THE IMPACT OF DIVERSIFICATION ON THE PERFORMANCE OF CONSTRUCTION FIRMS

BY

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DECLARATION

I IBRAHIM, Yahaya M....., confirm that this work submitted for assessment is my own and is expressed in my own words. Any uses made within it of the works of other authors in any form (e.g. ideas, equations, figures, text, tables, programmes) are properly acknowledged at the point of their use. A full list of the references employed has been included.

Signed: .....

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Abstract

Heavily built upon theories from outside the construction management literature, this study assesses the impact of diversification on the performance of construction firms in the UK. The primary objective is to determine performance differences between undiversified, moderately diversified and highly diversified firms, both in terms of product and geographic diversification. A secondary objective is to determine the various business segments into which construction firms diversify and the nature of the relationship between the extents to which they diversify and their performance. Performance was measured based on financial ratios of management performance along with their variability as measures of risk while diversification was measured by the specialisation ratio.

The research involved the use of financial data of construction firms covering the period 1995 - 2004. The choice of the period is informed by the economic stability during the period and also, by the fact that diversification is a long-term strategy. Only firms that have complete data for the period were included in the study. All data were colleted from the OSIRIS database. In all, 23 firms had complete data in terms of the various business segments in which they operate while 21 have complete data in terms of their geographic spread.

The findings indicate that construction firms diversify mostly into construction related businesses that arc in themselves as irregular and as cyclical as construction. The extent of product diversity was found to be negatively linearly related to performance when performance is measured in terms of ROTA and PM. However, no linear association was found between the extent of geographic diversification and performance. In terms of product diversification, undiversified firms were found to outperform both moderately and highly diversified firms based on ROTA and PM. However, no performance difference was found between the moderately diversified and highly diversified firms.

In terms of geographic spread, the findings suggest that undiversified firms outperform moderately diversified firms based on ROTA and PM and undiversified firms outperform highly diversified firms based on PM. Highly diversified firms were found to outperform moderately diversified firms based on ROTA and PM. Also, highly diversified firms exhibit the best risk profile.

Key words: Diversification, Specialisation ratio, Firm performance

Glossary of Abbreviations

ASR: Average specialisation ratio

AROE: Average Return on Equity

AROTA: Average Return on Total Assets

AROCE: Average Return on Capital Employed

APM: Average Profit Margin

SD: Standard deviation

CV: Coefficient of variation

Chapter one: Introduction

1.1 Background to the study

One characteristic of the market place is that it is continually changing. The construction markets in particular are volatile, making planning to move to new construction markets not only more difficult but also more necessary. There is a need to know about the correct combination of company strength and market analysis of potential markets for a company to survive and keep up with its competitors (Teo, 2002).

Hillebrandt and Canon (1989) define diversification as the process by which firms extend the range of their business operations outside those in which they are currently engaged. A diversified firm can therefore be considered as one having operations in more than a single industry. The consequences of such diversification can be examined for the individual firm with respect to the long-run growth/profit, which becomes less dependent on the trend in demand for products within its primary industry. In addition diversification increases the range of a firm's investment opportunities, since it permits a company to take advantage of the more profitable opportunities in sectors of the economy in which it previously had no activities. The measure of performance is the excess profitability of the firm as compared to the industry average or benchmark profitability (Pawaskar, 1999).

Different studies conducted in different parts of the world revealed different reasons why construction firms diversify or why they refuse to diversify. Cho (2003), for example, found that housebuilding firms in Korea diversify into both related and unrelated businesses and this diversification could be a short-time 'survival strategy' under a regulated environment rather than a long-term 'growth strategy'. Hua and Pheng (1998), in their study of "The Strategic Responses of Construction Firms to the Asian Financial Crisis in 1997-1998", concluded that 61% of the respondents did not intend to diversify because they felt they were already bogged down by their existing workload. 39% of the respondents, however, have the intention to diversify because they do not wish to place all their "eggs in one basket". They hope to expand their business portfolio and spread their risks. Further still, Teo (2002) found that a substantial proportion of all firms are not prepared to be involved in diversification but elect to operate in one market only, despite the obvious advantages of diversification.

Furthermore, the findings by different researchers on the relationship between diversification and firm performance have also been different. Palepu (1985), reported that the Industrial Organisation literature, including studies by Gort (1962), Arnold (1969) and Markham (1973), concluded that no significant relationship exists between diversification and firm performance, but that studies by Rumelt (1974, 1982), Montgomery (1982) and Christensen and Montgomery (1981) in the Strategic Literature, reported a systematic relationship between a firm's diversification strategy and economic performance. Pawaskar (1999) found that the directions of diversification leading to improved performance depend largely on how efficiently the assets are utilised in the present operations. Rumelt (1982) observed that the highest levels of profitability were exhibited by those firms having a strategy of diversifying primarily into those areas that are on some common core skill or resource. The lowest levels were those of vertically integrated businesses and firms following strategies of diversification into unrelated business. However, Choi and Russel (2004) noted that whereas the relationship between the type of diversification strategy and performance indicates that while the related diversification has been slightly favoured by both theories and empirical research findings over unrelated diversification, no significant performance difference was observed between the two diversification strategies.

