies comes from the notion that men and women consider money, risk, and investment differently (Bliss and Potter, p.2; Atkinson et al, p.2).

Bliss and Potter collected 2571 domestic, e.g. the US, equity mutual funds and 652 international equity mutual funds finding that female managers run approximately 11% of these funds. According to the descriptive statistics, female fund managers seem to take more risk than their male counterparts in terms of total risk (standard deviation of returns), market risk (beta), and Morningstar’s bear market rank index[6]. However, when the performance is measured by the Sharpe ratio, the differences turned out to be indistinct.

The second analysis that the authors demonstrate is to create the matched sample composed of 124 domestic funds and conduct a cross sectional regression. The

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[6] A bear market is defined as all months in the past five years that the S&P 500 lost more than 3%. Morningstar adds up a fund’s performance during each bear-market month to reach a total bear-market return. Based on these returns, each fund us then assigned a percentile ranking. For example, a fund with a bear-market rank of 5% has withstood poor markets well, whilst one with a rank of 95% has not

model has the fund return as the dependent variable and various control variables such as gender dummy variable, fund size, fund beta and fund manager's tenure. According to the result for the cross sectional regression, there were no performance differences between male and female fund managers in the matched sample.

Atkinson et al (2003) pursued a similar study by collecting data of fixed income funds and then limiting the number of funds in the sample so as to match female managed funds with male managed funds. The overall result was consistent with that of Bilss and Potter (2002) in that the regression results showed no difference between the male and female managed funds in terms of performance and risk.

Team effect

According to Prather and Middleton's literature summary (2002), opinions vary as to the effectiveness of team decision-making versus individual decision-making. Classic decision-making theory suggests no difference between team and individual decision-making. By contrast, behavioural decision-making theory posits that team decision-making is better than that of an individual. Given the conflicting viewpoints, Prather and Middleton (2002) examined whether funds managed by teams of fund managers are better than those managed by individual fund managers.

The authors collected 162 mutual funds over a 13-year period. There were 15 funds managed by teams of fund managers in the sample data. By substituting the return index for the individual managed funds the authors directly compared the performance of the individually managed and team-managed funds[7].

The result in the modified CAPM model shows that as the Jensen's alpha is not significant, there is no performance difference between the two management category groups regardless of their investment styles. This finding supports the efficient market hypothesis.

Summary remarks

As for the results from prior research, evidence is divergent. A few scholars documented evidence for effects of incentive fees and managers' educational backgrounds on their fund performance. Other studies reported little evidence on particular personal or managerial factors that affect the fund performance.

Given the literature review in this section, it is evident that the research angle of the analysis in Chapter VI is similar in one respect and different in other. The similarity is that the central issue of Chapter VI revolves around managerial factors that may have an impact on the fund performance. The difference is that most of the prior studies analysed attribution factors at the individual fund manager level. By contrast, the focus throughout this thesis is on the corporate or organisation level. This is a relatively untapped area to date. As Chapter II showed, only a few scholars like Frey (2001), and Berkowit and Qiu (2003)

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7 The modified model is written as follows. $R_{ot}^{team} - R_f = \alpha + \beta(R_{ot}^{ind} - R_f) + \varepsilon$

where R_{ot}^{team} is the return on the team managed fund sub-sample for a given investment objective group o during period t. R_f is the risk free rate,

R_{ot}^{ind} is the return on the individually managed fund sample for the same investment objective group o during period t.

investigated the organisational or ownership effect of the fund management company on their fund performance. Hence, potential contributions of the analysis in Chapter VI to the literature can not be overlooked.

As for the hypothesis development, Chevalier and Ellison's study (1999) is informative in a sense that fund management is knowledge intensive, requiring the collection of quality data and expert analysis. By putting Chevalier and Ellison's view into the organisation theory of Fama and Jensen (1983a and b) in Chapter II, it is possible to conjecture that certain organisational form have better managerial practice or skilful employees, fitting well into fund management business. Specifically, it is possible to make a hypothesis by building on the effect of incentive fees on fund performance (Golec 1989, and Elton et al 2003). The hypothesis is that as different forms of organisations have developed different incentive practices, funds managed by companies with different ownership form differ in terms of risk-adjusted performance.

6.2.4 Hypothesis development

Hypotheses (H6) and (H7)

There are two plausible but conflicting hypotheses that emerge from the review of prior studies. Given the Mayers and Smith's argument on the conflict of interests between customers and shareholders, the basic hypothesis is that: Funds with the mutual ownership groups take less risk than those with the proprietary ownership counterparts. However, under the efficient market hypothesis, funds with low (high) risk result in lower (higher) return of the funds. Moreover, there is a possibility that mutual affiliated companies charge less on their unit trusts because of the less conflict of interests between the account holders and owners in the mutual group than the comparable stock owned companies. Therefore, the implication from the basic hypothesis is that

(H6) Market efficient hypothesis: There should be no difference between the mutual and stock ownership groups in terms of the risk-adjusted performance of their funds. (H6)

Another implication can be derived from the first hypothesis in the context of the current thesis. If unit trusts managed by the mutual groups show tendency toward the lower risk-expected return investment, the mutuals' relative inefficiency reported in Chapter V is hardly attributable to the quality of their outputs.

An alternative hypothesis

An alternative hypothesis is formulated not only by applying agency perspective more broadly, but also by considering recent empirical studies regarding the managerial effects on fund performance. The alternative hypothesis predicts that:

(H7) Organisation effect hypothesis: Risk-adjusted performance of fund differs between the mutual and stock ownership groups.

The idea behind the alternative hypothesis is that as discussed in Chapter II, different organisational forms develop their own unique managerial practices, including incentives. On can be certain that such managerial practices have an impact on their fund management business. It is possible to assume that due to the different practices, one organisational form can facilitate a more favourable environment for the unit trust management business whereas the other ones do not have comparative advantages in the industry. It is important to note that the alternative hypothesis does not predict which type of organisational form generates better fund performance. The alternative hypothesis, e.g. hypothesis (H7) simply suggests the difference of the fund performance by ultimate ownership type.

Similar to hypothesis (H6), the alternative hypothesis has an important relevance to the preceding chapter. The analysis for superior fund performance may provide insights into why efficiency differs between unit trust management companies with the mutual groups and those with the proprietary groups.

Moreover, in formulating the hypothesis, the issue of fee setting is an additional complication that should not be overlooked (See, for example, section 6.2.1). In essence, the issue of whether ultimate ownership matters at the unit trust level is an empirical question because the hypotheses are at odds and the fee setting is a complex issue.

In summary, the most important aspect of testing out the hypotheses is to ensure that risk, return and fees are considered simultaneously. This is the central justification of the DEA approach in the subsequent analysis. To this end, the following methodology section concerns traditional risk-adjusted measures for mutual fund performance whilst highlighting key caveats of these measures.

6.3 Methodology and data description

6.3.1 Performance measures

Chapter II indicated that accurate performance measure is a principle of fund performance persistence that challenges the validity of the efficient market hypothesis. For this reason since shortly after the CAPM theory was proposed, numerous studies have been concerned with methodologies of performance measurement. The task in this section is to review traditional performance measures within the two dimensions of risk and return. Furthermore, major limitations of these conventional measures are described. In addressing such constraints, the next section will highlight several advantages of using the DEA method over the standard performance measures.

Sharpe ratio (1966)

Sharpe ratio divides fund excess return over the sample duration by the standard deviation of return over that duration. The measure shows the trade off between reward and total volatility. For this account, this measure is also named as reward-to-variability ratio. In choosing between two or more alternative investments, investment managers select the investment with a high Sharpe ratio because the investment achieved good return for its level of volatility.

Let us turn to an example of the Sharpe ratio in use. In order to evaluate overall performance of fund A, one needs to compute the Sharpe ratio of the relevant benchmark, (often the ex-post capital market line is used[8]) as the corresponding Sharpe ratio;

$$\text{Sharpe ratio} = (R_p - R_f) / \sigma_p \qquad (6.1)$$

where

R_p = the mean return on portfolio, *p*, over the interval considered.
R_f = the averaged risk free rate over the interval considered.
σ_p = the standard deviation of the *excess* return on portfolio, p over the interval considered.

If the Sharpe ratio of fund A is higher than that of the ex-post market portfolio, then one can say that fund A has outperformed the market.

Note that the precise denominator of Eq. (6.1) can be described as (σ_p-σ_f) because the Sharpe ratio involves dividing the portfolio's excess return, ($R_p - R_f$) by its standard deviation. In this light, a point to remember is that the Sharpe

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[8] The set of portfolio obtainable by combining the market portfolio with risk free borrowing or lending.

(Sharpe et al 1999)

ratio should be computed by using the mean and standard deviation of a differential return (Sharpe, 1994 and Dowd, 2000). Hence, great care is taken to avoid confusing the Sharpe ratio with the information ratio that uses the mean and standard deviation of the distribution of the return on a single investment such as a fund or benchmark.

There are further observations to be made regarding the Sharpe ratio. Firstly, investment risk with standard deviation of return is not a perfect approach because from a viewpoint of ordinary investors, the deviation above the mean is rarely considered as a "bad outcome". Based on standard deviation, the Sharpe ratio is also the case as the ratio does not distinguishing between upside and downside volatility. In other words, the Sharpe ratio penalises the upside volatility exactly the same as the downside volatility. Moreover, the Sharpe ratio is appropriate only if the distribution of its rate of return is known. Finally, the Sharpe ratio does not take account of correlation in choosing between two or more alternative investment. Sharpe (1994) noted *that "neither incorporates information about the correlation of a fund or strategy with other assets, liabilities, or previous realizations of its own return* (p.51)" For these reasons, the Sharpe ratio may not be a helpful tool for investors who attempt to add a fund to their existing portfolios (Strong, 2000). It is said that the Sharpe ratio is of use when the overall performances of well-diversified funds are evaluated and ranked (Bodie et al, 1996).

Nonetheless, a recent work by Dowd (2000) presented a solution to the non-correlation problem by constructing the Sharpe ratio for each resulting portfolio, combining the existing portfolio with each of the alternative new investment. This method automatically adjusts for the correlation between the existing portfolio and the potential new investment.

Treynor measure (1966)

In a manner similar to the Sharpe ratio, the Treynor measure uses averaged portfolio excess returns. However, the excess return is divided not by total risk (as measured by its standard deviation), but by systematic risk (as measured by beta). Stemmed from the CAPM, the underling assumption of the measure is that non-systematic risk is largely diversified way.

To compute the Treynor measure, one needs to determine the beta of the fund based on the ex post Security Market Line (SML). The ex post SML is plotted in the diagram where the vertical axis represents return and the horizontal axis proxies risk, i.e beta. To put it another way, the ex post SML is going through the points (0, the averaged risk free rate) and (1, the averaged market return). Under the ex post SML, the expected average return of a fund and its beta can be estimated as follows:

$$R_p = R_f + \beta_p(R_M - R_f) \qquad (6.2)$$

where
β_p = Covariance (r_p, r_M) / Variance (r_M).
R_f = the averaged risk free rate
R_M = the averaged market return
R_p = the expected average return of a portfolio, p.

Then, the Treynor measure is formulated

$$\text{Treynor measure} = (R_p - R_f) / \beta_p \qquad (6.3)$$

In practice market indices such as S&P 500 in the U.S and TOPIX in Japan substitute for the ex-post markets in case of equity fund valuations. Once the beta of the fund is estimated, the excess return of the fund, i.e. the net of the risk free rate on the fund, is divided by the beta. As similar to the Sharpe ratio, the higher Treynor measure means the more superior risk adjusted return on the ground that the two measures refer to return per unit of risk.

Jensen's alpha

The third risk-adjusted measure is the Jensen's alpha. This is one of the most widely used measures in the empirical performance literature (Farah, 2002, p5). Basically, Jensen (1968) created his measure based on the CAPM. To begin with, the ex-post alpha measure is defined as the difference between the (averaged) expected return of a fund, $E(A_{rp})$,and the (averaged) realised return of the fund given the realised risk of the fund, i.e. the beta. The ex-post Security Market Line is used so in order to estimate the expected return of the fund, in a similar manner to the Treynor measure.

That is; $E(R_p) = R_f + \beta_p(R_M - R_f)$. (6.4)

The difference between $E(R_p)$ and R_p is defined as the alpha. Thus, the alpha is also written as;

$\alpha_p = R_p - E(R_p) = R_p - R_f + \beta_p(R_M - R_f)$. (6.5)

Based on the premise that a fund manager has a superior investment skill, a point to note is that the alpha reflects the fund manager's skill, being a positive intercept if the manager has superior skill.

Using a linear regression model with three components; the alpha, the beta and the random error term, Jensen (1968) showed the way in which the alpha was used in context of performance measure. His equation is defined as follows;

$$R_p - R_f = \alpha_p + \beta_p(R_M - R_f) + \varepsilon_p \tag{6.6}$$

Furthermore, taking advantage of the regression formula, one can interpret the parameters under the premise that α_p and β_p are constant over time. For example, one can consider ε_{pt} as an indicator of the model fitness, simply by saying that a low ε_p indicates a well defined relationship among the parameters. Similarly, the standard deviation of ε_p is also proxied for the unique risk of the portfolio.

What is more, the t-values of the coefficients, e.g. α_p and β_p, provide their statistical significance. For fund managers who do not believe in the efficiency market hypothesis, the high alpha with statistical significance reflects superior skills of investment managers. On the other hand, such a positive alpha is contradictory to the CAPM where no alpha exists. For testing such a conflicting view, performance literature on mutual funds has focused on the positive alpha derived from the Jensen's measure. In addition to the theoretical perspective objective above, the Jensen's measure has an advantage over both the Sharpe and Treynor measures. The latter two measures are relative portfolio measures without statistical significance indicated.

6.3.2 Comparison of performance measures

Theoretical comparisons

Based on the formulas described above, the performance measures can be grouped in two ways. Firstly, the Sharpe measure and the Treynor measure are considered as return per unit of risk whereas Jensen's measure focuses on differential returns, i.e. alpha. It is interesting to note that despite the fact that the Sharpe ratio and the Treynor ratio are computed in a similar manner, there would be a case that their indications differ. For instance, if one is to assume that portfolio X has a relatively large degree of non-systematic risk and a low degree of market risk. Because the large amount of non-systematic risk is excluded in the Treynor measure, the Treynor measure becomes high. On the other hand, under the same portfolio, the Sharpe ratio is low as the Shape ratio includes the total risk, which incorporated the large amount of non-systematic risk and the small amount of market risk.

Secondly, the Treynor measure and the Jensen measure are theoretically relying on the ex-post market model that is derived from the CAPM. In this light, a problem of the benchmark error is inevitable. In contrast, the Sharp ratio can be computed without reference to benchmarks. Nevertheless it should be noted that the Sharpe ratio is not a panacea for performance measurement because the ratio excludes any effects of transaction costs. The next section also addresses this issue.

Empirical comparison

Using a sample of 25 mutual funds in the U.S from 1993 to 1995, Farrell (1997) compared three risk adjusted measures, the Sharpe ratio, the Treynor measure and the Jensen alpha. He reported that performance evaluation of the individual funds is consistent for the Treynor measure and the Jensen alpha. On the other hand, evaluations based on the Sharpe ratios, in particular for the less diversified funds, did not accord with those of the other two measures[9]. Reilly and Brown (2000, p.1154) presented similar findings by using the rank correlation coefficient matrix. The correlation coefficients between the Sharpe and Treynor ratios, and between the Sharpe ratio and the Jensen's alpha were 0.88 and 0.90 respectively whereas the coefficient between the Treynor ratio and the Jensen's alpha was 0.99.

Overall, as the coefficients across the three measures were high and positively correlated, the measures seem to provide a general consistent assessment as a whole. As for an individual case, the degree of non-systematic risk is often relevant to its performance measure. The paragraph above reminds us how important it is to understand the underling logic of these measures.

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[9] Overall, Farrell found that based on the Sharpe ratio, 8 out of the 25 funds had higher ratios than that of the market benchmark, i.e. the S&P 500. Using the Treynor measure, 14 out of the 25 funds showed better results than that of the market. Further, subject to the Jensen measure, 14 out of the 25 funds exhibited superior performance than that of the index. These findings provide evidence that different risk adjusted measures exhibit different results.

6.3.3 Caveats

Chapter II indicated that the Jensen's alpha as well as the Sharpe and Treynor ratios become conventional risk-adjusted performance measures. Moreover, if it is accepted that these measures reflect fund managers' investment skills, a number of models with various factors are developed (Elton et al 1996; Carhart, 1997). However, as the preceding section noted, the measures have been subject to considerable criticisms, which remain untouched up to this point. It is worth mentioning key caveats and problems. For example, some scholars discussed that these conventional measures fail to capture the managers' market timing (Treynor and Mazuy, 1966; Grinblatt and Titman, 1989) and the changing nature of economy affecting alpha and beta (Ferson and Schadt;1996, Ferson and Warther; 1996, Christopherson et al.;1999). Among these criticisms, scholars such as Farah (2002) and Murthi et al (1997) pointed out that the benchmark inefficiencies and the exclusion of transactions fees are the most important ones.