Apparently, therefore, a generalisation on the reasons why firms diversify or refuse to do so is difficult to make, more so about the relationship that exists between the kind of diversification strategy and financial performance of a firm. There is the need therefore, to carry out similar studies that will reveal the reasons why firms adopt or refuse to adopt the diversification strategy and the impact diversification has on the performance of construction firms in the.

1.2 Rationale for the study

Diversification strategy is an important component of strategic management of a firm, and the relationship between a firm's diversification strategy and its economic performance is an issue of considerable interest to both academics and managers (Palepu, 1985).

Teo (2002) observed that what makes the subject of movement (diversification) so important now is that in construction, current workloads do not guarantee future workloads due to fluctuating demands. The construction firm, be it in a developed country or a developing country, will have to live, if necessary learn to live with

fluctuating demands for its services. Teo opined that the survival technique for the firm is to diversify to markets where the opportunities exist for responding to the dynamic environment.

Donato and Peter (2003) concluded that more theoretical and empirical research is needed in order to understand the causes and consequences of diversification and business group formation in entrepreneurial firms.

Choi and Russel (2005) concluded that subsequent research is necessary to provide direction and increase current understanding concerning whether construction firms should seek related or unrelated diversification.

There is therefore the need to study the nature and extent to which construction firms adopt the diversification strategy and its impact on their performance.

1.3 Aim:

The aim of the research is to asses the impact of product and geographic diversification on the performance of UK construction firms.

1.4 Objectives:

1. To investigate the areas into which construction firms diversify.
2. To investigate the extent of diversification (Product and geographic) by construction firms.
3. To investigate the nature of the relationship between the extent of diversification (product and geographic) and performance.
4. Analyse the relative group-wise performance of highly diversified, moderately diversified and undiversified firms in terms of both product and geographic diversification.

1.5 Hypotheses

There have been many conflicting theoretical and empirical arguments regarding the nature of the relationship between the level of diversification and firm performance. Palich, Cardinal and Miller (2000) identified two theoretical models in the literature that seek to explain the nature of this relationship. The first is the linear model and is based

on the premise that the level of diversity and performance are linearly and positively related. The second is the curvilinear model. It recognises that increasing levels of diversification may not be associated with concomitant increase in performance. There are two main alternatives of this model – the inverted-U model and the intermediate model. Both alternatives recognise that some moderate level of diversification is better than none but they differ in their prediction of the trend in performance as firms move towards higher levels of diversity.

While recognising the existence of the curvilinear models, these models fall outside the scope of this work. Hence the following research hypotheses are posited both in terms of product and geographic diversity:

Research hypothesis (H1): A firm's extent of product diversity is negatively linearly related to its performance.

Null hypothesis (H1o): There is no negative linear relationship between a firm's extent of product diversity and its average performance.

Research hypothesis (H2): A firm's extent of geographic diversity is negatively linearly related to its performance.

Null hypothesis (H2o): There is no negative linear relationship between a firm's extent of geographic diversity and its average performance.

Furthermore, there are various arguments in favour of and against focusing, rather than diversifying. Choi and Russel (2005) submit that theoretically, both in construction and non construction, both theories and empirical evidence tend to support the idea that firms engaging in specialised areas outperform those that diversify.

The test of the null hypotheses H1o and H2o may only give some indication as to whether focused firms perform better than moderately and highly diversified firms. Even so, the test may not reveal the extent by which performance differs. For example, if it is found that a firm's average level of diversity is negatively linearly related with performance, this will only mean that focused firms perform better than moderately diversified firms which in turn perform better than highly diversified firms. However,

the degree by which performance differs as diversity increases is not revealed. The test is therefore only a measure of linear association and not a measure of difference. Hence, the following hypotheses relating to product diversification are posited.

Research hypothesis (H3): Undiversified (Focused) firms outperform moderately diversified and highly diversified firms.

Null hypothesis (H3o): There is no performance difference between undiversified firms and moderately and highly diversified firms.

Research hypothesis (H4): Moderately diversified firms outperform highly diversified firms.

Null hypothesis (H4o): There is no performance difference between moderately diversified firms and highly diversified firms.

The hypotheses relating to geographic diversification are as follows:

Research hypothesis (H5): Geographically undiversified firms outperform the geographically moderately and highly diversified firms.

Null hypothesis (H5o): There is no performance difference between geographically undiversified firms and geographically moderately and highly diversified firms.

Research hypothesis (H6): Geographically moderately diversified firms outperform geographically highly diversified firms.