The benchmark error

The Jensen alpha and the Treynor measure are sensitive to the choice of the benchmark portfolio (Roll 1980). Sparked by Roll, this is defined as a benchmark error and this becomes the main criticism made on the use of the CAPM. The benchmark error occurs because a non-optimised index is selected as the market index. For this reason, there is always a difference between the measured beta and the beta which should have been computed using a properly optimised index. Note that the optimised index refers to the index as being on the mean-variance efficient frontier.

A number of studies have elaborated on the benchmark error. For instance, Elton, Gruber, Das and Hlavka (1993) and Fletcher and Forbes (2001)[10] documented sensitivity of fund performance to chosen benchmark. Furthermore, to reduce the benchmark error, some empirical studies employed several benchmarks in measuring fund performance (Hendricks et al, 1993 and Brown and Goetzmann, 1997). Hence, it is important to remember that betas and alphas depend on the choice of a reference portfolio, e.g. a market portfolio.

Transaction costs

The simplest reason to consider the fee effect is that the higher the fee a unit trust charges, the lower the net return the unit holder gets (Hooks, 1996; Droms and Walker, 1995; Carhart, 1997, Sandler, 2002). The related remark from Chapter II is that the investment strategy to pursue superior return by switching one winning fund to another[11] is unlikely to yield economic profits due to the transaction costs (Quigley and Sinquefield, 1998).

Along the line of fee effects on fund performance, Grinbatt and Titman (1989) addressed the issue that if a fund manager or their company has superior investment skills, they can expropriate the economic rent by charging higher fees. What Grinbatt and Titman are implying is that higher fees can be justified by high quality, e.g. superior return of the fund. Nonetheless, in reality, there are three objections raised against their view. Firstly, as chapter II summarised,

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[10] Fletcher and Forbes (2001) "Does the benchmark or the measure matter ?" Conference proceedings, "Performance of managed funds", Scottish Institute for research in investment and finance, July 2001
[11] According to the authors, every year, on average, 80% of the underlying unit trusts in the top portfolio is replaced with unit trusts with higher return in the subsequent period.

much controversy surrounds evidence for performance persistency. Viewed in this light, it may be safe to assume that to continuously achieve superior return is a difficult task. Therefore, there is no guarantee to charge and maintain high fees based on the unit trust return. Secondly, for the sake of argument, let us suppose that some managers or companies have real skills to produce superior investment return constantly. If they take advantage of their superior returns by charging higher fees, the benefit can be cancelled out the cost to obtain their fund (Ippolite, 1989). This should be the case specifically when the degree of their superior rerun is marginal (Cheng et al, 1999). There seems to be much truth in this possibility given some empirical evidence for the performance persistence in Chapter II. Over and beyond the evidence in academic literature, the recent industry report by Paul Myners [12] found that all the costs of investing in open-ended funds were probably more than equity risk-premium of 2.5%. Finally and most important of all, no relationship has been found between fee charges and performance for the UK unit trust industry (Sandler, 2002) as well as for the U.S mutual fund industry (Kahn and Rudd, 1995).

From these remarks, one general point becomes very clear: *"the avoidance of high fees is a defensible strategy"* (Kahn and Rudd, 1995, p 49). Therefore, the fee feature must be included in evaluating unit trust performance. From the agency theoretical perspective, this is also crucial as the potential conflict of interest exists between unit holders and the company owners in the unit trust industry.

[12] Financial Times, 19 May 2003

6.3.4 Justification for the DEA approach

As the preceding section indicated, no measures are immunised against criticism. Nonetheless, more recently, a series of papers have employed the DEA to measure fund performance, overcoming various limitations of standard performance measures. Table 6.1 summarises these works.

Table 6.1: Recent DEA studies for fund performance

Authors (publish year)	Objective Function (see below)	Input Variables	Output Variables	Sample
Murthi, Choi, and Desai. (1997)	Output Augmentation	Expense Ratio a Standard Deviation Loads b Fund Turnover c	Annual Return	731 mutual funds for the 3rd quarter of 1999 in the U.S.
Morey and Morey (1999)	Output Augmentation and Input Reduction	Variance of monthly returns	3, 5, and 10 year mean monthly returns	26 mutual funds from 1985 to 1995 in the U.S.
McMullen and Strong (1998)	Output Augmentation and Input Reduction	Subscription and redemption fees (%) Standard Deviation of return over three years Expense Ratio	1, 3, and 5 year annualised returns	135 common stock mutual funds highlighted in popular financial magazines in 1997
Choi, and Murthi (2001)	Output Augmentation with (1) the same scale and with (2) different scales	Expense Ratio a Standard Deviation Loads Fund Turnover	Annual Return	731 mutual funds for the 3rd quarter of 1999 in the U.S.
Basso and Funari (2001)	Output Augmentation	Risk (Standard deviation of return, The semi variance risk indicator, and Beta) Subscription and redemption fees (%)	Weekly logarithmic returns	47 mutual funds in Italy in the period 1997 to 1999

a: Expense ratio refers to the costs incurred by the mutual fund in operating the portfolio, including administrative expenses and advisory fees paid to the investment manager, usually expressed as a percent of total assets under management.
b: Laods are sales charge or redemption fees incurred when investors purchase and sell the shares.
c: Fund Turnover is the less of monthly purchase or sales in the fund during the month divided by average net assets value.

Despite the fact the DEA methodology is outlined in Chapter V, this section attempts to justify the DEA approach in the context of analysing fund performance. The first advantage is that because of non-parametric nature, the DEA is free from any index, or market equilibriums. This means that as no theoretical model such as CAPM or APT is required, no benchmark errors occur. The second merit using the DEA for the performance measurement is that the DEA considers return and risk simultaneously. The framework is consistent with the risk-adjusted performance measures in the modern financial literature. In this regard, it can be said that the DEA performance measure is a variant of the Sharpe ratio (Murthi et al, 1997). The third is that the DEA can deal with multiple inputs and outputs simultaneously. This is important because the DEA based measure can capture the fee effect by including the fees into the input of the DEA equation. The fourth benefit is that the DEA provides a prescription for improvement for each inefficient fund. The improvement is based on the distance between the inefficient fund and the efficient frontier that has the same risk and fee factor mix (inputs) and the same return (output). Coupled with the improvement target, the hypothesis on differences of unit trusts between mutual and stock owned company groups can be nicely operationalised. Finally, the underlying notion of "relative efficiency" in the DEA fits in the current industry practice where individual unit trusts are compared with each other, often in the form of a peer league table. Empathising with the importance of the tournament mechanism, Brown et al (1996) documented that the peer group comparison has an impact on trading patterns of mutual funds. This is why the relative measure is the key to study individual unit trust performance.

6.3.5 The DEA model specifications

As already described in Chapter V, there are several issues to be addressed in building the DEA model. Whilst minimising repetition, the points which need to be considered are (i) choosing input and output factors, (ii) input minimisation or output maximisation, (iii) returns to scale.

Choosing factors

The main objective of this chapter is to rule out whether return, risk-propensity and fees of unit trusts are attributable to test ultimate ownership of the management company. From the DEA perspective, the return refers to output whereas risk-taking and fees refer to inputs. On the output side, an investment return of a unit trust during the investment period is defined as the output. On the input side, the input of risk is the standard deviation of the fund price during the investment period. The other inputs are an initial fee and an annual management fee.

In computing the return and risk of a unit trust, the choice of the investment period is open to consideration as the duration can vary. For example, the UK monthly financial magazine, *Money Management*, which is the data source for the present analysis, provides various durations for cumulative returns: one, two, three, five and ten year periods. However, for the current DEA, the three-year period is selected on the following ground. Sections 2.4.1 and 2.4.2 in Chapter II examined the money flows from fund investors, revealing that a performance rating system such as Standard Poors has become a popular tool among retail investors when making decisions on fund investment. One important aspect to remember is that these ratings are computed on the basis of three-year period. Hence, as the three-year return is a key composite of the performance ratings, it may be safely assumed that the three-year return is a reasonable choice in computing the standard deviation of unit trusts' returns. This is something to which investors are likely to pay much attention.

Input minimisation model[13]

In the present DEA model, the input minimisation is used under the following premise. Investment return of an individual unit trust is affected not only by the capital markets, but also by various factors such as a business economic situation and unforeseeable events. Unit trust managers cannot control these market or environment driven factors, but rather they can adjust risk propensity of their managed unit trusts. For example, the portfolio manager can control the risk of his or her fund by adjusting the number of stocks in their unit trusts. By and large, the more stocks the unit trust invests, the less volatile the unit trust appears. An alternative method to control the fund risk is by outweighing small capital company stocks, which are generally highly volatile. Moreover, the management companies can increase or reduce their initial and management fees for their unit trusts. Within the range of the current fees in the industry, the companies have some discretional powers over the fee pricing.

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[13] *Output Augmentation or Output-Deficient*: How much augmentation to the outputs is necessary for a specific inefficient fund to become DEA efficient. *Input Reduction or Input Excessive*: Each input can be reduced to achieve a relative efficiency.

Returns to scale

It may be worth recalling section 5.5.5 in Chapter V that as for the DEA model, there are two basic types of envelopment surfaces, referred to as constant return to scale (CRS) and variable return to scale (VRS). The difference between the two models is that the pure technical efficiency is estimated under the VRS whereas the aggregated efficiency including scale efficiency is obtained by the CRS. The choice of a particular surface should be determined by economics and other business factors. However, the following analysis does not put forth a specific surface. Instead, the two surfaces are computed. The results from each model is compared, identifying the scale efficiency. This is the same procedure employed in Chapter V.

6.3.6 The next stage of the analysis

Before turning into the data collection, the section outlines the next stages of the analysis using the DEA scores. Overall, the approach in the current chapter is almost identical to that of Chapter V. That is, Tobit regression models are used to evaluate the sources of variation in computing efficiency scores for the sample companies. Obtained from the first stage of analysis, the efficiency scores ranging from 0 to 100 constitutes the dependent variable in the Tobit regression models.

Explanatory variables are divided into three groups. The primary explanatory variable is the ultimate ownership status (e.g. mutual = 1; stock owned = 0).
The second explanatory variable group is associated with the company's product mix, including the number of funds, the number of sectors, and the Herfindhal

index. The main reason to use these variables is to allow for the potential diversification effect. Therefore, the question of interest is that having a wide range of products that are not perfectly correlated each other, the company would have the benefit of the diversification effect at the company level, by taking maximum risk at the individual unit trust level. The third variable is related to the size effect of a fund on its return. A few recent papers (Indro et al 1999; Beckers and Vaugham, 2001) explicitly addressed this topic, summarising cost advantages and disadvantages that affect fund return. The typical benefits for large funds are; as the fund grows, brokerage commission rates for large transactions usually decrease. Furthermore, various costs such as market research, fund administration and general overheads do not rise proportionally more than the increase of the fund's asset. Consequently, the average costs declines as the fund size increase, generating more room to reduce management fees. Such situations are likely to contribute to the return improvement.

The disadvantages for large funds are; trading costs for large blocks of shares which are, in fact, expensive due to the liquidity and asymmetric problem for market makers. Moreover, it is difficult for a fund manager with large assets to trade without signalling his or her intentions because of the fund size, which attracts attention in stock markets.

Empirical evidence from Indro et al (1999) and Beckers and Vaugham, (2001) concurred on the size effect on the fund return. Some small funds suffered from trading inefficiency due to their small size whereas larger funds tend to overspend in acquiring and trading on information measured by the expense ratio and turnover respectively. These studies suggest that fund size matters.

6.3.7 Data Collection

The data on individual unit trusts is collected mainly from two sources; The FT Unit Trust Year Books, and Money Management magazine. Money Management contains individual unit trust information on return, risk, asset size, Standard & Poors' fund ranking. The FT Unit Trust Year Books provides detailed information on other fund-specific variables such as the fund type, fee charges. The information with regard to individual fund managers' characteristics is not available and therefore not included in the present analysis. It is also important to note that similar to the two preceding chapters, information of ultimate ownership is based on the UK Fund Industry Review and Directory.

6.3.8 Description of Data

Table 6.2 provides descriptive statistics on the sample of 209 unit trusts classified into the ALL UK companies sector as of the end of 1999. The condition to select is that a fund should have a three year return record. The total fund sample accounts for 94 % in terms of the number of funds in the sector and 95% in terms of the size in the sector.

The upper panel of Table 6.2 (Panel A) reports sample means, standard deviations, ranges of the unit trusts across three ownership groups. The lower panel of Table 6.2 (Panel B) reports control variables. The control variables include not only other unit trust characteristics such as trust size, but also their management company's asset, and product mix. The descriptions in Table 6.2 are also reported separately for mutual, quoted and privately owned company group.

Several interesting features emerge from Table 6.2. For example, defined as the output, average monthly return in the first row indicates no obvious difference across the different ownership groups. This may not be surprising viewed from the efficient market hypothesis perspective.

In evaluating the fund return more rigorously, it is indispensable to pay attention to the risk accompanied with the return. In this light, the second row in the upper panel of Table 6.2 shows the fund volatility on the basis of standard deviation of the monthly return. Interestingly, on average, the unit trust with the lowest volatility belongs to the mutual group company whereas the unit trust with the highest volatility is managed by the listed company group. The observations indicate the risk-averse tendency of the mutual ownership group, or to put it another way, the relatively strong risk preference of the exchange listed company. More notably, it follows from the first and second rows that, on average, the unit trust with the mutual (*quoted company*) group displays the superior (*poor*) performance in terms of the risk-adjusted return measure; the Shape ratio.

As for the fee levels reported in the third and fourth rows of Table 6.2, the observations are more interesting. The average initial fee is the highest for the unit trust with mutual group (4.506%) whilst that of the privately owned group is the lowest (3.865%). In contrast to the initial fees, the order for the annual management fee is inverse; the private owned company (1.206%), quoted company (1.187%) and mutual institution (1.079%).

The lower part of Table 6.2 (Panel B) also provides interesting features concerning characteristics of individual funds across the three ownership groups. Specifically, the first row shows that, in terms of the unit trust's size, the unit trust of the mutual company group is the largest (379 million) on average whilst that of the privately owned company group (164 million) is less than half of the mutual counterpart.

What is more, presented in the second row (Panel B), the fund run by the mutual owned group shows the highest proportion of the individual unit trust out of the company's total asset size. It can be said that because of the large proportion of a unit trust classified into the UK all companies sector, the unit trust is important to the mutual group. Other summary statistics in Panel B such as the Herfindahl index, the number of funds and their sectors appear to support the statement above.

Table 6.2: Summary statistics for inputs, output variables (Panel A) regarding unit trusts in the *UK All Companies* sector.

Panel A	Total	Mutual (18 mutuals)	Stock (61 companies)	Private (19 companies)
Number of funds	209	31	146	32
Average Monthly Return				
Mean	1.305	1.296	1.307	1.306
Std. Deviation	0.322	0.206	0.351	0.275
Minimum	0.542	0.945	0.542	0.708
Maximum	2.758	2.088	2.758	1.920
Volatility				
Mean	4.339	4.200	4.377	4.297
Std. Deviation	0.555	0.253	0.612	0.476
Minimum	3.100	3.400	3.500	3.100
Maximum	8.100	4.700	8.100	5.200
Initial Fee%				
Mean	4.115	4.506	4.086	3.865
Std. Deviation	1.890	1.530	1.894	2.166
Minimum	0.000	0.000	0.000	0.000
Maximum	6.000	6.000	6.000	5.750
Annual Fee %				
Mean	1.174	1.079	1.187	1.206
Std. Deviation	0.325	0.313	0.325	0.330
Minimum	0.250	0.500	0.250	0.500
Maximum	2.000	1.500	2.000	1.750

(*Source: Money Management February 2000, FT Unit Trust & Year books 1999/2000, and the UK Fund Industry Review and Directory 2000)*

Table 6.2 (continued): Summary statistics for control variables (Panel B) regarding unit trusts in the *UK All Companies* sector.

Panel B	Total	Mutual (18 mutuals)	Stock (61 companies)	Private (19 companies)
Number of funds	209	31	146	32
Number of funds in the company				
Mean	20.02	13.39	21.82	18.28
Std. Deviation	12.37	10.40	12.28	12.41
Minimum	1.00	1.00	1.00	1.00
Maximum	50.00	35.00	50.00	36.00
SECTORS				
Mean	12.31	9.39	13.51	9.63
Std. Deviation	5.85	6.11	5.60	4.84
Minimum	1.00	1.00	1.00	1.00
Maximum	22.00	21.00	22.00	18.00
H-Index				
Mean	2207.73	3200.87	1984.49	2264.17
Std. Deviation	2056.71	2731.35	1703.32	2523.45
Minimum	467.14	971.51	563.51	467.14
Maximum	10000.00	10000.00	10000.00	10000.00
Fund Size				
Mean	310,347,943	379,290,323	327,584,247	164,919,375
Std. Deviation	479,868,347	450,582,292	515,726,440	276,643,765
Minimum	480,000	17,000,000	480,000	2,000,000
Maximum	3,919,000,000	1,817,000,000	3,919,000,000	1,149,000,000
Fund's Proportion % in the company's total asset				
Mean	15.80	29.21	12.94	15.82
Std. Deviation	22.88	30.76	18.80	26.91
Minimum	0.07	0.74	0.07	0.61
Maximum	100.00	100.00	100.00	100.00
Company's Total Asset				
Mean	4,016,271,244	2,366,329,032	4,386,500,205	3,925,483,125
Std. Deviation	4,205,002,243	2,107,003,209	4,030,378,795	5,915,099,697
Minimum	10,050,000	53,390,000	10,050,000	13,610,000
Maximum	14,891,200,000	8,371,160,000	14,891,200,000	14,658,810,000

(Source: Money Management February 2000, FT Unit Trust & Year books 1999/2000, and the UK Fund Industry Review and Directory 2000)

Table 6.3 presents the correlation coefficients across the variables providing a number of interesting dimensions. First and foremost, the first column shows that the average monthly return variable has a positive and significant correlation ($r = 0.518$, two tailed $p<0.01$) with the volatility variable. The result is consistent with the risk-expected return axiom of modern financial theory. The correlation coefficient between the output and the initial fee is a negative and significant ($r = -0.191$, $p<0.01$), suggesting the fact that all other things equal, the more you pay for the initial fee, the less you get from your investment. On the other hand, the management fee is positive but insignificant correlated with the monthly return ($r=0.08$, $p>0.05$).

Interestingly, the relationship between the initial and management fees is positive and significant ($r=0.34$, $p<0.01$), suggesting that funds with higher initial fees carry higher annual management fees. Furthermore, such higher fees are hardly justified from the viewpoint of risk that the fund pursues, because there is no correlation between the volatility and fee variables ($r=0.046$ for the risk-initial fee; $r=0.074$ for the risk-management fee; both are statistically insignificant). These findings indicate the possibility that some funds are exploiting their investors' indifference to the fee effect. This is not surprising as Capon et al (1996) and the Association of Unit Trusts and Investment Funds (Arber,2001) documented evidence on investors' naïve knowledge about their holding investment products.

As for the fund size effect on its return, no significant correlation ($r= 0.008$, $p>0.05$) was found, suggesting no size advantage or disadvantage. The effects of characteristics with a fund management company are also noteworthy. On the return side, the correlation coefficient between the monthly return and the size of their management company is negative but insignificant ($r= -0.075$, $p>0.05$). Hence, the size of the unit trust management company is irrelevant to their fund returns. The point above provides a partial explanation for the survival of small companies in the U.K unit trust industry.

On the risk side, the volatility variable has a negative and significant correlation coefficient with the fund asset proportion within the company's total managed asset. In other words, the fund that is relatively small within the fund management company is likely to take higher risk. The observation is of interest in terms of the marketing strategy of new funds in the industry. According to Arteaga et al (1998) many companies incubate funds hoping that some of them will generate attractive looking numbers whilst others can be quietly withdrawn. Given the line of arguments, it can be said that a fund company may take excess risk with their small funds in order to bootstrap their fund performance. Emerging from the experimental small funds certain funds succeed, attracting a great deal of positive publicity and bringing a lot of new money into the fund. This reason explains why the risk and fund proportion variables are negatively correlated.

Table 6.3 Correlation matrix for inputs, output, and other control variables.

Correlations

		Average Monthly Return	volatility	Initial Fee%	Annual Fee %	H-Index	SECTORS	FUNDS	Log_Fund_size	Log_Company_Asset	Proportion in the group
Average Monthly Return	Pearson Correlation	1.000	.518**	-.191**	.008	.018	-.143*	-.152*	.008	-.075	.057
	Sig. (2-tailed)	.	.000	.006	.903	.798	.039	.028	.906	.283	.409
	N	209	209	209	209	209	209	209	209	209	209
volatility	Pearson Correlation	.518**	1.000	.046	.074	-.129	.010	-.024	-.219**	-.093	-.186**
	Sig. (2-tailed)	.000	.	.510	.286	.063	.891	.726	.001	.180	.007
	N	209	209	209	209	209	209	209	209	209	209
Initial Fee%	Pearson Correlation	-.191**	.046	1.000	.340**	-.128	.030	-.025	-.020	.011	-.118
	Sig. (2-tailed)	.006	.510	.	.000	.064	.663	.724	.776	.871	.089
	N	209	209	209	209	209	209	209	209	209	209
Annual Fee %	Pearson Correlation	.008	.074	.340**	1.000	.034	-.043	-.052	-.056	-.096	-.049
	Sig. (2-tailed)	.903	.286	.000	.	.628	.533	.456	.423	.165	.484
	N	209	209	209	209	209	209	209	209	209	209
H-Index	Pearson Correlation	.018	-.129	-.128	.034	1.000	-.683**	-.621**	-.122	-.614**	.824**
	Sig. (2-tailed)	.798	.063	.064	.628	.	.000	.000	.078	.000	.000
	N	209	209	209	209	209	209	209	209	209	209
SECTORS	Pearson Correlation	-.143*	.010	.030	-.043	-.683**	1.000	.901**	.236**	.777**	-.599**
	Sig. (2-tailed)	.039	.891	.663	.533	.000	.	.000	.001	.000	.000
	N	209	209	209	209	209	209	209	209	209	209
FUNDS	Pearson Correlation	-.152*	-.024	-.025	-.052	-.621**	.901**	1.000	.225**	.775**	-.534**
	Sig. (2-tailed)	.028	.726	.724	.456	.000	.000	.	.001	.000	.000
	N	209	209	209	209	209	209	209	209	209	209
Log_Fund_size	Pearson Correlation	.008	-.219**	-.020	-.056	-.122	.236**	.225**	1.000	.585**	.261**
	Sig. (2-tailed)	.906	.001	.776	.423	.078	.001	.001	.	.000	.000
	N	209	209	209	209	209	209	209	209	209	209
Log_Company_Asset	Pearson Correlation	-.075	-.093	.011	-.096	-.614**	.777**	.775**	.585**	1.000	-.451**
	Sig. (2-tailed)	.283	.180	.871	.165	.000	.000	.000	.000	.	.000
	N	209	209	209	209	209	209	209	209	209	209
Proportion in the group	Pearson Correlation	.057	-.186**	-.118	-.049	.824**	-.599**	-.534**	.261**	-.451**	1.000
	Sig. (2-tailed)	.409	.007	.089	.484	.000	.000	.000	.000	.000	.
	N	209	209	209	209	209	209	209	209	209	209

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

6.4 Results of the DEA scores

6.4.1 Summary Statistics

Table 6.4 provides the summarised statistics of the DEA scores; overall technical efficiency, pure technical efficiency and scale efficiency by ownership group type. Basically, a higher score refers to a higher efficiency. For the total efficiency score reported in the first column, the mean is 68.98. This means that a fund, on average, can reduce the inputs by up to 31%.

Furthermore, the total efficiency is composed of the pure technical efficiency and the scale efficiency. The pure technical efficiency is estimated at 83.58, whereas the scale efficiency is estimated at 81.91. Such mean values imply that the fund is moderately inefficient relative to the best practice funds in the sample. Moreover, the moderate standard deviations of the efficiency scores suggest that the degree of efficiency does not differ substantially.

The DEA efficient funds are exhibited in Tables 6.5 (a) and 6.5(b). Shown in Table 6.5 (a), of the 209 funds analysed, 7 were efficient for the total technical efficiency (CRS). Table 6.5 (b) shows that 39 funds were pure technical efficient (VRS). These funds have a combination of input attributes that dominate the other funds. It is evident that many of the funds with no initial fee are estimated as the efficient funds.

Table 6.4: Summary statistics for efficiency by ultimate ownership type

	Total	Mutual (18 mutuals)	Stock (61 companies)	Private (19 companies)
Number of funds	209	31	146	32
SCORE_CRS				
Mean	68.98	70.28	68.52	69.81
Std. Deviation	16.33	12.29	17.17	16.18
Minimum	28.12	46.5	28.12	33.64
Maximum	100	100	100	100
SCORE_VRS				
Mean	83.58	83.68	83.49	83.91
Std. Deviation	10.18	8.32	10.39	11.12
Minimum	58.69	70.72	58.69	64.42
Maximum	100	100	100	100
SCALE				
Mean	81.91	83.56	81.38	82.77
Std. Deviation	13.37	7.93	14.23	13.70
Minimum	36.13	65.75	36.13	47.49
Maximum	100	100	100	100

where
SCORE_CRS = Overall Technical Efficiency
SCORE_VRS = Pure Technical Efficiency
SCALE = Scale Efficiency

Table 6.5 (a) Total Technical Efficiency

Unit Trusts with 100% efficiency	Monthly Return (%)	Volatility	Initial Fee%	Annual Fee %	Ownership	Regular Saving Plan	Pep scheme	Herfindahl-Index	Sectors in Company	Funds in company	Fund Size
Family Inv Mgmt Family Asset	2.09	4.7	5	1	Mutual	Yes	Yes	2044	6	8	73,000,000
Fidelity Inv Svcs Money Builder Index	1.64	4.4	0	0.5	Private	No	Yes	467	14	36	210,000,000
Fleming (FPFM) General Opportunity	1.36	3.1	0	1.25	Private	No	No	804	7	20	57,000,000
Liontrust Inv Fds Top 100 (exempt)	1.54	4.3	0	0.35	Quoted	No	No	2846	9	15	81,000,000
Norwich Union T/Mg Uk Gro	2.00	6	0	1	Quoted	Yes	Yes	1354	16	21	104,000,000
Scot Widows Ut Mgr Uk Equity Growth (xLTSB)	1.31	4	6	0.25	Quoted	No	Yes	1296	16	25	178,000,000
St James Place Ut Uk Gene	2.08	4.4	5	1.5	Quoted	Yes	Yes	2006	8	11	263,000,000

Table 6.5 (b) Pure Technical Efficiency

Unit Trusts with 100% efficiency	Monthly Return (%)	Volatility	Initial Fee%	Annual Fee %	Ownership	Regular Saving Plan	Pep scheme	Herfindahl-Index	Sectors in Company	Funds in company	Fund Size
Abn Amro Fd Mgrs Uk Growth	2.33	5.8	5	1.25	Quoted	Yes	Yes	6364	5	5	123,000,000
CIM Community Growth	1.16	4.4	0	1.5	Quoted	No	No	8647	2	3	480,000
Consistent	0.80	3.1	5	1	Private	Yes	Yes	10000	1	1	24,810,000
Deutsche Inv Fds Uk Equit trucker	1.25	4.2	0	0.75	Quoted	Yes	Yes	1340	14	21	74,000,000
Direct Line Ut Direct Line 100 Tracker	1.56	4.1	0	1	Quoted	No	Yes	10000	1	1	131,000,000
Dresdner Rcm (Uk) Uk Index	1.50	4.2	0	0.5	Quoted	Yes	Yes	869	12	16	120,000,000
Dresdner Rcm (Uk) Uk Mid Cap	2.47	6.6	4	1.25	Quoted	Yes	Yes	869	12	16	119,000,000
Family Inv Mgmt Family Asset	2.09	4.7	5	1	Mutual	Yes	Yes	2044	6	8	73,000,000
Fidelity Insutitutional UK	1.35	4.5	0	0.8	Private	No	No	467	14	36	460,000,000
Fidelity Inv Svcs Money Builder Growth	1.17	4	0	1	Private	Yes	Yes	467	14	36	372,000,000
Fidelity Inv Svcs Money Builder Index	1.64	4.4	0	0.5	Private	No	Yes	467	14	36	210,000,000
Fleming (FPFM) General Opportunity	1.36	3.1	0	1.25	Private	No	No	804	7	20	57,000,000
Fleming Growth (FPFM)	1.39	4	0	1.5	Private	No	Yes	804	7	20	50,000,000
Gartmore Fund Mgrs Uk Equity	1.54	4.4	0	1	Quoted	No	No	595	21	50	6,000,000
HSBC Unit The Footsie Fund	1.58	4.4	0	1	Quoted	Yes	Yes	1135	13	24	144,000,000
HSBC Unit UK Index	1.49	4.2	0	0.5	Quoted	Yes	No	1135	13	24	301,000,000
Jupiter Ut Mngrs Uk Growth Exempt	2.20	5.2	5	1	Quoted	No	No	2130	12	17	77,000,000
Legal & General Ut Equity	1.38	4.2	0	1	Quoted	No	Yes	1776	14	23	546,000,000
Legal & General Ut Uk Index	1.52	4.2	0	0.5	Quoted	No	Yes	1776	14	23	1,689,000,000
Legal & General Ut Uk Recovery	1.37	4.1	0	1.5	Quoted	No	Yes	1776	14	23	184,000,000
Legal & General Ut Uk Stock Market	1.51	4.5	0	2	Quoted	No	Yes	1776	14	23	128,000,000
Legal & General Ut Uk TAA	1.44	4.4	0	1.5	Quoted	No	No	1776	14	23	7,000,000
Liontrust Inv Fds Top 100 (exempt)	1.54	4.3	0	0.35	Quoted	No	No	2846	9	15	81,000,000
Maldon General	0.96	4.2	0	1.05	Private	No	No	10000	1	1	13,610,000
Marks & Spencer Ut Uk 100	1.57	4.3	0	1	Quoted	Yes	Yes	3577	3	4	490,000,000
MT General	1.22	3.8	0	0.62	Quoted	No	No	10000	1	1	193,820,000
Norwich Union T/Mg Uk Equ	1.49	4.8	0	1	Quoted	Yes	No	1354	16	21	711,000,000
Norwich Union T/Mg Uk Gro	2.00	6	0	1	Quoted	Yes	Yes	1354	16	21	104,000,000
Norwich Union T/Mg Uk Idx	1.32	3.9	0	0.9	Quoted	Yes	Yes	1354	16	21	542,000,000
Old Mutual Fd Mgrs Uk All Share Mirror Trust	1.39	4.1	0	1	Mutual	Yes	Yes	1133	11	24	133,000,000
Schroder Ut'S Ltd Index	1.37	4.1	3	0.3	Quoted	No	No	706	20	40	31,000,000
Schroder Ut'S Ltd Instl Growth	0.84	3.5	6	0.5	Quoted	No	No	706	20	40	67,000,000
Scot Widows Fd Mgt Uk Index	1.58	4.4	0	0.5	Mutual	No	Yes	972	21	35	225,000,000
Scot Widows Ut Mgr Uk Equity Growth (xLTSB)	1.31	4	6	0.25	Quoted	No	Yes	1296	16	25	178,000,000
Solus Funds Solus Uk Special	2.76	8.1	3.5	1.5	Quoted	Yes	Yes	1267	10	12	7,000,000
St James Place Ut Uk Gene	2.08	4.4	5	1.5	Quoted	Yes	Yes	2006	8	11	263,000,000
Threadneedle Inv Uk Institutional Growth	1.29	4	0	0.75	Quoted	No	No	880	22	36	1,920,000,000
Threadneedle Inv Uk Overseas Earns	1.27	4.2	0	1.5	Quoted	No	No	880	22	36	257,000,000
Virgin Direct Pfs Uk Index Tracker	1.47	3.9	0	1	Quoted	No	Yes	7977	2	2	1,998,000,000

6.4.2 Comparison of the DEA scores by ownership type

From the second, third, and fourth columns in Table 6.4, there is no noticeable difference in the efficiency scores across the ownership groups. To investigate the group differences statistically, two non-parametric tests were used: Kruskal-Wallis test was for the three groups; the mutual, listed company and privately owned company groups. Mann-Whitney test was especially for the mutual versus stock owned company hypothesis.

As reported in Panel A of Table 6.6, the probability levels of the Kruskal-Wallis tests for total technical efficiency, pure technical efficiency, and scale efficiency were 0.876, 0.938, and 0.861 respectively, indicating that the differences are statistically indistinguishable. Similarly, the results of Mann-Whitney in Panel B of Table 6.5 show that the difference between the two ownership group were insignificant with the respect to total technical efficiency, pure technical efficiency, and scale efficiency (the significant levels are 0.739, 0.725, and 0.841 respectively).

Table 6.6: Rank tests for efficiency scores

A: The Kruskal Wallis Test
for Efficiency Measures across the ownership groups

Mean Rank	*Overall Technical Efficiency*	*Pure Technical Efficiency*	*Scale Efficiency (%)*
Mutual	*108.34*	*108.52*	*102.98*
Quoted	*103.59*	*104.24*	*104.27*
Private	*108.22*	*105.05*	*110.28*
Chi-Square	0.265	0.129	0.300
Asymp. Sig. (2-tailed)	0.876	0.938	0.861

B: The Mann-Whitney Test for Efficiency Measures
between the mutual and the stcok owned company groups

	Overall Technical Efficiency	*Pure Technical Efficiency*	*Scale Efficiency (%)*
Mann-Whitney	*2655.5*	*2650*	*2695.5*
Wilcoxan W	*18586.5*	*18581*	*3192.5*
Z	*-0.333*	*-0.352*	*-0.201*
Asymp. Sig. (2-tailed)	0.739	0.725	0.841

All of the results in Table 6.6 confirm no significant difference across the ownership groups in terms of all efficiency measures. What is more, as Table 6.7 shows, this pattern of no difference by ultimate ownership type also holds for the input variables; risk and fees. The Mann-Whitney tests failed to support the underlying notion for the first hypothesis: risk and fee charges of funds differ between the mutual and stock owned company groups.