Null hypothesis (H6o): There is no performance difference between the geographically moderately diversified firms and geographically highly diversified firms.

1.6 Exclusions and limitations

The study involved collecting financial data of construction companies covering the period 1995 – 2004. These data were obtained from the OSIRIS database. Although the database keeps financial records of more companies than the ones that formed the sample, only those companies that have complete records over the period of the study

were included in the sample. Others were excluded. Any biases due to this exclusion could not have been avoided.

The financial ratios used as measures of performance have limitations. Critical among these limitations is the fact that the accounting numbers used in the calculation of these ratios may be affected by different accounting policies. The major causes of these differences in accounting policies lie in valuations of depreciation and stock which are highly subjective (Weetman, 2003).

1.7 Dissertation Structure

Chapter two provides an overview of the concept and theories of diversification. Reasons why firms diversify are explored and the costs and benefits of diversification are highlighted. Various approaches to the measurement of diversification and company performance are explored. The chapter reviews both theoretical and empirical arguments relating to the diversification-performance relationship in both construction and non construction industries. Lastly, the kind and extent of diversification within the construction industry are examined.

Chapter three examines the methodology adopted for the research. It presents the procedure used in the collection of data and the various statistics employed in the analysis.

Chapter four presents the data collected and statistical tests of the hypotheses. It presents all analysis and discusses the results and findings.

Chapter five presents the conclusions drawn from the analysis and literature review. It compares the conclusions reached in this research with those of past studies on the diversification-performance relationship. The chapter provides recommendations for further research efforts.

Chapter two: Literature review

2.1 Introduction

This chapter articulates the general theories of diversification. Various definitions of diversification as a business strategy are presented and a distinction between geographic and product diversification drawn. Theoretical arguments as to why firms diversify as well as the benefits and costs of diversification are presented. The modes by which firms may pursue the diversification strategy as well as the type of diversification strategy are explained. Diversification as a business strategy within the construction industry is examined, highlighting main areas into which construction firms diversify.

To address the question of how a firm's level of diversification strategy and its performance may be measured, various approaches to measuring a firm's diversity and performance are explored. Finally, empirical studies that sought to establish relationship between a firm's diversification and its performance both within and outside the construction industry are explored.

2.2 Diversification

2.2.1 Definition: Product diversification

Diversification is derived from the word "diverse", which literally means "different; unlike; distinct; separate" and in the sense of a business enterprise, it signifies "difference" among aspects of a firm's activities (Pitts and Hopkins, 1982).

Ramanujam and Varadarajan (1989) highlight a great deal of variation in the way diversification is conceptualised, defined and measured. For example, Gort (1962) defined diversification in terms of the concept of heterogeneity of output based on the number of markets served by that output. In this regard, two products are said to serve separate markets if their cross-elasticity of demand are low and if, in the short run, the necessary resources employed in the production and distribution of one can not be shifted to the other.

Berry (1975) defined diversification as an increase in the number of industries in which firms are active. Kamien and Schwartz (1975) see diversification as the extent to which firms classified in one industry produce goods classified in another. According to Pawaskar (1999), a diversified firm can be considered as one having operations in more than a single industry. In all these definitions, industry and market boundaries are assumed to be defined. Ramanujam and Varadarajan (1989) argue that these definitions fail to address the process and administrative aspects of diversification. Hence, they

defined diversification as the entry of a firm or business unit into new lines of activity, either by processes of internal business development or acquisition, which entail changes in its administrative structure, systems and other management processes.
Hillebrandt and Cannon (1989) defined diversification as the process by which firms extend the range of their business operations outside those in which they are currently engaged. They explained that this definition encompasses the directions of diversification which include:

1. Vertical Integration: This is further classified into;
    a. Backward Vertical Integration: This is the process of acquisition or development of business whose products are inputs to the firm's main operations.
    b. Forward Integration: The extension of the firm's activities to those of the normal purchaser of its products.
2. Horizontal diversification: This is the process of moving into other markets not involving the firm in any vertical relationships as in 1a and 1b above.
    The above definitions seem to relate more to the product of the firm. However, diversification can also be viewed from the perspective of geographical spread of a firm's activities both domestically and internationally.

NB: Note that where the term 'diversification' is used without any qualification in this work, it is meant to refer to 'product diversification'.

2.2.2 Definition: geographic or international diversification

Capar and Kotabe (2003) defined International diversification as a firm's expansion beyond the borders of its home country across different countries and geographical regions. They posit that the terms, international diversification, multinationality, and international diversity, are often used interchangeably in the diversification literature. According to Qian (1997) international market diversification refers to firms which are horizontally- or vertically-integrated across different national sub-markets.

Firms enjoy a number of advantages from internationalisation. For example, Buhner (1987) argued that internationalisation offers prospective market opportunities, which gives firms the opportunity for greater growth. Kim, Hwang and Burgers (1989) as well as Qian (1997) posit an increased geographic scope of operation may increase a firm's

ability to share or co-ordinate its international activities. Such benefits include economies of scale, scope and experience.