Table 6.7: Rank tests for input variables

A: The Mann-Whitney Test for input variables
between the mutual and the stcok owned company groups
under the overall technical efficiency model (CRS)

	Monthly return volatility	*Initial Fee*	*Annual management fee*
Mann-Whitney	*2658.5*	*2416.5*	*2536.5*
Wilcoxan W	*18589.5*	*2912.5*	*18467.5*
Z	*-0.323*	*-1.102*	*-0.716*
Asymp. Sig. (2-tailed)	0.746	0.270	0.474

B: The Mann-Whitney Test for input variables
between the mutual and the stcok owned company groups
under the pure technical efficiency model (VRS)

	Monthly return volatility	*Initial Fee*	*Annual management fee*
Mann-Whitney	*2652.5*	*2324*	*2627.5*
Wilcoxan W	*3148.5*	*18255*	*18558.5*
Z	*-0.344*	*-1.4*	*-0.424*
Asymp. Sig. (2-tailed)	0.731	0.161	0.671

6.4.3 Results from Tobit models

Table 6.8 shows the estimations of the Tobit regression models for explaining the variation of the DEA scores, in terms of mutual ownership (Model 1), fund size (Model 2) and the company characteristics such as size and their product mix (Model 3). It should be noted that, as reported in Table 6.9, the variables controlling for the fund size and company characteristics are moderately correlated to each other. Therefore, in order to avoid the multicollinearity problem, these control variable are separately added to Model 2 and 3 whilst the main variable, e.g. the mutual dummy variable was included in all of the models.

The most important and common finding across the models is that the coefficient of the mutual dummy variable is statistically insignificant. This means that there is no impact of the mutual ownership on the efficiencies of their managed unit trusts. Hence, after controlling for influential variables, no evidence was found to support the alternative hypothesis (H7). In this respect, the implication of the primary proposition seems to remain in effect.

In addition to the insignificant effect of ultimate ownership, there are a few interesting features. First and foremost, the proportion of fund size (%) in terms of the company's total asset contributes to the fund efficiencies. Shown in the third columns in Table 6.8 (a) and (b), the coefficients of the fund proportion are positive and significant ($r=10.719$, $p<0.05$ for overall technical efficiency; $r=12.325$, $p<0.01$ for pure technical efficiency). This means that a unit trust with the relatively larger asset within the management company has the benefit of efficiency.

A possible explanation for this finding comes from the flagship fund. As its name implies, the flagship fund refers to the representative fund with the large asset within the unit trust management company. Such a fund often attracts a lot of media attention because of its size and proxy nature for the company's managed unit trusts. For this reason, it can be said that aiming at superior investment performance for the fund, resulting in good publicity, management of the company allocates a lot of human and monetary resources into the fund. Moreover, the management can reduce the fund's fees in the hope of making the flagship fund more attractive. It is possible that simply because of its size management takes more care about the flagship fund than their other funds. The positive correlation between the variable of the fund proportion and the efficiency scores seems to reflect these management strategies.

The size of the individual fund seems to have a somewhat positive effect on the efficiencies of the fund. Presented in Model 2 of Table 6.8, the coefficients of the fund size variable for the total technical efficiency in Table 6.8-(a) and for the scale efficiency of in Table 6.8-(c) are 2.98, and 2.348 respectively and both are statistically significant at the 10% level. Hence, it can be said that the major source of overall technical efficiency is due to scale efficiency, which is attributable to the size of fund. One possible explanation for this is as follows. Table 6.3 presents the negative correlation between the standard deviation of monthly return e.g. risk and the size of fund (-0.219). Due to its size, the small fund may not benefit from its diversification effect as much as the larger fund does. This results in relatively higher volatility of the small fund. Other things equal, the higher risk increases the weighted sum of inputs in the DEA model, reducing the efficiency score.

Table 6.8 (a) Tobit Regression results: Dependent variable (1) Total Technical Efficiency

Dependent Variable (1) = Total Technical Efficiency	Model 1: Controlling for Mutual Ownership	Model 2a: Controlling for Mutual Ownership, Fund Size	Model 2b: Controlling for Mutual Ownership, Fund Size Proportion (%)
Intercept	68.944 (54.44)***	45.043(3.36)***	67.496 (47.0)***
Mutual Dummy	1.553 (0.47)	0.734 (0.22)	-0.136 (-0.04)
Fund Size (log)		2.980 (1.79)*	
Fund Size Proportion (%)			10.719 (2.06)**
Company Size (log)			
Number of Funds			
Number of Fund Sectors			
Herfindahl Index			
Likelihood ratio	-863.99	-862.39	-861.9
Probability>Chi^2	0.637	0.181	0.111

Dependent Variable (1) = Total Technical Efficiency	Model 3a: Controlling for Mutual Ownership, Company's Size	Model 3b: Controlling for Mutual Ownership, Number of Funds	Model 3c: Controlling for Mutual Ownership, Number of Sectors	Model 3d: Controlling for Mutual Ownership, the Product Mix
Intercept	62.571 (3.92)***	71.523 (29.74)***	73.473 (25.40)***	67.926 (39.3)***
Mutual Dummy	1.654 (0.5)	0.606 (0.18)	0.344 (0.10)	0.969 (0.29)
Fund Size (log)				
Fund Size Proportion (%)				
Company Size (log)	0.687 (0.4)			
Number of Funds		-0.122 (-1.26)		
Number of Fund Sectors			-0.353 (-1.74)*	
Herfindahl Index				0.0004 (0.86)
Likelihood ratio	-863.905	-863.2	-862.484	-863.615
Probability>Chi^2	0.826	0.406	0.199	0.617

*,**, *** significant at the 0.10, 0.05, and 0.01 level respectively.

Model 1: Efficiency score = a + b(Mutual Dummy) + e
Model 2: Efficiency score = a + b(Mutual Dummy) + c(Size Control) + e
Model 3: Efficiency score = a + b(Mutual Dummy) + c(Other Control) + e

where Mutual Dummy = 1 if the fund is managed by a mutual group otherwise 0
Size Control = (a) fund log size, (b) fund proportion within the company
Other Control = (a) company size, (b) No. of funds, (c) No. of categories (d) Product mix

Table 6.8-b (continued) Tobit Regression results: Dependent variable (2) Pure Technical Efficiency

Dependent Variable (2) = Pure Technical Efficiency	Model 1: Controlling for Mutual Ownership	Model 2a: Controlling for Mutual Ownership, Fund Size	Model 2b: Controlling for Mutual Ownership, Fund Size Proportion (%)
Intercept	84.731 (89.97)***	74.743 (7.52)***	83.087 (79.19)***
Mutual Dummy	-0.493 (-0.2)	-0.837 (-0.34)	-2.503 (-1.02)
Fund Size (log)		1.245 (1.01)	
Fund Size Proportion (%)			12.325 (3.11)***
Company Size (log)			
Number of Funds			
Number of Fund Sectors			
Herfindahl Index			
Likelihood ratio	-710.416	-709.908	-705.584
Probability>Chi^2	0.8379	0.5895	0.0078

Dependent Variable (2) = Pure Technical Efficiency	Model 3a: Controlling for Mutual Ownership, Company's Size	Model 3b: Controlling for Mutual Ownership, Number of Funds	Model 3c: Controlling for Mutual Ownership, Number of Sectors	Model 3d: Controlling for Mutual Ownership, the Product Mix
Intercept	89.106 (7.5)***	85.915 (47.98)***	87.617 (40.49)***	82.594 (64.73)***
Mutual Dummy	-0.565 (-0.23)	-0.938 (-0.38)	-1.283 (-0.52)	-1.786 (-0.73)
Fund Size (log)				
Fund Size Proportion (%)				
Company Size (log)	-0.471 (-0.37)			
Number of Funds		-0.056 (-0.78)		
Number of Fund Sectors			-0.225 (-1.49)	
Herfindahl Index				0.0010 (2.39)**
Likelihood ratio	-710.35	-710.113	-709.313	-707.54
Probability>Chi^2	0.9148	0.7235	0.3252	0.0552

*,**, *** significant at the 0.10, 0.05, and 0.01 level respectively.

Model 1: Efficiency score = a + b(Mutual Dummy) + e
Model 2: Efficiency score = a + b(Mutual Dummy) + c(Size Control) + e
Model 3: Efficiency score = a + b(Mutual Dummy) + c(Other Control) + e

where Mutual Dummy = 1 if the fund is managed by a mutual group otherwise 0
Size Control = (a) fund log size, (b) fund proportion within the company
Other Control = (a) company size, (b) No. of funds, (c) No. of categories (d) Product mix

Table 6.8-c (continued) Tobit Regression results: Dependent variable (3) Scale Efficiency

Dependent Variable (3) = Scale Efficiency	Model 1: Controlling for Mutual Ownership	Model 2a: Controlling for Mutual Ownership, Fund Size	Model 2b: Controlling for Mutual Ownership, Fund Size Proportion (%)
Intercept	81.825 (79.08)***	62.99 (5.76)***	81.254 (68.67)***
Mutual Dummy	1.960 (0.73)	1.311 (0.49)	1.294 (0.47)
Fund Size (log)		2.348 (1.73)*	
Fund Size Proportion (%)			4.229 (0.98)
Company Size (log)			
Number of Funds			
Number of Fund Sectors			
Herfindahl Index			
Likelihood ratio	103.369	104.858	103.853
Probability>Chi^2	0.4657	0.1729	0.4724

Dependent Variable (3) = Scale Efficiency	Model 3a: Controlling for Mutual Ownership, Company's Size	Model 3b: Controlling for Mutual Ownership, Number of Funds	Model 3c: Controlling for Mutual Ownership, Number of Sectors	Model 3d: Controlling for Mutual Ownership, the Product Mix
Intercept	73.614 (5.65)***	84.044 (42.8)***	85.123 (35.96)***	81.934 (57.88)***
Mutual Dummy	2.09 (0.78)	1.147 (0.42)	1.081(0.40)	2.023 (0.74)
Fund Size (log)				
Fund Size Proportion (%)				
Company Size (log)	0.885 (0.63)			
Number of Funds		-0.105 (-1.33)		
Number of Fund Sectors			-0.257 (-1.55)	
Herfindahl Index				0 (-0.11)
Likelihood ratio	103.568	104.247	104.56	103.375
Probability>Chi^2	0.6278	0.3185	0.2328	0.7614

*,**, *** significant at the 0.10, 0.05, and 0.01 level respectively.

Model 1: Efficiency score = a + b(Mutual Dummy) + e

Model 2: Efficiency score = a + b(Mutual Dummy) + c(Size Control) + e

Model 3: Efficiency score = a + b(Mutual Dummy) + c(Other Control) + e

where Mutual Dummy = 1 if the fund is managed by a mutual group otherwise 0

Size Control = (a) fund log size, (b) fund proportion within the company

Other Control = (a) company size, (b) No. of funds, (c) No. of categories (d) Product mix

Table 6.9 Correlation matrix for efficiency scores and other control variables
(CSCORE= Overall Technical Efficiency, VSCORE= Pure Technical Efficiency, and SCALE= Scale Efficiency)

Correlations

		H-Index	SECTORS	FUNDS	Log_Fund_size	Log_Company_Asset	Proportion in the group	CSCORE	VSCORE	SCALE
H-Index	Pearson Correlation	1.000	-.683**	-.621**	-.122	-.614**	.824**	.073	.156*	.009
	Sig. (2-tailed)	.	.000	.000	.078	.000	.000	.291	.024	.895
	N	209	209	209	209	209	209	209	209	209
SECTORS	Pearson Correlation	-.683**	1.000	.901**	.236**	.777**	-.599**	-.127	-.101	-.116
	Sig. (2-tailed)	.000	.	.000	.001	.000	.000	.068	.147	.095
	N	209	209	209	209	209	209	209	209	209
FUNDS	Pearson Correlation	-.621**	.901**	1.000	.225**	.775**	-.534**	-.096	-.061	-.104
	Sig. (2-tailed)	.000	.000	.	.001	.000	.000	.165	.382	.133
	N	209	209	209	209	209	209	209	209	209
Log_Fund_size	Pearson Correlation	-.122	.236**	.225**	1.000	.585**	.261**	.126	.074	.124
	Sig. (2-tailed)	.078	.001	.001	.	.000	.000	.070	.287	.073
	N	209	209	209	209	209	209	209	209	209
Log_Company_Asset	Pearson Correlation	-.614**	.777**	.775**	.585**	1.000	-.451**	.022	-.025	.038
	Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.757	.720	.589
	N	209	209	209	209	209	209	209	209	209
Proportion in the group	Pearson Correlation	.824**	-.599**	-.534**	.261**	-.451**	1.000	.151*	.205**	.083
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.029	.003	.230
	N	209	209	209	209	209	209	209	209	209
CSCORE	Pearson Correlation	.073	-.127	-.096	.126	.022	.151*	1.000	.777**	.872**
	Sig. (2-tailed)	.291	.068	.165	.070	.757	.029	.	.000	.000
	N	209	209	209	209	209	209	209	209	209
VSCORE	Pearson Correlation	.156*	-.101	-.061	.074	-.025	.205**	.777**	1.000	.378**
	Sig. (2-tailed)	.024	.147	.382	.287	.720	.003	.000	.	.000
	N	209	209	209	209	209	209	209	209	209
SCALE	Pearson Correlation	.009	-.116	-.104	.124	.038	.083	.872**	.378**	1.000
	Sig. (2-tailed)	.895	.095	.133	.073	.589	.230	.000	.000	.
	N	209	209	209	209	209	209	209	209	209

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

6.5 Chapter Summary

This chapter has shown that differences of fund performance between the mutual and stock ownership companies are much less pronounced than the agency theoretic hypothesis supposed. Under the efficient market hypothesis, the implication is that there is no difference of risk and fee adjusted performance by type of the company's ultimate ownership (H 6).

The alternative hypothesis (H7) contrasts with the implication of hypothesis (H6). By emphasising the different managerial mechanisms are rooted in the ownership forms, the hypothesis expects some performance discrepancies of fund performance between the mutual and proprietary ownership companies. The logic is that risk taking and fees of their unit trusts differ due to conflict of interest between policyholders or account holders and owners of these companies.

The results revealed that risk-taking and fee setting are indistinguishable. Moreover, the DEA performance measure where return, risk and fees are considered simultaneously showed no significant differences by type of the company's ultimate ownership. After controlling for various fund and company factors, the results did not change. Hence, the finding can be possibly interpreted as evidence against the alternative hypothesis (H7), and seemingly in favour of the implication of hypothesis (H6).

Overall, the results of the chapter comes up with some support for the efficient market hypothesis. More interesting, with regard to the risk-taking and fee setting issues, ownership is irrelevant. It seems to be the case that the degree of competition is more powerful than organisational form in terms of influencing companies' strategy (Drake and Llewellyn, 2001) The next chapter conclusively addresses this point of view further by reviewing a few recent papers.

Chapter VII: Conclusions

7.1 Introduction

Building on the insights of agency theory, the central proposition of this thesis is that ultimate organisational form is an important factor within the U.K unit trust industry. To test out the proposition, the thesis has investigated the relationship between ultimate organisational form and (i) risk-taking, and (ii) efficiency at the company level, and (iii) performance at the product level.

A study of the U.K unit trust industry is valuable for two reasons. Firstly, most of the agency literature has limited itself to studying either the insurance or the banking industries and solely within the U.S. A minimal amount of research has so far emanated from financial industries in the U.K (Armitage and Kirk, 1994; Genetay, 1999; Letza et al, 2001; and O'Sullivan and Diacon, 1999 and 2003). Following the line of investigation, this is the first comprehensive study on the subject of U.K unit trust companies. Secondly, there has been a large number of studies of individual funds. Until recently, however, the study on the fund management company has been strangely neglected by academic researches. Arguably this is an oversight given the fact that the fund management companies play an important role in the economy particularly as the fund management industry experienced spectacular growth in the last decade.

There are several advantages to study the U.K unit trust industry. In the first place, ultimate organisational form varies in the industry. Some unit trust management companies are ultimately owned by mutual organisations whereas others are owned by proprietary companies i.e. publicly and privately owned companies. A unit trust management company is required by law to be a corporate body, irrespective of the company' ultimate organisational form. In addition to the legal requirement, the unit trust company is not permitted to conduct any other type of business except unit trust business[1]. On these grounds, it is safe to assume that regulatory, taxation and business character are homogeneous in the industry. Hence, these legal criteria make it more valid to compare risk-taking and efficiency across the sample companies. Finally, basic frameworks of risk and performance management are relatively well-established in the fund management literature. Various forms of information can be obtained both at the corporate and product levels.

7.2 Conclusion about the risk-taking activities

Chapter IV examined whether the issue of ultimate ownership is of importance in relation to business activities at the corporate level. Based on the company's product mix consisting of a number of unit trusts with various investment objectives, the managerial decision indicators are defined in three ways; business specialisation, business concentration and the magnitude of risk-taking activities. The main reason for the multiple indication approach is that a single measure can not be representative of the company's managerial decision making as a whole.

[1] The Financial Service Act 1986, section 78 (3).

Consistent with the Mayers and Smith approach (1988), the second measure is a preliminary one, which asks whether companies with different organisational forms operate on a different product mix. The first and third measures attempt to capture the different risk-taking choices by ultimate ownership type.

7.2.1 Choice of high and low risky sectors

The first risk-taking analysis started to split the unit trust sectors into high and low risk sectors based on (i) return volatility and (ii) money flow volatility for each sector. The proportion of unit trusts with the high risk within the company is subsequently compared by ultimate ownership type. Overall, the analysis reported mixed evidence that stock owned company groups are associated with relatively more risky activities than the mutual owned counterparts (H1). The reason is that the findings are subject to the basis for the high and low risk sectors. On the one hand, there is weak evidence to support hypothesis (H1) in using the monthly return volatility. On the other hand, stock owned company groups, e.g. listed companies and privately owned companies, have more unit trusts categorised into the high risk sectors where money flow from unit holders is relatively unstable.

Following the approach of Schrand and Unal (1998), who made a distinction between interest-rate risk and credit risk for their thrift study, it can be said that stock owned company groups take more business risk than the mutual ownership group whereas no difference is present by the ownership group in terms of the market risk.

The result of the current analysis is in concordance with the findings of the U.S savings and loans (S&L's or thrifts) industry studied by Esty (1997a and b) and the U.S property-liability insurance industry studied by Lamm-Tennt and Starks (1993). To the extent that the risk activity choice differs by ownership group in terms of money flow volatility, such an agreement is interesting because the present study and the U.S studies differ in respect of the industries and countries that they analyse. In addition to the agreement on the risk-taking choice, these research works roughly coincide in terms of the development of the risk measure. The common focus of the U.S studies is on cash flow in order to create a risk proxy for each company. Similarly, the current thesis classifies the various fund sectors on the basis of cash flow, which is affected by unit holders' new purchases and redemptions.

7.2.2 Business specialisation

The analysis of the business specialisation indicated that the unit trust companies with different ultimate ownership display particular preferences for investment objectives within the category of unit trusts. The finding is consistent with earlier studies of the U.S property-liability insurance (Mayers and Smith, 1988 and Lamm-Tannant and Starks, 1993) and of the U.S health insurance study (Pottier and Sommer, 1997). The agreement among these studies leads to two indications. From a theoretical perspective, the managerial discretion hypothesis seems to account for the finding, predicting that companies with distinctive organisational form are sorted into specific market segments where they have comparative advantages. From a literature perspective, the analysis of business specialisation in this thesis offers a useful contribution to the literature, serving as an out-of-sample test. It is clear that the tendency of business specialisation reported here is neither industry nor country specific.

7.2.3 Business concentration

The business concentration analysis with the Herfindahl index finds the difference between the quoted and non-quoted company ownership groups, partially supporting the primary hypothesis that stock owned companies exhibit relatively high-risk preferences in comparison to their the mutual counterparts. The degree of concentration differs between the market listed and the non-listed company groups in terms of the Herfindahl index, based on the number of unit trusts per company. Similarly but slightly less significantly, such a difference holds in terms of the Herfindahl index based on the number of funds' investment objectives within the company.

In light of the managerial discretion hypothesis, it is not surprising to see the quoted company group having a more diversified product mix. The explanation based on the managerial discretion hypothesis is that listed companies are associated with diversification that requires greater managerial autonomy. On the contrary, by managing the concentrated product mix, mutual organisations can limit managerial discretion, which is more costly for the mutual institutions than for the stock owned companies.

However, on examination of existing empirical works, it appears that the result of Chapter IV is inconsistent with the findings of the previous literature. Mayers and Smith (1988) found that the mutual insurers appeared slightly more diversified than the stock insurers in the U.S property-liability insurance market. In a similar vein, no linkage was found between ownership form and the line of business concentration in the U.S life-health insurance industry (Pottier and Sommer, 1997).

The discrepancy between the result of Chapter IV and the findings of previous studies can be explained by the methodological differences. For example, comparing the degree of business concentration, Mayers and Smith (1988) employed analysis of variance whilst this thesis used Tobit regression model. Another example is that the Pottier and Sommer's study (1997) included not only the size, but also age, credit rating and location of the company as their controlling variables. In contrast, the corresponding analysis in Chapter IV takes into account the potential size effect, leaving aside the other controlling factors because of the limited data availability.

7.2.4 Discussion

Other than the quoted company's tendency toward the more diversified product mix, there is an indistinguishable pattern between the mutual and privately owned company groups in terms of the business concentration. This gives rise to the question why the business concentration differs between the quoted and non-quoted company groups. More precisely, why does the quoted company group prefer the more diversified product mix?

The findings appear to contradict the primary proposition that stock owned companies are more associated with higher risk-taking activities. The underlying logic of this view is that *"diversification is designed to reduce risk"* (Milgron and Roberts, 1992, p 598). That is, all else being equal, the more diversification a company pursues, the less risky the company's business becomes.

There are two possible reasons for the preference for the more diversified product mix of the quoted company group. The first and most general reason is the choice of corporate strategy, derived from the difference between the market listed and non-market listed companies with regard to the access to capital markets. Despite the fact that effects of economies of scale are not substantial (Chapter III), the relatively large size in terms of the asset under management (Table 4.2) and the capital employed (Table 5.1) can provide the quoted company group with competitive advantages. No other class of organisational form can attain the scale of operation that large public listed companies can achieve. Hence, taking advantage of easy access to financing, the listed company secures their competitive advantage by offering a broad range of products. On the other hand, it may be necessary for non-listed companies e.g privately and mutual owned groups, to choose a niche strategy because of their financial constraints.

The next possible reason is that diversification effect is specific to each industry or subject to the definition of the diversification and its effect. In the context of the fund management industry, this may mean that a diversification strategy which offers a wide range of fund products may not necessarily reduce risk. A recent study by Massa (2003) seems to validate the above remark. Massa reveals that funds belonging to companies that offer more funds tend to have less stable investors as investors tend to move money from one fund to another, taking advantage of the low switching costs. This results in less stability of money flows, which increases the company's risk. Moreover, such unstable money flows are likely to require the higher managerial discretion. If this is the case, the finding of the diversified product set of the quoted company group supports the Mayers and Smith prediction that quoted companies are successful in business where a greater managerial discretion is needed.

The implication is that care should be taken to make a conclusion by applying the conventional risk proxy such as the business concentration ratio. It is, therefore, necessary to check the validity from the industry-specific perspective. In a similar vein, it may also be dangerous to rely on a single risk measure. In this sense, an approach from multiple risk dimensions is essential in analysing the risk-taking activities of a company.

7.3 Conclusion about efficiency

7.3.1 Methods and findings

The objective of Chapter V is to examine the relationship between performance and ultimate organisational form for a sample of unit trust management companies in the U.K. In developing the performance measure for the investigation, two methodological difficulties are described. First of all, many studies of publicly traded companies emphasise a company's stock return as the primary performance of the companies. Nonetheless, no unit trust management company in the U.K is traded in stock exchanges so that the stock price is simply not available. Secondly and more challenging, the financial data for these companies is limited in the sense that belonging to the large parent companies, the unit trust management companies take advantage of limited disclosure requirement. A further complication of such companies' financial statements occurs due to the possible transfer pricing between the unit trust company and their affiliated companies within the group and for this reason standard financial ratios are not reliable. To overcome these problems, Chapter V considers efficiency as the performance of the unit trust management company. One justification is that the primary goal of mutual organisations could differ from that of stock companies. Arguably, the mutual organisation aims at providing lower-cost mortgages or insurance policies to their members whereas the comparable stock company may be more concerned with maximising their own profit (Swiss Re, 1999). If this is the case, an efficiency ratio based on revenue and cost is more suitable than the conventional profitability measures such as return on equity in comparing the mutual organisation and stock company. To this end, the current thesis employs Data Envelopment Analysis (DEA) to generates the efficiency score for each unit trust management company on the basis of carefully selected items from the financial statement.

Overall evidence suggests that the mutual ownership group is less efficient than the proprietary rivals in the unit trust industry. Notably, the inefficiency of the mutual ownership group is attributable to its high administration expenses, indicating the weaker cost control mechanism in the mutual ownership group. The results support the prediction from agency theory, specifically the expense preference hypothesis (for instance, see Rasmusen, 1988). What is more, the results are consistent with those of earlier empirical researches such as Masulis (1987) and Hermalin and Wallace (1994) who studied the U.S S&L's; Cummins et al (1999) who investigated the U.S property-liability insurers.

7.3.2 Considerations

Comparison to previous researches

In addition to these U.S studies, a recent study (Genetay, 1999) about U.K life insurance companies presented a similar finding in that the mutual insurers display lower return on total assets than the proprietary insurers. Nonetheless, it should be noted that as for the expense ratio, the Genetay study presented scant support for the expense preference hypothesis because the expense ratio was not significantly related to form of the insurer's ownership. Such an inconsistency between the findings of the present analysis and those of the early literature is not surprising because several studies have presented contradictory evidence. For example, according to Cebenoyan et al (1993), the cost structure and the operating efficiency are indistinguishable between the mutual and the proprietary S&L's. Similarly, Caudill et al (2001) found that the mutual S&L's exhibit cost efficiency in comparison with the proprietary counterparts.

As for other U.K examples, Armitage and Kirk (1994) presented evidence that on average, the mutual life insurers demonstrate higher pay-out, lower cost ratio, and a greater growth rate than their proprietary rivals. Letza et al (2001) found that the mutual life insurers outperformed their proprietary insurers in terms of the year-end surplus, and annual investment income. More recently, O'Sullivan and Diacon (2003) presents evidence that there is no significant difference between the mutual and stock owned companies with regard to four performance measures[2], (i) the annual percentage change in the company's life fund; (ii) the annual percentage change in the market value of total investment; (iii) the annual percentage change in total direct premiums written; (iv) the volume of new business sales in a particular year.

It follows from these discrepancies that the different performance measure or different computation framework are likely to influence the estimation of a company's efficiency. The typical contrast for this point is that: Chapter V and Cummins et (1999) employ the DEA whereas Cebenoyan et al (1993) and Cardill et al (2001) used a stochastic cost frontier method. In essence, the critical issue in selecting the estimation model is whether the cost or production function is known. Moreover, the choice is subject to the data availability.

In Chapter V, it is assumed that the cost function is unknown mainly because the literature has paid little attention to the cost function in the U.K unit trust industry. Another justification for the DEA approach is the limited and complex disclosure practice of the sample companies' financial statements. On these grounds, the findings of Chapter V still have validity of the model selection, providing valuable additions to the evidence for the effect of organisational form.

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[2] There is the fifth measure of performance defined by the salary of the highest-paid director. The authors find that this proxy is significant greater in the case of proprietary companies.

The quoted versus non-quoted company ownership

As for the argument on the quoted versus non-quoted company ownership, the finding was contrary to the hypothesis that market listed companies operate their business more efficiently than their non-listed counterparts. Of greater interest is the fact that an additional analysis revealed no significant differences between the quoted company and the private company owned groups. Three possible explanations can be made for these observations. Firstly, along with the hypothesis assumption, the market for corporate control may not be sufficient enough to differentiate efficiency between the listed company and the private company. Secondly and as an extension of the first point, the effect of the market for corporate control may not be monotonic, but more complex as Mudambi and Nicosia (1998) argued. If this is the case, a simple comparison between the listed and the privately owned companies is not adequate. Finally, in a view similar to O'Sullivan and Diacon (2003) that mutuals have stronger broad governance as a substitute for external governance mechanisms, non-quoted company groups have their unique internal disciplinary forces acting on their managers in the same way to control comparable managers in public listed companies. For instance, as viewed in the Fama and Jensen's hypothesis (1983), the closeness between decision management and decision control can be a good source of management control when privately owned companies run their unit trust business.

Hence, the observation of the insignificant difference between the quoted company ownership and private company ownership offers a useful contribution to the literature on the impact of the market for corporate control.

7.4 Conclusion about fund performance

The final chapter continues the line of enquiry on the effect of ultimate ownership form. However, what differs from Chapter VI and the preceding two chapters is that Chapter VI explores the linkage between ultimate ownership and performance of products of the sample companies. Viewed from agency theory, the product analysis is interesting because the analysis can capture the conflict of interests between owners and customers as Mayers and Smith (1986) suggested. In more general term, if ultimate ownership of a unit trust management company is related to the ability to provide superior performance via its incentive or managerial mechanism, the type of ultimate ownership should be a factor in explaining the performance of individual unit trusts. Furthermore, the performance analysis of individual unit trusts is essential in a sense that a study like Chapter V is incomplete without considering the quality of products that the company offers. The underlying assumption is that higher quality products require higher costs.

7.4.1 Methods and findings

In evaluating performance of unit trusts, a number of conventional measurers are available. It is essential from the viewpoint of owner-customer conflict that the performance measure must incorporate three components into the measurement framework. These components are risk, return and fees of an individual unit trust. In order to consider the three factors simultaneously, DEA is employed in a similar manner to Chapter V.

The results of Chapter VI suggest that there are no significant differences in terms of the DEA performance measure across the different ownership groups. The results hold after controlling for various influential factors such as the size of the unit trust and the company's total asset. Consequently, there is no compelling reason to believe that the performance of individual unit trusts is dependent either on the management company's ownership or on the size of the unit trust management company.

7.4.2 Implications of Chapter VI for theory

The above findings above have important implications for the agency theory literature and for the financial market literature. Agency theory argues that managers at mutuals are typically not as motivated as their proprietary counterparts (Rasmusen, 1988) because different incentive schemes or weak monitoring by owners. As a consequence, unit trusts offered by the mutual groups should be characterised by poor performance. More generally, it is also argued that performance of unit trusts differs according to ultimate ownership form, reflecting comparative advantages or disadvantages associated with the ultimate ownership form.

Implications for agency theory

Two indications can be found for explaining the findings that contradict agent theory. Firstly, at the individual portfolio manager level, there are some common incentive or remuneration schemes regardless of their company's ownership form. In other words, a variation on the incentive practice is practically trivial across the fund management industry. An extreme but convincing indication for such a common incentive to portfolio managers is the threat of losing their job (something which is documented by Khorana, 1996). Given the ultimate incentive effect, it is in the portfolio manager's best interest to work hard. A second possible explanation is that the performance linked remuneration scheme may be in place at the level of individual portfolio managers. Whilst competing with their rival companies for good portfolio managers, most of the unit trust management companies are likely to offer the performance based reward system in order to employ and retain good portfolio managers. The similar remuneration package across the industry may not lead to performance differences at the individual unit trust level. Certainly, in order to verify the latter argument, obtaining the information about the reward is of paramount importance. However, the data regarding the remuneration scheme is the most secretive information and difficult to obtain. Therefore, further studies could explore this line of enquiry by collecting the salary and incentive data from practitioners.

Implication for financial theory

As for the financial market theory, the major strand of the literature pursues the question of whether unit trusts can beat the market. In this connection, the efficient market hypothesis is supported by the finding that there is no linkage between ultimate ownership and unit trust's performance of the company.

To some extent, Chapter VI departs from the "beat the market" literature by focusing on the company ownership as a key factor for the performance of their individual unit trusts. As summarised in Chapter II and VI, there are several attempts to identify effects associated with superior performance. For example, two studies (Golec, 1996; Chevalier and Ellison, 1999) found that a fund manager's educational background has an impact on their managed funds. Other researchers examined this issue from the standpoint of; manager's gender, (Bliss and Potter, 2002) and Atkinson et al (2003); fund management by team (Prather and Middleton, 2002) and banking group ownership (Frey 2001). The latter studies found no significant relationship between performance and these variables. In light of this, the principal finding of Chapter VI compliments the line of research by highlighting that no relationship exists between ownership and fund performance of the unit trust management company.

This topic is one of the research areas not covered in the financial literature until very recently (Berkowitz and Qiu, 2003). The result of Chapter VI is inconsistent with Berkowit and Qiu's study as the result of Chapter VI showed that the risk adjusted return of mutual funds run by the quoted companies does not differ from that run by the privately owned companies. As counter-evidence to Berkowits and Qiu's study, Chapter VI makes a useful contribution to our understanding of the ownership effect on the investment product.

7.5 Limitation and future research

7.5.1 Limitation

This thesis considers just one-year period, e.g. year 2000, after the wave of mutuals' conversions occurred in the half of the 1990s. This is partly because only one demutaulisation occurred in the year, providing the "stable" sample in terms of the category of ultimate organisational form. Another reason is that the limited data does not allow an investigation by the panel-study that are similar to the cross-sectional design with multiple points in time.

However, the one-year cross-sectional approach is a concern for this thesis in two respects. Firstly, the results from the cross-sectional analysis may not generalised to other time periods because the results may be influenced by year-specific factors. In short, there is a possible sample period bias. One counter argument to this limitation is that focusing on a very short time period can allow for more homogeneity in the market conditions changed significantly in 1990's.

The second potential shortcoming involves a potential time-lag effect after the change of organisational form. The one-year approach implicitly assumes that the changes of ownership form occur immediately after the demutualisation. However, changes in efficiency of the unit trust management companies and shifts in performance of their managed unit trusts may not be observed instantly after the organisational changes because the converted companies need some time to adjust themselves to the market listed companies. The analysis with the snap-shot in time is unlikely to capture the potential time-lag effects for the converted mutual groups. Nonetheless, one possible counter-argument is that there are only 11 ex-mutual groups out of 118 stock owned companies. More specifically, two of the converted companies were demutualised before 1995 and the rest of them were demutaulised after 1995. Therefore, it can be assumed that the impact of these ex-mutual groups within the stock group is marginal.

There is another possible limitation of this thesis with regard to the unit holder segmentation. It is important to note that behaviour of certain unit holders, e.g. wealthy individuals, institutional investors, and in-house insurance investors, may be different from that of retail unit holders. If this is the case, the mixture of the customer segments is likely to affect the corporate profitability or efficiency. For exmple, a large number of small retail accounts incurs higher administration costs than a small number of institute accounts. On the other hand, institutional investors have more negotiating power over the initial and management fees whereas the retail investors are not in the position to negotiate the fees. Such a potential effect of the unit holder segmentation is an interesting topic, but this thesis did not pursue this line of inquiry. This is due to the fact that the data is not in a public domain or easily assessable with regard to a type of the existing unit holders in the unit trust management companies.