Qian (1997) is of the opinion that diversification across geographic boundaries should improve a firm's risk-return opportunities when economic activity in different countries is less than perfectly correlated. He argues that although international activities in any one country may be more risky than a similar investment in a home country, the riskiness of international activities as a whole may be lower than the riskiness of domestic investment. Hence, firms that are more heavily engaged in foreign activities should exhibit a more stable stream of profits than comparable firms which are not internationally diversified.

Kim Hwang and Burgers (1993) argue that the more international a firm is, the greater its opportunities to leverage strategic resources while simultaneously diversifying market risks, thus raising its performance.

2.3 Theories of diversification

2.3.1 Why diversify?

Hillebrandt and Cannon (1989) assert that a number of theories have been postulated to explain the reasons for diversification and that such reasons may be linked back to the objectives of the firm, which may be, or include, increases in profits, rate of profit, value of assets and turnover. They assert that growth in some form or other is usually the driving force for diversification. One reason for this is that there are barriers to growth in existing products. Those barriers may be related to a market which is declining or not capable of further expansion, to one in which the particular firm has a monopoly position which inhibits further growth, or to one with a few producers where upsetting the equilibrium by increasing market share could be costly.

In line with this, Pawaskar (1999) noted that diversification by the firm, either through internal capacity expansion or through external expansion by merger, is essentially a means of growth for the firm. However, he explained that there is an interesting implication for the relation between the desire to grow and the desire to make profits. If profits are a pre-condition of successful growth, but profits are sought primarily to grow, that is, to reinvest in the firm rather than to reimburse shareholders for the use of their capital or their 'risk bearing', then, from the point of view of investment policy,

growth and profits become equivalent as the criteria for the selection of investment programs . In addition, he explained that firms will never invest in expansion for the sake of growth if the expected return on the investment will not generate profit, for that would be self-defeating. Firms will therefore diversify if and only if the managers expect that it eventually lead to a further increase in the funds available for investment. To increase total long-run profits of the enterprise in some sense is therefore equivalent to increasing the long-run rate of growth. Hence, 'growth' or 'profits' may be considered as the goal of a firm's investment activities.

There seem to be a consensus amongst authors that diversification offers the firm opportunities for growth. For example, Ofori and Chan (2000) pointed out that authors have categorised business growth paths into concentration, diversification and acquisition, and of these, diversification attracts the most attention.
Hillebrandt and Cannon identified reasons for diversification based on the direction of diversification. These directions are:

2.3.2 Vertical integration

There are a number of theories which seek to explain the reasons for vertical Integration. These are:

2.3.3 The market failure approach

According to Williamson (1971) market failures in this regard are failures only in the limited sense that they involve transaction costs that can be attenuated by substituting internal organisation for market exchange. As with Rogers'(2001) performance based arguments, it is argued based on this approach that wherever the costs of relying on the market and undertaking transactions through the market are higher than the costs of in-house production, firms may wish to diversify into the business of their suppliers and/or customers. Vertical Integration is more likely when there is a high degree of uncertainty in the firm's environment and when transactions recur frequently so that transaction costs would be high (Hillebrandt and Cannon, 1989).

2.3.4 Monopolistic motives for integration

A monopoly firm may combine with another firm which may itself be a monopolist or operating in a competitive situation, in a number of different ways. For the monopolist, the reduction of uncertainty is a higher motive for vertical integration. Specifically,

backward vertical integration is driven by the need to overcome a failure of existing suppliers to meet the firm's demand at the time required, in the right quantity, at the right quality, and at a reasonable price. In addition, it enables the firm to increase its market power, either by increasing existing barriers to entry or by creating new ones high (Hillebrandt and Cannon, 1989).

2.3.5 Horizontal diversification

Hillebrandt and Cannon explained that horizontal diversification includes the following categories of association between firms:

1. Diversification by merger with another firm in the same market, sometimes known as horizontal integration.
2. Diversification into a market which is related to the existing business of the firm, either because of common types of outlets or because of common resources, often implying some synergy between the businesses.
3. Diversification into a market which has no connection with the existing business of the firm.

Essentially, the main reason for horizontal diversification is to avoid risk. As explained by the portfolio theory of diversification, horizontal diversification is undertaken to increase the stability of profits by spreading risks or reducing the proportion of high risk businesses in the portfolio of the company. Other reasons to diversify horizontally are to compensate for barriers to expansion in existing markets and to take advantage of the outcome of an unexpected event or of slack in resources, especially highly efficient resources such as outstanding expertise (Hillebrandt and Cannon, 1989).