Related to the above data limitation, this study implicitly assumes that unit holders of unit trusts run by the mutual groups are accountholders or policyholders of the mutual groups. However, the assumption seems to be sensible because of the cross-selling practice in many financial services in the U.K.

The cross-selling refers to promoting additional products and services to the existing customer base. The logic behind the cross-selling is that if longer term customers are satisfied with the company and the company has what the customers want, they will buy more or buy different products from the same financial service providers (Harrison, 2000, p.231).

Traditionally, working as the tied agents of insurance companies, most banks and building societies have offered insurance products and become "*bancassurers*" referred to as organisations that sell insurance products through banking branch networks (Stephens, 2001, p338). A more recent example is that the lenders established their own insurance and investment subsidiaries. These subsidiaries have been used for promoting a range of long term saving products such as unit trusts and Individual Savings Account (ISA) to their entire customer base. These products are distributed via branch networks or their own sales forces.

Certainly, future researchers can pursue these research options. In spite of the these limitations, it is still believed that the results at least reveal interesting links between ultimate organisational form and risky activities and the efficiency of the unit trust management companies. At the product level, the results show no relationship between the company's ultimate organisational form and the performance of unit trusts

7.5.2 Future research

Given the above limitations, future research can be developed in several different ways. The first and most general question to be addressed in future research is whether the results of this thesis hold in other countries. For this purpose, future research can expand the data collection beyond the U.K.

Additional future research could compensate for the drawback of the snap-shot approach used in this thesis. That is, more data collection using a longitudinal approach can allow for the event-study. The general applicability of the event study methodology in finance literature is the effect of an event such as mergers and acquisitions, and earnings announcements on the price of common stocks of the company. However, applications in other fields of studies are possible. For example, Campbell et al (1999) point out that event studies are of use in evaluating the impact on he value of a company of a change in the regulatory environment.

One potential applications of such a longitudinal approach is the evaluation of ex-mutual's efficiency or fund performance over the 3 to 5 year period prior to and following demutualisations. By comparing the pre-post conversion values for their fund performance or the company efficiency score, it is possible to examine whether there has been significant improvement in the fund performance and in the management efficiency. This type of a event study gives insight into the progression of the demutualisation process, reflecting the effect of the ownership change.

Finally, as Stephens (2001) suggests in his case studies with regard to the U.K building societies, survey and interview to the demutualised groups could help compliment the quantitative data, providing a more qualitative assessment on the effect of organisational change.

7.6 Concluding remark

Chapter IV and V reported evidence that at the corporate level, there are differences of risk and performance between the mutual and proprietary ownership companies. By contrast, an empirical analysis in Chapter VI provided no evidence of the ownership effect on performance of their managed unit trusts. Therefore, as the concluding remark, this research indicates that *competition rather than governance mechanisms associated with ultimate ownership, disciplines managers in the unit trust management companies in the U.K.*

The concluding remark is consistent with the general consensus that the product market competition leads to higher economic performance (OECD, 2002)[3]. In a similar context it is argued that product market competition acts to align managers' goals with those of the owners (Nickell et al 1997; OECD 2002; Köke, 2002, and Januszewsk et al 2002). Within the context of this thesis, the degree of competition in a market seems to be more important than organisational or corporate forms in terms of influencing a firm's objectives and strategy (Llewellyn, 1997)

The underlying mechanisms for improving performance are twofold. Firstly, as the number of products increases, greater opportunities for the product comparison emerge, enhancing managerial incentives. Consequently, it is easier for the shareholders or the market to monitor managers in such a competitive environment. Secondly, fierce competition will raise the possibility of business

[3] Economic Outlook No 72 OECD, 2002

failure at any given level of managerial efforts. Hence, management will have to work harder to avoid bankruptcy.

From an empirical perspective, several recent studies support the positive effect of product competition on corporate performance. For example, using a panel data of 580 UK manufacturing companies, Nickell et al (1997) found a positive relationship between the degree of competition[4] and sales growth.

As for the unit trust industry, the practice of performance comparison in the industry provides some validity for the two explanations above. A variety of tools such as financial websites, magazines and newspaper articles conduct fund performance comparisons, leading to the sharpening of managerial incentives. In short, this thesis provides further evidence for the positive role of the product market competition on managerial behaviour at their product management level.

One question may arise from an implication of the concluding remark. If the product competition is fierce enough to discipline managers irrespective of their company's organisational form, then, such an organisational from is only of second importance.

The answer to the question is that ultimate organisational form is still of consequence given the findings across the empirical analyses in this thesis. The analysis of corporate efficiency in Chapter V uncovered the relative inefficiency of mutual owned unit trust companies in comparison with those owned by stock

[4] The magnitude of competition is measured by the size of price-cost margins.

companies. Moreover, the relative inefficiency of the mutual group companies can be hardly justified either by their product mix (Chapter IV) or by their product performance (Chapter VI).

Viewed in the realm of agency theory in Chapter II, such a difference could be a reflection of different forms of corporate governance. The idea above leads to the conclusion that due to their weak corporate governance mechanisms, mutual ownership systematically induces such inefficiency at their subsidiary level. In particular, the present research suggests that mutual organisations are inefficient with respect to administrative costs and to a lesser degree the use of capital employed. Although the lack of market-based governance may be used to explain their failings, O'Sullivan and Diacon (2003) suggest that the board of directors act as a substitute for the external discipline mechanisms within mutual institutions. The present thesis suggests however that if this is the case, this form of internal governance force is ineffective in managing their affiliated unit trust companies.

In summary, evidence from this thesis suggests that ultimate organisational form or ownership seems to play some disciplinary roles at the corporate level whereas the product market competition fulfils a governance mechanism at the product level.

The final and more serious issue emerges from the finding that given the higher administration expenses, mutual organisations appear to need more financial resources in providing competitive products in the unit trust industry. In line with the finding, it can be said that if such a resource hungry characteristic of mutual organisations remains for a prolonged period, eventually, the mutual group will fail financially (Hermalin and Wallance, 1994). This concluding view is welcomed by the pro-demutualisation side and unpleasant for supporters of mutual organisations.

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Appendix

Appendix 1: Company Data Set for DEA (Type:0=mutual, 1=listed, 2=private. 3=others)

Company Name	type	Net Revenues	Admin costs	Cap Employed
Tesco	1 -	12,000	752,000	1.647,000
Arbuthnot	1	12,503	12,087	36,116
Burrage	1	51,132	21,185	127,432
Belvin Frank	2	62505	100955	325,585
Saracen	2	76,683	75,750	14,411
Gresham	2	91,000.00	25,000.00	630.500
MPFS	0	92,358	112,375	49,833
McHattie	2	92,972	76,207	119,964
Maldon	2	136,614	136,395	75,302
Homeowner	0	170,984	204,016	639,544
Discretionary	3	225,675	103,352	244,905
Consistent	3	234,358	187,017	596,562
Lombard Odier	3	234,958	174,800	3,994,336
Saltire	2	236,101	97,556	253,082
Mayflower	1	238,014	242,918	104,370
Endurance	2	345,024	326,121	180,745
Leggmason (Johnson Fry)	1	452,000	560,000	2,003,000
MW Joint	2	452,095	392,019	218,796
MGM	0	471,067	646,908	521,037
Mirabaud	2	489,091	429,387	225,530
T Bailey	2	574,000	553,000	100,500
Liverpool	0	600,000	2,021,000	1,912,000
ACM	1	706,298	854,716	2,233,890
Taube	2	770,658	329,660	949,674
Fleming Unit (JP Morgan Fleming Fund)	2	777,333	816,000	1,821,000
Police Mutual	0	812,000	564,000	822,500
Allchurch	0	946,012	595,676	1.127.530
Duncan Lawne	1	961,232	208,257	180,294
GA	1	982,000	495,000	5,393,000
Thesis (Thomas Eggar)	2	1,043,436	1,043,436	88,398
New Street	1	1,120,139	750,111	394,648
MT General	2	1,169,890	1,058,666	238,087
Aberforth	3	1,229,337	966,126	142,133
Wesleyan	0	1,246,909	1,184,670	1,116,018
Sanwa	1	1,322,973	1,342,379	207,567
Direct Line	1	1,332,000	1,695,200	1,342,000
State Street	1	1,393,125	1,342,569	520,674
KBL	1	1,465,524	534,287	774,722
Premier	1	1,479,000	744,000	2,277,000
Bank of Ireland	1	1,614,376	1,469,805	1,459,712
Eagle Star	1	1,763,000	5,074,000	17.957,000
Hargreaves	2	1,860,162	1,833,666	638,657
Family	0	1,876,940	1,672,242	607.255
TU	3	1,940,476	1,920,190	1.361,180
Marlborough	2	1,949,248	1,883,456	275,046
Norwich Union	1	2,010,000	14,430,000	7,280,500
NUF	0	2,157,849	1,904,137	1,815,445
City Financial Managers	2	2,378,706	1,246,209	558,269
Thornhill	2	2,545,979	906,881	125.575
Sand Aire	2	2,690,000	2,070,000	1.289.500
Reliance	0	2,761,706	2,095,763	187,028
Sarasin	3	2,815,357	2,560,900	922.499
Close	1	2,886,624	3,081,276	1.765.394
GAM	2	2,957,784.00	2,880,000.00	1.708,391
AXA	1	3,302,579	2,633,062	11.717.028

Appendix 1: Company Data Set for DEA (Type:0=mutual, 1=listed, 2=private, 3=others)

Company Name	type	Net Revenues	Admin costs	Cap Employed
Artemis	3	3,512,685	3,301,407	925,854
United	1	3,537,000	3,597,000	4,063,500
NPI	1	3,570,920	1,629,207	4,453,808
Lincoln	1	3,604,000	2,224,000	2,118,500
Quilter	1	3,607,062	2,822,458	1,332,641
BWD	1	3,809,518	3,022,965	1,485,487
Royal Bank of Scotland	1	4,258,000	2,490,000	7,883,500
Manek	2	4,554,604	2,218,946	3,071,469
Portfolio	1	4,595,000	4,733,000	7,863,000
Singer & Friedlander	1	4,943,011	3,320,072	1,477,192
Martin Currie	2	5,275,815	5,201,838	2,267,445
Rathborne	1	5,382,748	4,825,918	1,376,051
Sovereign	0	5,459,107	5,331,730	3,633,739
Colonial First State	1	5,560,666.67	4,589,333.33	2,101,000
FPFM (Fleming Private F)	2	5,611,299	2,789,000	623,590
Alliance & Leicester	1	6,051,000	1,634,000	6,348,500
Liontrust	1	6,456,000	4,203,000	2,262,000
Edingburgh	1	6,720,159	5,578,029	5,360,659
AIB_JGovett	1	6,835,498	5,626,879	1,984,757
Smith & Williamson	2	7,209,652	6,975,967	1,317,275
Exeter	1	7,517,506	5,683,872	2,099,566
Scot Amicable	1	7,869,000	7,437,000	7,363,500
Canlife	0	8,001,000	4,814,000	9,425,500
ABN Amro	1	8,207,672	8,100,784	5,401,469
National Australia	1	8,335,000	8,726,000	4,726,340
SoGen	1	9,160,649	9,839,245	3,757,171
Clerical Med	1	9,476,000	7,248,000	3,232,500
Equitable	0	9,485,173	10,309,127	13,122,402
Royal London	0	9,562,000	9,150,000	2,678,500
Abbey Life	1	9,750,000	3,105,000	6,995,500
Capel Cure Sharp	1	9,957,000	5,775,000	2,969,500
Foreign & Colonial	1	10,230,000	2,619,000	2,756,000
Old Mutual	0	10,792,000	12,193,000	2,507,500
Scot Mutual	1	11,044,435	10,371,585	5,913,086
Pearl	1	11,314,000	11,742,000	19,673,000
Rothschild	2	11,486,000	10,976,000	2,595,500
Lazard	1	11,660,163	10,611,151	2,014,763
SunLife_Canada	0	11,666,000	7,235,000	5,566,500
Dresdner	1	11,697,220	7,943,372	22,247,080
Investec	1	12,883,000	5,023,000	1,488,538
Cazenove	3	13,307,000	12,323,000	7,338,000
Legal & General	1	13,566,000	12,169,000	16,006,000
Marks & Spencer	1	14,254,000	10,017,000	11,506,000
AEGON (Scott Equitable)	1	14,434,000	11,993,000	4,963,500
CGU	1	14,718,000	10,515,000	8,499,500
HSBC Unit	1	14,846,000	10,621,000	12,963,500
Scot Widow	0	14,916,000	9,320,000	10,058,000
Guardian	1	15,422,000	11,532,000	4,365,500
Credit Swiss	1	15,599,385	10,372,000	12,200,500
Royal & SunAlliance	1	15,975,000	15,944,000	13,242,000
Kleinwor	1	16,222,513	13,919,432	4,351,023
Nationwide	0	17,617,000	18,482,000	9,931,000
Prudential	1	18,244,000	18,875,000	21,177,000
Hill_Sam	1	18,508,000	7,764,000	14,547,000
Stan_Life_Inv (Mutual)	0	19,143,000	26,148,000	32,063,000

Appendix 1: Company Data Set for DEA (Type:0=mutual, 1=listed, 2=private, 3=others)

Company Name	type	Net Revenues	Admin costs	Cap Employed
Phillips&Drew	1	19,461,000	19,872,000	9,043,000
Virgin Direct	1	19,467,000	15,599,000	5,922,500
St James	1	21,839,000	15,288,000	9,109,000
Britanic	1	22,802,000	18,668,000	3,767,500
Scot.Life	0	22,817,463	22,037,262	5,113,118
CIS	0	23,600,891	35,564,709	20,701,370
Halifax	1	25,253,000	15,967,000	23,077,000
Stan_Life_Unit (SLTM)	0	26,384,000	25,041,000	4,092,500
Woolwich	1	28,261,000	7,409,000	4,806,000
Deutsche	1	29,926,000	17,827,000	38,300,500
Save & Prosper	2	33,930,666.67	12,508,000.00	9,686,500
Newton	1	34,292,000	22,996,000	18,297,000
Framlington	1	34,723,000	17,304,000	2,957,500
Friends Provident	0	36,359,000	29,756,000	18,287,000
Abbey national	1	38,809,456	10,437,699	51,272,792
perpetual	1	43,556,129	25,583,892	37,631,139
HSBC Inv	1	49,850,000	13,578,000	9,302,000
Henderson	1	50,530,000	39,178,000	17,634,500
Baring	1	57,890,357	49,494,651	10,370,048
Invesco	1	60,746,828	46,938,501	99,621,665
Scottish Widow Unit (Lloyds)	1	70,936,000	51,375,000	57,139,000
Aberdeen	1	73,683,000	62,623,000	10,345,500
Fidelity	2	79,577,000	70,295,000	52,563,500
Jupiter	1	90,938,691	55,611,919	10,538,087
Gartmore	1	91,310,000	49,278,000	31,802,000
Berclays	1	93,454,000	73,109,000	31,301,000
Threadneedle	1	97,171,000	96,736,000	108,585,500
Mercury	1	123,909,417	134,311,061	101,169,437
M&G	1	129,905,600	107,656,800	75,741,800
Schroder	1	140,330,000	135,633,000	22,889,000
Bank Scot	1			-
Cavendish	2			-
CIM	1			-
City Financial (investors)	2			-
City London	3			-
Scot Friend	0			-
Tilney	2			259,500
Baillie G	3			791,500
Stewart Ivory	2			1,018,270
Templeton	1			1,967,000
Murray J	1			7,884,000
Morgan Stanley	1			41,543,000

Appendix 2: Company Data Set (Control Variables: Log Asset size, Herfindahl Index, Number of Categories, and Funds)