2.4 Other motives for diversification

Dawkins, Harris and Kells (1997) assert that a well known motivation for diversification involves the realisation of managerial economies of scale. As firms become larger, their per-unit cost of engaging managerial and administrative resources declines. As managerial resources are not uniquely applicable to any single production technology, the same mangers can oversee diverse operations. A company that is prevented from reaching a certain scale in one line of business (due to the size of its market, for example) can still grow by acquiring related but not identical business, or businesses in other industries altogether. The same argument applies to the suggestion that diversified companies are able to realise economies of scope 'synergies' in production and marketing.

Again, Dawkins et al explain that another view put forward is that firms diversify in order to build up a portfolio of product areas that matches their competitors'. The main rationale for this strategy is that it enables companies to reduce the risk and uncertainty in repeated game situation.

Another motive for diversification may be that managers, having formed a view about the expected future profitability of their main business and business' industry, might, if that outlook is negative, gamble that to diversify into an industry with a more positive outlook. This will preserve the firm that will otherwise decline thereby preserving the market value of its managers in the employment market.

2.5 Types of diversification

According to Choi and Russel (2004), the type of diversification refers to the degree of business relatedness or fit between the existing operations of a firm and the diversified operations. In this regard, there are two types of diversification strategy; related diversification and unrelated diversification.

Similarly, the strategic management literature classifies firms by the nature of their diversification strategies as well as well as the extent of their diversification into two distinct types of diversification: related and unrelated. Related diversifiers are defined as firms that diversify predominantly within industries while unrelated diversifiers are defined as firms that diversify across industries (Hwang and Burgers, 1989).

2.6 Modes of diversification

The mode of diversification refers to the extent to which the firm relies on internal business development vis-à-vis acquisitions as a means of entering new lines of activities (Ramanujam and Varadarajan, 1989).

Choi and Russel (2004) assert that under the premise that growth is a vital element for business survival; a firm can grow and develop core competencies either internally by investing in and nurturing within-firm resources or externally by acquiring another firm. If a firm buys a business unit or an entire firm from another party, it is a business transaction between two independent organisations; such transactions are termed mergers and acquisitions (M&A).

2.7 Benefits and costs of diversification

As in any economic activity, there are costs and benefits associated with diversification, and ultimately, a firm's performance must depend on how managers achieve a balance between costs and benefits in each case. Moreover, these benefits and costs may not fall equally on managers and investors. Management researchers argue that diversification prolongs the life of a firm. Researchers in finance argue that diversification benefits managers because it buys them insurance, and shareholders usually bear all the costs of such insurance (Pandya and Rao, 1998).

Diversification can improve debt capacity, reduce the chances of bankruptcy by going into new product/markets and improve asset deployment and profitability. Skills developed in one business, transferred to other business, can increase labour and capital productivity. In addition, a diversified firm can transfer funds from a cash surplus unit without taxes or transaction costs. Diversified firms pool unsystematic risks and reduce the variability of operating cash flow and enjoy comparative advantage in hiring because key employees may have a greater sense of job security (Bhide, 1993).

Diversification can lead to the problem of moral hazard, the chance that people will alter behaviour after entering into a contract – as in a conflict of interest by providing insurance for managers who have invested in firm specific skills, and have interest in diversifying away a certain amount of firm-specific risk and may look upon diversification as a form of compensation. In addition, diversification can be expensive and place considerable stress on top management. Furthermore, it is argued that diversification, firm size, and executive compensation are highly correlated, which may suggest that diversification provides benefits to managers that are unavailable to investors, creating what economists term the agency problem (Pandya and Rao, 1998).

Other costs associated with diversification relate to those of control and effort losses (due to increased shirking), coordination costs and other diseconomies related to organization, inefficiencies from conflicting "dominant logics" between businesses, and internal capital market inefficiencies. Given these dynamics, one could argue that the marginal costs of diversification increase rapidly as diversification hits high levels (Palich, Cardinal and Miller, 2000).

Again, other costs associated with diversification are highlighted by Mitchel and Singh (1995). Failure of a new business may managerial or financial problems for an existing business. They argue that successful expansion of a business may result in sales cannibalisation, organisational and market confusion, and diversion of material and managerial resources. Therefore, the established businesses of expanding firms may sometimes suffer, while non expanding firms may continue to perform well.

2.8 Measurement of diversification

2.8.1 Specialisation ratios

Pandya and Rao (1998) posit that the logic of the specialisation ratio reflects the importance of the firm's core product market to that of the rest of the firm. Operationally, specialisation ratio (SR) is a ratio of the firm's annual revenues from its largest discrete product-market activity to its total revenues. SR has been one of the methods of choice for measuring diversification in the diversification literature. It is easy to understand and calculate.

Chatterjee and Blocher (1992) assert that the specialisation ratio is an entirely objective measure especially if the same data source is used for information on sales in each business.