Company Name	Lg_AUM	HI_99	Sectors	Funds
Tesco	1.992951	8473.7752	2	2
Arbuthnot	0.2201081	10000	1	1
Burrage	0.7041505	10000	1	1
Belvin Frank	0.794488	6136.3361	2	2
Saracen	0.6394865	10000	1	1
Gresham	0.9222063	5601.6632	2	2
MPFS	0.9242793	10000	1	1
McHattie	0.5965971	10000	1	1
Maldon	1.1436392	10000	1	1
Homeowner	1.2380461	6178.7898	2	2
Discretionary	1.2581582	10000	1	1
Consistent	1.3967223	10000	1	1
Lombard Odier	0.8976271	10000	1	1
Saltire	1.3273589	2331.4093	2	5
Mayflower	1.2833012	4549.7125	4	4
Endurance	1.3694014	10000	1	1
Leggmason (Johnson Fry)	2.5279133	4020.4363	7	8
MW Joint	1.3760292	3513.5428	2	3
MGM	2.5353448	4393.9988	5	6
Mirabaud	1.4589399	10000	1	1
T Bailey	1.6062739	10000	1	1
Liverpool	1.6866363	5002.3785	2	2
ACM	1.8426716	2379.3283	4	6
Taube	2.0098332	4413.4871	2	3
Fleming Unit (JP Morgan Fleming Fund)	3.1624091	1175.042	13	17
Police Mutual	1.2750809	7001.5236	2	2
Allchurch	2.114611	2570.3931	5	5
Duncan Lawne	1.25042	10000	1	1
GA	2.5225225	3321.3233	7	9
Thesis (Thomas Eggar)	1.9557358	3891.1811	3	3
New Street	1.8846821	1658.4372	3	10
MT General	2.2873986	10000	1	1
Aberforth	2.2671717	10000	1	1
Wesleyan	1.7273786	9818.0959	2	2
Sanwa	1.869701	3588.8176	3	3
Direct Line	2.1525024	10000	1	1
State Street	2.118397	3061.6445	7	8
KBL	2.1314262	1266.9751	10	12
Premier	2.2784106	1170.2289	10	12
Bank of Ireland	2.2445245	3367.0189	4	6
Eagle Star	2.2749426	2216.6926	6	7
Hargreaves	1.8827522	2302.1727	3	6
Family	2.507613	2043.8241	6	8
TU	2.2534592	5510.9181	3	3
Marlborough	2.0853619	3220.0887	10	12
Norwich Union	3.4843283	1354.4192	16	21
NUF	2.0712927	10000	1	1
City Financial Managers	2.6244574	978.53464	9	32
Thornhill	1.9876663	7441.3656	2	2
Sand Aire	2.4562597	10000	1	1
Reliance	2.4843426	10000	1	1
Sarasin	1.8288532	6597.1348	2	2
Close	2.5251744	1778.0483	5	11
GAM	2.3895028	1894.9836	8	9
AXA	3.4756044	1321.1597	16	18

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Appendix 2: Company Data Set (Control Variables: Log Asset size, Herfindahl Index, Number of Categories, and Funds

Company Name	Lg_AUM	HI_99	Sectors	Funds
Artemis	1.6023856	5023.9419	2	2
United	3.1123536	2872.3098	8	9
NPI	3.0108001	2104.6469	11	14
Lincoln	3.0261163	2197.1606	10	10
Quilter	2.0817073	1944.2066	6	7
BWD	2.3205409	3060.4458	4	6
Royal Bank of Scotland	2.928109	2337.3817	6	7
Manek	2.2605484	10000	1	1
Portfolio	2.3744551	1744.2413	9	9
Singer & Friedlander	2.4914597	2380.7328	6	6
Martin Currie	2.8058609	1824.355	12	16
Rathborne	2.2582061	2076.1941	6	7
Sovereign	2.6206461	1845.6113	6	8
Colonial First State	3.4354733	2873.6874	15	18
FPFM (Fleming Private F)	2.7084719	804.49215	7	20
Alliance & Leicester	2.7010151	5771.489	3	5
Liontrust	2.7455432	2846.3168	9	15
Edingburgh	2.6090499	1130.2658	15	16
AIB_JGovett	2.86163	1217.3073	15	22
Smith & Williamson	2.744066	1075.9768	10	16
Exeter	2.4612734	3659.3446	7	9
Scot Amicable	3.4583039	3104.6259	15	25
Canlife	3.2621852	1728.99	12	13
ABN Amro	2.2961385	6363.7168	5	5
National Australia	2.6033826	6489.4749	3	4
SoGen	2.8328537	1484.6177	12	15
Clerical Med	3.3690079	1834.6236	11	11
Equitable	3.5382054	1237.0817	8	12
Royal London	3.0188461	2408.6753	8	8
Abbey Life	3.5007303	1383.9848	16	20
Capel Cure Sharp	3.0363294	1361.7524	14	17
Foreign & Colonial	2.9214732	2840.1603	11	11
Old Mutual	3.5503715	1132.9097	11	24
Scot Mutual	3.010003	1776.3109	8	10
Pearl	3.1862555	1977.961	5	8
Rothschild	2.8744818	1723.4822	10	12
Lazard	3.0305269	1548.3419	12	15
SunLife_Canada	3.2749495	1490.3085	11	15
Dresdner	3.2138895	869.44495	12	16
Investec	2.6142115	1240.5881	10	18
Cazenove	3.2862745	1749.3857	13	13
Legal & General	3.6919104	1776.159	14	23
Marks & Spencer	3.065841	3577.2646	3	4
AEGON (Scott Equitable)	3.1309799	1144.435	17	22
CGU	3.4532847	2841.5946	16	20
HSBC Unit	3.3229838	1135.3153	13	24
Scot Widow	3.5242806	971.51829	21	35
Guardian	3.024539	1775.7249	11	13
Credit Swiss	3.1320002	1358.9383	9	11
Royal & SunAlliance	3.3645791	1202.2692	12	17
Kleinwor	2.1651256	5022.1736	2	2
Nationwide	2.8379544	5492.8561	2	3
Prudential	3.569608	1700.7196	11	12
Hill_Sam	3.5471788	3201.1776	16	26
Stan_Life_Inv (Mutual)	3.1654521	3171.9085	13	15

Appendix 2: Company Data Set (Control Variables: Log Asset size, Herfindahl Index, Number of Categories, and Funds)

Company Name	Lg_AUM	HI_99	Sectors	Funds
Phillips&Drew	2.8153519	8700.2936	3	3
Virgin Direct	3.3766682	7977.177	2	2
St James	3.0950123	2006.3049	8	11
Britanic	3.2487357	1391.835	11	13
Scot Life	3.3590401	3983.6199	5	5
CIS	3.4057117	6137.9581	3	3
Halifax	3.2810311	3551.6857	3	5
Stan_Life_Unit (SLTM)	3.9227856	5044.7492	6	6
Woolwich	3.3129597	4792.8382	3	3
Deutsche	3.5595679	1339.9435	14	21
Save & Prosper	3.7125453	847.82328	18	26
Newton	3.4475224	1421.6514	15	26
Framlington	3.0890357	678.54221	18	22
Friends Provident	3.7753002	1083.6801	18	26
Abbey national	3.4532021	5454.9856	7	9
perpetual	3.9866952	1376.3804	16	21
HSBC Inv	3.5219679	1822.0502	8	12
Henderson	3.5320508	780.05816	18	28
Baring	3.5352599	914.72198	19	32
Invesco	3.7080723	1794.6348	18	29
Scottish Widow Unit (Lloyds)	3.9262997	1295.762	16	25
Aberdeen	3.7057671	1016.4862	18	27
Fidelity	4.1753668	467.14166	14	36
Jupiter	3.6356546	2129.8873	12	17
Gartmore	3.9591268	595.01273	21	50
Berclays	3.888595	763.85806	13	28
Threadneedle	4.0361053	879.65658	22	36
Mercury	3.9345479	2536.602	21	43
M&G	4.1229272	563.51358	21	41
Schroder	4.1637879	705.9551	20	40
Bank Scot	1.7834033	3408.8048	3	3
Cavendish	1.1682027	0.5011617	2	2
CIM	1.0021661	8647.0038	2	3
City Financial (investors)	1.7762652	3795.3826	5	5
City London	1.5158738	9351.7623	2	2
Scot Friend	0.346353	10000	1	1
Tilney	2.4753951	2218.9299	6	7
Baillie G	3.3974064	3061.4934	15	19
Stewart Ivory	2.5826314	2068.265	9	10
Templeton	1.6683859	6846.5067	2	3
Murray J	2.3452757	1379.5679	13	15
Morgan Stanley	1.2395497	3336.6537	3	3

Appendix 3: Unit Trust Data Set For DEA (Fund Sector ategory = UK All Companies)

DMU	Output_1	Input_1	Input_2	Input_3
Unit Trust	Ave.Monthly Return	volatility	Initial Fee%	Annual Fee %
Nfu Mutual Unit Mg_Avon Equity	1.271600255	4	3	1
Reliance Unit Mgrs_ British Life UT	1.491509256	4	6	1
Abbey National Utm N&P Uk	1.356034764	4.3	4	1.25
Abbey National Utm Uk Growth	1.385357844	4.2	4	1.25
Abbey Ut Managers Asset & Earnings	0.666144775	3.9	6	1
Abbey Ut Managers Abbey General	0.731451758	3.7	6	1
Aberdeen Ut Mgrs Uk Blue chip	1.354300596	4.1	4.25	1.25
Aberdeen Ut Mgrs Uk Growth	1.417783222	3.9	4.25	1.25
Aberdeen Ut Mgrs Uk Mid C (Spec Situ)	1.127034564	4.7	4.25	1.25
Abn Amro Fd Mgrs Uk Growth	2.329463438	5.8	5	1.25
Aegon Fund Mgt Uk Eqt Groth (Scot Eq)	1.094957051	4.2	5.5	1.25
Aegon Fund Mgt Uk Uk Blue (Scot Eq)	1.027771553	4	5.5	1.25
Alliance Leicester Capital Growth	1.354300596	4.2	3	1.25
Axa Fund Managers General	1.155045497	4.1	5	1
Axa Fund Managers Uk Grow	1.202963854	4.1	3.5	1
Baille Gifford British 350	1.579502094	4.1	5	1.25
Barclays Fds Ltd 500	0.621768201	4.2	5.25	1.25
Barclays Fds Ltd Capital	1.338646173	4.2	5.25	1.25
Barclays Fds Ltd Ftse 100	1.397346299	4.4	5	1
Barclays Fds Ltd General	1.271600255	4.1	5.25	1.25
Barclays Fds Ltd Trustee	1.230252057	4.1	5.25	1.25
Barclays Gbl Inv Bgi Grow(& Income)	1.273384666	4	5.25	1.25
Barclays Gbl Inv Bgi Uk (Growth)	1.444810153	4	5.25	1.25
Baring Fd Mngrs Uk Growth	1.600292917	4.8	5	1.5
Bk Of Ireland Fm Capital Growth	1.050983121	4.5	5	1
Britannic Fd Mngrs Balanc	1.259078465	4.3	5.25	1.5
Britannic Fd Mngrs Uk Gen	1.547222514	4.7	5.25	1.5
BWD Equity Growth	1.206617193	4.3	4.5	1.5
Bwd Rensburg Uk Blue-Chip Growth	1.235678935	4.3	4.5	1.5
Canada Life Mgmt (Growth)	1.273384666	4.2	5	1.25
Canada Life Mgmt General	1.162469452	4.4	5.75	1.25
Cavendish Un Mngrs Opport	1.550466679	4.8	3.5	1
Cazenove UK Equity	1.110096729	4.1	5	1
CF Friars House Capital	1.224814976	4.7	5.5	1.25
CF Quontock	1.489854319	4.5	5	1.5
CGU PPT UK & General	1.269814742	4.2	4	1
CGU PPT UK Growth	1.132658514	4.1	4	1.25
CGU UK Index Tracking	1.516220648	4.5	1	0.85
CIM Community Growth	1.156903274	4.4	0	1.5
Cis Unit Mngrs Uk Gth Tst	1.434704568	4.3	5	1
City Finance Assets	0.910850729	4.9	5	1
Cler Med Inv General Equity	1.0797376	4.1	5.25	1.25
Cler Med Inv Pedigree Growth	1.735726777	4.7	5.25	1.25
Cler Med Inv Special Situation	1.093059	3.9	6	1.25
Consistent	0.797414043	3.1	5	1
Credit Suisse A M Growth	1.301786614	4.8	5.25	1.5
Deutsche Inv Fds Uk Blue	1.664905412	4.3	5.25	1.5
Deutsche Inv Fds Uk Equit trucker	1.250101031	4.2	0	0.75

Appendix 3: Unit Trust Data Set For DEA (Fund Sector ategory = UK All Companies)

Deutsche Inv Fds Uk Growt	1.404174637	4.3	5.25	1.5
Direct Line Ut Direct Line 100 Tracker	1.558561258	4.1	0	1
Dresdner Rcm (Uk) Exempt	1.752409662	4.5	2.5	0.75
Dresdner Rcm (Uk) Uk Growth	1.997377365	5.3	4	1.25
Dresdner Rcm (Uk) Uk Index	1.499769805	4.2	0	0.5
Dresdner Rcm (Uk) Uk Mid Cap	2.465223959	6.6	4	1.25
Edinburgh Ut Mngrs Uk Growth	1.378484956	3.8	3.5	1.25
Equitable Pelican	1.319397329	3.9	5	0.5
Equitable Special Situation	0.945028574	4.7	5	0.5
Equitable UK Index Tracking	1.483225108	4.2	5	0.5
Exeter Fd Mngrs Capital G	2.304543165	6.8	5	1.25
Family Inv Mgmt Family Asset	2.087717214	4.7	5	1
Fidelity Growth & Income	1.301786614	4.1	5.25	1
Fidelity Insutitutional UK	1.352565389	4.5	0	0.8
Fidelity Inv Svcs Money Builder Growth	1.173569754	4	0	1
Fidelity Inv Svcs Money Builder Index	1.644573751	4.4	0	0.5
Fidelity Inv Svcs Special Situations	1.177260402	4.2	5.25	1.5
Fidelity Inv Svcs UK Growth	1.233871107	4.3	5.25	1.5
Fidelity Recovery	0.964945598	5.2	5.25	1.25
Five Allows UK Major Companies	1.448170867	4.7	5	1.5
Fleming (FPFM) General Opportunity	1.356034764	3.1	0	1.25
Fleming Growth (FPFM)	1.393926086	4	0	1.5
Framlington Ut Mgt Income (& Growth)	1.096853856	4.2	5	1
Framlington Ut Mgt Uk Gro	1.340389739	4.3	5	1
Friends Prov U/T'S Fp Uk Focus	1.378484956	4.4	5.75	1.5
Friends Prov U/T'S Uk Gro	1.410986919	4.3	5.75	1.5
Friends Provident Fp Equi	1.356034764	4.3	5.75	1
GA Equity Growth	0.670545	4.2	5	1.5
GA GANDA	1.115753715	4.1	5	1.5
Gartmore Fund Mgrs Uk Equity	1.542349455	4.4	0	1
Gartmore Fund Mgrs Uk Gro	1.380204707	4.1	5.25	1.5
Gartmore Fund Mgrs Uk Ind(ex)	1.489854319	4.2	5	1.25
Gartmore UK Select Opportunity	1.158759858	4.1	5.25	1.5
Gerrard Uk Growth (CCS UK Gro)	1.553707221	5.2	5	1.25
Gerrard Uk Opport (CCS UK Opp)	1.410986919	4.8	5	1.25
Global Asset Mgt Gam Uk (Diversified)	1.199305893	4.6	5	1.5
Govett Geared UK index	1.555326136	7	5.5	1
Govett Investments Govett FTSE 250	0.898690578	4.8	3.5	1
Govett UK Equity General	1.226628472	4.3	5	1.5
Guardhill	0.89462577	4.1	6	1.5
Guardian Growth Equity	1.08735735	4.4	6	1.5
Halifax Ut Mgt Growth Inc	1.08735735	3.9	3	1.5
Halifax Ut Mgt Halifax Accmulation	1.208442133	3.9	5	0.5
Hargreaves Lansd'N Hl The Utilities	1.36469006	3.6	5.75	1.5
Hargreaves Lansd'N Optimum Income & Growth	1.104428645	4.3	5.25	1
Henderson Gbl Invs Uk Cap	1.151326356	4.3	5.25	1.5
Henderson Income&Growth	1.16061525	4.1	5.25	1
Henderson Income&Growth Exempt	1.315883747	4	2.5	0.5
Hill Samuel Utm British T	1.356034764	4.1	4	1.5
Hill Samuel Utm Uk Select Growth	1.255490834	4.1	4	1.5

Appendix 3: Unit Trust Data Set For DEA (Fund Sector ategory = UK All Companies)