Table 2.8.1: Values of specialization ratios in Rumelt's and Pandya and Rao's schemes

	SR Values in Rumelt's Scheme	**SR Values in Pandya and Rao's Scheme**
Undiversified, Single Product Firms	$SR \geq 0.95$	$SR \geq 0.95$
Moderately Diversified Firms	$0.7 \leq ASR < 0.95$	$0.5 \leq ASR < 0.95$
Highly Diversified Firms	$SR < 0.7$	$SR < 0.5$

Source: Pandya and Rao (1998)

Table 2.8.1 above shows the classification scheme proposed by Rumelt (1974) and the one proposed by Pandya and Rao (1998). Rumelt systematically classified firms into three groups. These groups are:

- Single product firms with $SR \geq 0.95$;
- Moderately diversified firms with SR values between 0.95 and 0.7. This group includes dominant, related diversifiers and unrelated diversifiers

- Highly diversified firms with SR < 0.7 and include conglomerates, relatedly-constrained and relatedly-linked firms.

If a firm's sales from its dominant business lie between 95 percent and 70 percent of its total sales, then by Rumelt's definition, such a firm is moderately diversified. On the other hand, a firm is highly diversified if sale from its dominant business is less than 70 percent of its total sales.

Pandya and Rao (1998), while agreeing in general with Rumelt's classification, proposed a scheme that varies from that of Rumelt only in the moderate and highly diversified categories. The range of the SR value in each of these two groups is enlarged. They argue that the enlargement is necessary in order to address the contradiction amongst management and finance researchers who both have different views with regards to what a diversified firm is. For instance, the financial economists see a diversified firm typically as a conglomerate with unrelated businesses in its portfolio. They do not view related diversification as being diversified. To address this contradiction, Pandya and Rao enlarged the range of values for the moderately and highly diversified categories. In essence, this entails increasing the variance of the moderately diversified category to include both related and unrelated diversifiers and adding highly diversified conglomerate firms with $SR \geq 0.5$ into a separate group of highly diversified firms.

2.8.2 The herfindahl index

The herfindahl index is a measure that is computed from the sales of a firm by segment. It is defined by Lang and Stulz (1994) as the sum of the squared values of sales per segment as a fraction of total firm sales. For example, if a firm has 5 segments with each contributing 20% of the sales, its herfindahl index is 0.2. If the firm has 20 segments with each contributing 5% of the total sales, its herfindahl index is 0.05. It follows therefore that the herfindahl index falls as the degree of diversity increases. In a similar fashion, the herfindahl index can be computed from the firm's assets per segment. A fully focused firm will have herfindahl index equal to 1.

2.8.3 The product count

This measure is simply the number of segments in which a firm operates. Therefore a firm becomes more diversified as its number of segments increase. Theses segments can be identified using the number of the different SIC (Standard Industrial classification)

codes reported by the firm (Lang and Stulz, 1994). According to Pitts and Hopkins (1982) the product count approach (also known as numerical count) has a major failing in that it does not recognise differences in the size distribution of businesses.

2.8.4 The entropy measure

The entropy measure was originally proposed by Jacquemin and Berry (1979). They employed it to analyse the relationship between corporate diversification and growth. The measure is based on three elements of a firm's diversity of operations:

- The number of product segments in which the firm operates
- The distribution of the firm's total sales across the product segments
- The degree of relatedness among the various product segments.

Palepu (1985) explained that what distinguishes the entropy measure from other diversification indices is its ability to consider the third element. Because of this, the entropy measure overcomes the limitations of the earlier diversification indices and allows the decomposition of a firm's total diversity into additive components, i.e., an 'unrelated' component that measures the extent to which a firm's output is distributed across unrelated industry groups and a 'related' component that measures the distribution of the output among related products within the industry groups. While allowing this, the entropy measure still retains the computational simplicity of the other index measures. An intuitive explanation of the Jacquemin-Berry approach is as follows.

The related diversification arising out of operations within an industry is the weighted sum of the shares of each of the product segments in firm's sales in that industry. If the firm operates in several industries, the net related diversification is the weighted sum of the related diversification within each of these industries. In addition to the related diversification, a firm operating in several industries has unrelated diversification. This is computed as the weighted sum of the shares of each of the industries in the firm's total sales. The measure thus provides three indices: the index of related diversification, the index of unrelated diversification, and the index of total diversification which is the sum of the first two indices.

For example, consider a firm operating in N industry segments. The entropy measure of total diversification DT is defined as follows:

$$DT = \sum_{i}^{N} P_i \ln(1/P_i)$$

Where p_i is the share of the i_{th} segment in the total sales of the firm.

The above expression is the weighted average of the shares of the segments, the weight for each segment being the natural logarithm of the inverse of its share. The measure thus, takes into account the number of segments in which a firm operates and the relative importance of each of the segments in the total sales.