Hsbc Inv Fds (Uk) British	1.484883832	4.4	4	1.5
HSBC Unit Fds (Uk) Uk Growth	1.661786713	4.9	5.25	1.25
HSBC Unit The Footsie Fund	1.579502094	4.4	0	1
HSBC Unit UK Index	1.488198436	4.2	0	0.5
HSBC Inv UK Top 100 Tracker	1.444810153	4.4	4	1
Invesco Fund Mgrs Gt Uk Blue Chip	1.201135452	4.5	5.25	1.5
Invesco Fund Mgrs Perp Rupert Children's	1.40758278	4.6	5.25	1.5
Invesco UK Growth	1.307081088	4.6	5.25	1.5
Invesco UK Income & Growth	1.08735735	4.2	5.25	1.5
Investec (Guinnes F)Blue Chip Port	1.223000342	4	5	1.25
Investec (Guinnes F) Uk Opp	0.89665889	5.4	5	1
Jpmorgan Fleming (Unit) Specialist Equity	1.375042387	4.2	1	0.5
Jpmorgan Fleming A Instl UK Income	1.453204643	4.2	1	0.5
Jupiter Ut Mngrs Uk Growth	1.106319242	3.6	5	1.5
Jupiter Ut Mngrs Uk Growth Exempt	2.201384932	5.2	5	1
Jupiter Ut Mngrs Uk Special Situation	1.498119577	4.9	5.25	1.5
Lazard Fund Mgrs Uk Growth Retail	1.166174291	4.3	3.75	1.25
Legal & General Ut Equity	1.380204707	4.2	0	1
Legal & General Ut Uk Index	1.521137761	4.2	0	0.5
Legal & General Ut Uk Recovery	1.368144949	4.1	0	1.5
Legal & General Ut Uk Stock Market	1.511295186	4.5	0	2
Legal & General Ut Uk TAA	1.441445538	4.4	0	1.5
Leggmason Inv Utm Uk Emergin Growth	1.241095651	4.3	5	1.5
Leggmason Inv Utm Uk Growth	1.657102377	4.5	5	1.5
Lincoln Utm Mgrs Growth	1.269814742	4.3	5.82	1.25
Liontrust Inv Fds First Growth (exempt)	1.677346833	4.1	5	1.5
Liontrust Inv Fds Top 100 (exempt)	1.535839284	4.3	0	0.35
M&G Securities British Opportunity	1.010239562	4.5	5	1
M&G Securities Ltd Blue Chip	1.232062148	4.2	5	1
M&G Securities Ltd Capita	0.612810102	3.9	5	1
M&G Securities Ltd Pension Exempt	1.326411725	4	2	0.44
M&G Securities Ltd Recovery	0.855721473	4.9	5	1
M&G Securities Ltd UK Equity	0.659531788	3.7	5	1
M&G Securities Ltd Uk Growth	1.356034764	4.3	5	1
Maldon General	0.955004277	4.2	0	1.05
Marks & Spencer Ut Uk 100	1.56824504	4.3	0	1
Marks & Spencer Ut Uk Select Port	1.226628472	3.8	3	1.5
Marlborough F Mgrs Hargre	1.168024932	4	5	1.5
Marlborough F Mgrs Uk Equ	1.919894228	5	5.25	1.5
Martin Currie Ut Uk Growt	0.707677631	4.6	5.25	1.25
Mayflower British Leaders	0.542421577	4.3	5	1
Mercury Recovery	1.012192829	5.1	5	1.5
Merrill (Mercury) Fd M British Blue Chip	1.077829517	4.1	5	1.5
Merrill (MAMPI)Growth	1.041334305	4	6	1.5
Merrill (MAMPI) Income	0.953011895	4.1	6	1.5
Merrill Lynch Fd M Uk Equ (exempt)	1.121399645	4.2	2	0.5
Merrill Lynch Fd M Uk Equity Bull	1.451527688	4.3	4	0.75
Merrill Lynch Fd M Uk Gen	0.912872443	4.4	5	1.5
Mgm Unit Managers Special	1.269814742	4	5	1
Mgm Unit Managers Uk Grow	1.2047911	4.1	5	0.75

Appendix 3: Unit Trust Data Set For DEA (Fund Sector ategory = UK All Companies)

MT General	1.221184569	3.8	0	0.62
Murray UK Growth	0.776300557	3.9	5	1.5
National Australia Stockmarket Growth	1.224814976	4	3	1.5
Nationwide Utm Uk Growth	1.275167978	4.1	3	1.25
Newton Fd Mgrs Growth Fun	1.195643298	4.6	4	1.25
Newton Fd Mgrs Income Nav	1.595508235	3.8	4	1.25
Norwich Union T/Mg Uk Equ	1.486541608	4.8	0	1
Norwich Union T/Mg Uk Gro	2.004320169	6	0	1
Norwich Union T/Mg Uk Idx	1.321152522	3.9	0	0.9
Npi Inv Mgrs Uk Equity Retail	1.331661392	4.5	0	0.5
Npi Inv Mgrs Uk Growth Ac	1.349091853	4.4	4.5	1.5
Old Mutual Fd Mgrs Uk All Share Mirror Trust	1.392214464	4.1	0	1
Old Mutual Fd Mgrs Uk Gro	1.368144949	4.3	5.5	1.5
Pearl Unit Trusts Equity	1.268028127	4.3	4	1.5
Pearl Unit Trusts Equity Growth	1.262661652	4.2	4	1.5
Pearl Unit Trusts Pearl Growth	1.421175405	4.3	4	1
Perpetual UK Growth	0.663942135	4.7	5.25	1.25
Prudential Uts Uk Growth	1.012192829	4.2	5.5	1.5
Rathbone Ut Mgt Rathbone Income Growth	1.378484956	4.3	5.5	1
Rathbone Ut Mgt Rathbone Special Situation	1.085454297	4.6	5	1.5
Rothschild Fd Mgt Five Arrows UK Portfolio	1.123279173	4	4.17	1.5
Royal Bk Scot Ut Growth	1.023884748	4	6	1.25
Royal Bk Scot Ut income	1.230252057	4	6	1.25
Royal London Utm Uk Growt	1.287620483	4.4	4	1
Royal&Sun Allnc Ut Equity Fund	1.448170867	4.4	5	1
Royal&Sun Allnc Ut Ftse All Share Track	1.340389739	4.1	5	0.3
Royal&Sun Allnc Ut Gth & Income	1.307081088	4	5	1
Sanwa Intl Inv Ser Sanwa Growth	1.715886394	4.5	5.5	1.25
Save & Prosper Premier Equity	1.563407188	4	5.5	1.5
Save & Prosper UK Growth & Income	1.378484956	4.1	5.5	1.5
Schroder Ut'S Ltd Index	1.36641802	4.1	3	0.3
Schroder Ut'S Ltd Instl Growth	0.843325986	3.5	6	0.5
Schroder Ut'S Ltd Instl Recovery	0.755031106	5.1	3	0.5
Schroder Ut'S Ltd Uk Enterprise	0.851595566	5	5.25	1.5
Schroder Ut'S Ltd Uk Equi	1.221184569	4.3	5.25	1.25
Scot Amicable Utm Equity	1.168024932	4.1	4.54	1.5
Scot Amicable Utm Equity Income	1.119518894	4.8	4.54	1.5
Scot Amicable Utm Equity Strategy	0.841254877	4.1	4.54	1.5
Scot Life Invest Uk Equit	1.321152522	4.2	5	1
Scot Mutual Inv Uk Equity	1.427947882	4.4	5.25	1
Scot Mutual Inv Uk Select Opportunity	1.385357844	4.6	5.75	1
Scot Widows Fd Mgt Uk Equity Acc	1.098749416	4.1	5	1
Scot Widows Fd Mgt Uk Index	1.584313211	4.4	0	0.5
Scot Widows Fd Mgt Uk Special Situation	1.149464989	4.5	5	1.25
Scot Widows Balance (x LTSB)	1.219367655	3.9	6	1
Scot Widows Environment (x LTSB)	1.955369521	4.6	5.5	1.5
Scot Widows Ut Mgr Ftse 100 (x LTSB)	1.388788182	4.3	6	1
Scot Widows Uk Equity Growth (xLTSB)	1.310605364	4	6	0.25
Scot Widows Uk Growth (x LTSB)	1.262661652	3.9	5.5	1.5
Smith & Williamson S&W Growth	1.692824054	5	5	1.25

Appendix 3: Unit Trust Data Set For DEA (Fund Sector ategory = UK All Companies)

Solus Funds Solus Uk Grow	0.681516205	3.7	3.5	1.25
Solus Funds Solus Uk Special	2.758052721	8.1	3.5	1.5
Sovereign Ut Mgrs Ftse 100	1.381923438	4.4	2.5	1
Sovereign Ut Mgrs Uk Grow	0.966929758	4.4	5.5	1.5
St James Place Ut Uk Gene	2.079619186	4.4	5	1.5
Standard Life Invs Growth & Income	1.169874388	4.1	3	0.95
Standard Life Invs UK Equity Growth Retail	1.145738655	4	3.5	1.5
Standard Life Tst Uk Equity General	1.149464989	3.9	5.75	1.5
Stewart Ivory British	1.484883832	4.2	5	1
Sun Life Canada UK Growth	1.191976058	4.2	4.95	1.5
Thornhill Utm Capital Trust	1.791465519	4.4	5	1.75
Threadneedle Inv Uk Growt(&Inc)	1.242898971	4	3.75	1.5
Threadneedle Inv Uk Growth(1)	1.257285205	3.9	3.75	1.5
Threadneedle Inv Uk Institutional Growth	1.291168522	4	0	0.75
Threadneedle Inv Uk Overseas Earns	1.273384666	4.2	0	1.5
Threadneedle Inv Uk Select Growth	1.224814976	4.1	3.75	1.5
Tilney Collective Uk Equity	1.387073521	4.5	5	1.25
T British	1.285844831	4.1	5	1
United Friendly UK Equity Growth	1.199305893	4.1	6	1
Virgin Direct Pfs Uk Index Tracker	1.469921042	3.9	0	1
Wesleyan Ut Mgrs Wesleyan Growth	1.127034564	3.4	4	1.25
Woolwich Ut Mgrs Uk Stock	1.284068089	4.2	5	1.25

Appendix 4-a. A List of sample companies

Mutual Ownership Group

Allchurch
Canlife
CIS
Equitable
Family
Friends Provident
Homeowner
Liverpool
MGM
MPFS
Nationwide
NFU
Old Mutual
police
Reliance (B-life)
Royal London
Scot Friend
Scot Life
Scot Widow
Sovereign
Stan_Life_Inv (15 funds)
Stan_life_Unit (6 funds)
SunLife_Canada
Wesleyan

Quoted Company Group

Abbey Life	Direct Line	Lincoln	Sanwa
Abbey national	Dresdner	Liontrust	Schroder
Aberdeen	Duncan Lawne	Lloyds	Scot Amicable
ACM	Eagle Star	M&G	Scot Equitable
AIB_JGovett	Edingburgh	M&S	Scot Mutual
Alliance & Leicester	Exter	Mayflower	Singer&Fried
AMRO	F&C	Mercury	SoGen
Arbuthnot	Framlington	Morgan Stanley	St James
AXA	GA	Murray J	State Street
Bank of Ireland	Gartmore	National Australia	Templeton
Bank Scot	Guardian	New Street	Tesco
Baring	Halifax	Newton	Threadneedle
Berclays	Henderson	Norwich Union	United
Britanic	Hill_Sam	NPI	Virgin
Burrage	HSBC Inv (Midland)	Pearl	Woolwich
BWD	HSBC Unit	Perpetual	
Capel Cure Sharp	Invesco	Phillips&Drew	
CGU	Investec	Portfolio	
CIM	J-Fry	Premier	
Clerical Med	Jupiter	Prudential	
Colonial	KBL(Solus)	Quilter	
Close	Kleinwor	Rathbome	
Credit Swiss	Lazard	Royal & SunAlliance	
Deutsche	Legal & General	Royal Bank of Scotland	

Privately Onwed Company Group

Belvin Frank	Smith & Will
Cavendish	Stewart Ivory
City Financial Investment	T Bailey (Fortes)
City Financial Managers	Taube
Endurance	Thesis (Thomas Eggar)
Fidelity	Thornhill
Five	Tilney
Fleming Unit	
FPFM	
GAM	
Gresham	
Hagreaves	
MacHattie	
Maldon	
Manek	
Marlborough	
Martin Currie	
Mirabaud	
MT General	
MW Joint	
Saltire (SPFM, Martin_Currie)	
Sand Aire	
Saracen	
Save & Prosper	

Appendix 4-b. Descriptions of unit trust sectors

(1) UK All Companies	Funds which invest at least 80% of their assets in UK equities and which have a primary objective of achieving capital growth.
(2) UK Equity Income	Funds which invest at least 80% of their assets in UK equities and which aim to have a yield in excess of 110% of the yield of the FT-SE All Share Index.
(3) UK Smaller Companies	Funds which invest at least 80% of their assets in UK equities of companies which form part of the FT-SE Small Cap Index or have a capitalisation value below that of the FT-SE Small Cap Index.
(4) UK General Bonds	Funds which invest at least 80% of their assets in corporate or public fixed interest securities.
(5) UK Gilt	Funds which invest at least 80% of their assets in UK government securities
(6) UK Equity & Bond	Funds which invest at least 80% of their assets in the UK but invest less than 80% of their portfolio in either Uk equities or UK gilt and fixed interest securities. Which also aim to yield no higher than 120% of the FT-SE All Share Index.
(7) UK Equity & Bond Income	Funds which invest at least 80% of their assets in the UK but invest less than 80% of their portfolio in either UK equities or UK gilt and fixed interest securities. Which also aim to have a yield of 120% or over of the FT-SE All Share Index.
(8) Active Managed	Funds would offer investment in a range of assets, with the Manager being able to invest up to 100% in equities at their discretion. At least 10% must be held in non-UK equities.

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(9) Balanced Managed	Funds would offer investment in a range of assets, with the maximum equity exposure restricted to 85% of the fund. At least 10% must be held in non-UK equities. Assets must be held at least 50% in Sterling/Euro and equities are deemed to include convertibles.
(10) Cautious Managed	Funds would offer investment in a range of assets, with the maximum equity exposure restricted to 60% of the fund. There would be no specific requirement to hold a minimum % non-UK equity. Assets must be held at least 50% in Sterling/Euro and equities are deemed to include convertibles.
(11) Managed Income	Funds should have a maximum equity content of 60%, a minimum gross running yield requirement of at least 120% of the FTSE All Share Gross Yield. Assets must be held at least 50% in Sterling/Euro and equities are deemed to include convertibles.
(12) Global Growth	Funds which at least 80% of their assets in equities and have primary objective of achieving capital growth.
(13) Global Equity Income	Funds which invest at least 80% of their assets in equities and aim to achieve a yield in excess of 110% of the FT Actuaries World Index.
(14) Global Equity &Bond	Funds which have less than 80% of their portfolio invested in either equities or fixed interest securities
(15) Global Bond	Funds which invest at least 80% of their assets in fixed interest stocks
(16) Global Emerging Markets	Funds which invest 80% or more of their assets directly or indirectly in emerging markets as defined by the World Bank
(17) Europe excluding UK	Funds which invest at least 80% of their assets in European securities and exclude UK securities.
(18) Europe including UK	Funds which invest at least 80% of their assets in European securities. They may include UK securities but these must not exceed 80% of the funds assets.

(19) Far East Excluding Japan	Funds which invest at least 80% of their assets in Far Eastern securities but exclude any Japanese content
(20)Far East Including Japan	Funds which invest at least 80% of their assets in Far Eastern securities including a Japanese content (the Japanese content must be less than 80%)
(21) Japan	Funds which invest at least 80% of their assets in Japanese securities
(22) North America	Funds which invest at least 80% of their assets in North American securities
(23) Guaranteed / Protected	Funds other than money market funds which principally aim to provide a return of a set amount of capital back to the investor (either explicitly guaranteed or via an investment strategy highly likely to achieve this objective.)
(24) Money Market	Funds which invest at least 95% of their assets in money market instruments
(25) Index Bear	These funds are designed to track inversely the performance of an index by using derivatives
(26) Property	Funds which invest at least 80% of their assets either directly in property itself or indirectly in property company securities

Source: Money Management Magazine May 2000

Appendix 5-a: The DEA linear programme (the CRS model)

y_{rj} = known positive output level of company or fund j, r = 1,2,....s where, s is the number of outputs

x_{ij} = known positive output level of company or fund j, r = 1,2,...,s where, s is the number of outputs

n= total number of companies or funds

The Constant Return of Scale for determining the relative efficiency of a designated company or fund "0" is given

$$Max = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} \tag{1}$$

$$\text{subject to } \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, \; j = 1,2,\ldots n, \tag{2}$$

$$r = 1,2,\ldots, s, \text{ and } i = 1,2, \ldots, m. \tag{3}$$

The variables in the above model are input and output weights u_r and v_i respectively.
The objective function (1) is the ratio of weighted sum of outputs to weighted sum of inputs with weights being the optimal values of the variables u_r and v_i to be determined as a solution to the CRS model.

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Appendix 5-b: The DEA linear programme (the VRS model)

The CRS model can be transformed into an equivalent linear programming model. The VRS model is the dual of this equivalent linear programme together with a constant capturing returns to scale characteristics. The linear programme so obtained for determining the relative efficiency score, θ of company or fund "0" is given by

$$\text{Min } \theta \tag{4}$$

$$\text{subject to } \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0} \quad r = 1,2,\ldots,s, \tag{5}$$

$$\theta x_{i0} \geq \sum_{j=1}^{n} \lambda_j x_{ij}, \quad i= 1,2,\ldots,m, \tag{6}$$

$$\sum_{j=1}^{n} \lambda_j = 1 \tag{7}$$

$$\lambda_j \geq 0 \qquad j = 1,2,\ldots n. \tag{8}$$

The variables in the VRS model are θ and λ, which is non-negative. The variable θis the proportional reduction required in each input of the designated company or fund to achieve efficiency. The constraints in the model ensure that relative efficiency of the company or fund never exceeds 1. The sufficient condition for efficiency of the company or fund is that the optimum value of θ is 1. Otherwise, it is labelled as inefficient compared to the other companies or funds in the sample. Thus, a DEA run will produce a relative efficiency score and a set of λ_j j= 1,2…n, values for each company or fund. The set of λ_j values defines a point on the envelopment surface.
Therefore, for an inefficient company or fund the point so defined by the λj values becomes a role model that in turn establishes precedence for it to become efficient. The set of efficient companies or funds {j:λj >0} is called the peer group of the designated company or fund.

The constraint given in (7) is referred to as the convexity constraint and accounts for variable returns to scale (VRS). When the convexity constraint is removed the resulting model represents the constant returns to scale (CRS) situation. The relative efficiency score obtained for a designated company or fund under CRS is a measure of overall technical efficiency of the company or fund. The relative efficiency score obtained under VRS is a measure of pure technical efficiency. The difference in overall and pure technical efficiencies is attributed to scale efficiency that is measured as the ratio of overall and pure technical efficiencies.