To incorporate the degree of relatedness among the various segments in which a firm operates, each industry group is defined as a set of related segments. The segments among an industry group are expected to be more related to one another than segments across groups. Let the N industry segments of the firm aggregate into M industry groups, ($N \geq M$). Also, let DRj be defined as the related diversification arising out of operating in several segments within an industry group j. Then, by the definition of the entropy measure, DRj can be expressed as

$$DR_j = \sum_{i \in j} P_i^j \ln(1/P_i^j)$$

Where P_i^j is defined as the share of the segment I of group j in the total sales of the group. Where a firm operates in several industry groups, its total related diversification DR is a function of DR_j. Where j = 1, 2... M.

This is expressed as

$$DR = \sum_{j=1}^{M} DR_j P_j$$

Where P_j is the share of the j^{th} group sales in the total sales of the firm.

Similarly, let DU be the unrelated diversification. This is usually as a result of operating across several industry groups. In line with the definition of DT, DU is defined as

$$DU = \sum P^j \ln\left(1/P^j\right)$$

Palepu (1985) concluded that it can be shown that, under the above definitions, the sum of the related and unrelated components equals the total diversification.

2.8.5 Measurement of firm multinationality

Multinationality is measured in a number of ways. Tallman and Li (1996) assert that one measure is the ratio of sales from foreign operations to the total sales of a firm. Other measures include foreign employee ratio and foreign assets ratio. However, they argue that none of these measures address the scope of foreign operations. Instead they focus on the overall strategic importance of foreign operations to a firm.

Delios and Beamish (1999) employed the use of two counts to measure the extent of a firm's geographic operations: a count of the number of foreign direct investments the firm had made and a count of the number of countries in which foreign direct investment had occurred.

2.8.6 Entropy measure of global diversification

Kim, Hwang and Burgers (1989) extend the entropy measure of diversification to a global context. They posit that in order to analyse the profit performance impact of global diversification, a measure that captures both the product and international market dimensions of diversification is required. This measure thus, takes into account the geographic diversification of a firm in addition to the product diversification (related and unrelated).

In this regard, if a firm operates in say N geographic market area, the entropy measure of total diversification (DT) can be defined as follows.

$$DT' = \sum_{a=1}^{N} \sum_{i \in a} P_{ia} \ln(1/P_{ia})$$

Where P_{ia} is the proportion of the size of the i^{th} business segment in the a^{th} market area to a firm's total size of operations.

Furthermore, if a firm operates in say M industry segments, then the entropy measure of global market diversification (GMD) is defined as.

$$GMD = \sum_{j=1}^{M} P_j \sum_{a \in j} P'_{aj} \ln(1/P'_{aj})$$

Where $P'_{aj} = P_{aj}/P_j$ and P_{aj} is the proportion of the j^{th} industry segment in the a^{th} market area to the total size of a firm. The global market diversification measure assesses the dispersion of a firm's operations across global market areas.

Kim et al also extended the entropy measure of global diversification to related diversification. They posit that global related diversification measures the extent of diversification across business segments within industry segments within global market areas. Hence, if a firm operates in say M industry segments, the entropy measure of global related diversification (GRD) is defined as.

$$GRD = \sum_{j=1}^{M} P_j \sum_{a \in j} P^{aj}_{iaj} \sum_{i \in a} P^{aij}_{iaj} \ln(1/P^{aij}_{iaj})$$

Where $P_{iaj}^{aj} = P_{iaj} / P_{aj}$ and P_{iaj} is the proportion of the ith business segment within the jth industry segment in the ath market area to the total size of a firm.

2.9 Diversification and the construction firm

It is well known that the construction industry is by its very nature characterised by low profitability and high competition (Choi and Russel, 2005). However, an investigation into the possible reasons for the differences in profitability between companies by Akintoye and Skitmore (1991) showed that the degree and type of diversification into different activities, particularly housebuilding, is a major factor associated with enhanced profitability. The subject of diversification is hence an important area of a construction firm's strategy.

According to Langford and Male (2001), UK contractors operate in five business arenas: civil engineering; building; property development; estate development; and construction product manufacture. In addition to these, Hillebrandt and Cannon (1990) identified such other activities as time share, form work, health care, waste disposal mechanical and electrical engineering and mining as business activities into which construction firms diversify. Hillebrandt (1996) identified boat building and in one case, meat processing as other areas.

Ofori and Chan (2000) assert that the more successful Singaporean contractors diversify into both construction related and construction unrelated businesses, both at home and overseas. They found that the most common construction related business Singaporean contractors diversify into is property development. Non construction related areas into which contractors diversify include: commerce; materials manufacture; and securities trading.

Choi and Russel (2005) found that the business composition of US public construction firms is stable, suggesting that management of construction firms are cautious of taking risks associated with changing business portfolio. In general, the level of unrelated diversification was found to be higher for non contractors than for contractors.
Langford and Male (2001) identified the following as reasons why construction firms pursue diversification strategy:

- To increase profitable growth
- To seek different activities in which profitable growth could be achieved

- To increase efficiency through control of supplies or linked activities because they provide greater synergy
- To use more positive cash flow and fixed assets
- To avoid construction cycles and particular clients and markets

Hillebrandt and Cannon (1989) identified two scenarios of diversification that should be considered in relation to the contracting firm. These are:

- Where the process of diversification is initiated by the contracting firm
- Where the process is initiated by a firm outside the industry.

2.9.1 Diversification by contracting companies

Hillebrandt (1996) assert that large contractors diversified into a range of activities. The most important of these were construction related. These construction related activities include housing development, property development and material production, especially aggregate and sand and gravel.

Cho (2003) found that Korean housebuilding firms diversify into both related and unrelated businesses. Some of them diversify into totally unrelated businesses, such as forestry and logging, sales of motor vehicles, hotel and restaurant business, broadcasting and financial institutions, while others diversify into related businesses such as civil engineering, plant hire and property development. Cho identified activities such as concrete and aggregates fabrication, which are more likely to produce economies of scale, and general plant hire, piling, road surfacing, timber trading, producing building materials and various forms of property development and managerial services as the main activities that attract integration by housebuilding firms.

2.9.2 Common sectors into which construction firms diversify

Housing

Hillebrandt (1996) found that diversification into housing achieved the objective of increasing profitable growth in the short run. The main reason for diversification into housing was to make good use of positive cash flow. This is so because surplus cash could be invested in land. It was found that enhanced activity in housing increased turnover and profits in the short run and over the period 1987 – 1993 as a whole.

Property

Again, Hillebrandt found that growth and profits were the major reasons for diversifying into property. It was found that neither the contribution to turnover nor absolute profit were as great as in housing. Even so, the rate of profit related to turnover was found to be about the same during the late 1980s boom. This was proportionately much greater than in contracting.

Another reason for diversifying into property is to make good use of positive cash flow and in some cases increase asset base, especially where the property is retained. Again research findings indicated that enhanced activity in property development increased turnover and profits. However, during the period 1987 – 1993, the net benefit was negligible in terms of profit.

Materials

Often, the reasons for diversifying into material production are quite different from reasons for diversifying into other business activities. Again, Hillebrandt (1996) found that a major incentive for diversifying into material production was to control supplies. In 1986, for example, overall increase in construction activity was seen to be jeopardising supplies so that firms had much greater security owning and operating their own material supply. Although material businesses were not found to be very profitable, they proved to be more stable than other businesses and fulfilled the objective of increasing control over supply during the mid 1980s boom.

Other activities

Again, Hillebrandt (1996) found that some companies made very substantial investment in other non-contracting activities. The reasons for diversifying into these other activities might in part have been to have some contra cyclical activities. This, according to Hillebrandt, did not work. It was found that in some cases, these activities were acquired by mistake, or they came as part of the portfolio of an acquired business, or were initiated by a respected member of staff. In some cases however, they were initiated as a result of deliberate board policy.

In general, these other activities were not found to be very profitable and were even loss making during the period 1987 – 1993 as a whole.

2.9.3 Diversification into contracting

Hillebrandt and Cannon (1990) posit that diversification is not only a one way option for the construction firm. A number of large corporations have over the years taken over construction companies either to complement some of their activities or to strengthen their financial base.

Hillebrandt and Cannon (1989) argue that where diversification is initiated by a firm outside the construction industry, the first reason a firm may diversify specifically into contracting is to increase the return on capital employed. This is particularly so because contracting firms have low capital requirements and high cash flow. The second reason proposed for diversifying into contracting by a firm outside the industry is to improve the capability of other subsidiary companies which badly require cash or are suppliers to, or customers of contracting firms.

There are advantages enjoyed by a contracting firm taken over or merged with a conglomerate. These include:

- As part of a conglomerate, the acquired firm enjoys greater stability and keeps in close relation with other subsidiaries.
- Greater stability in workload since the contracting companies' fluctuations are different from those of other activities of the group.
- Enjoys the reputation of the parent company in terms of securing work
- The acquired firm has an edge over its competitors since it enjoys the financial strength of the parent company

2.10 Barriers to diversification

Although growth has been identified as the main reason for diversification, not all companies who wish to grow also wish to diversify. Even if a firm wishes to diversify, it requires management that is willing to expand and take risks. Some of the barriers relating to diversification are the considerable risk involved in moving from construction to a completely new line of business and the managerial requirement associated with the management of those new lines of business. It is the lack of this combination of attributes that culminates into the main barrier to diversification.

Even where a firm wishes and has the competence to diversify, there are often financial barriers. Although a contracting firm may have positive cash flow, the acquisition of a company may require more cash than is available (Hillebrandt and Cannon, 1990).

2.11 Measures of company performance

Pawaskar (1999) noted that it can be assumed, under the profit maximisation hypothesis that a firm undertakes diversification into new industry with the expectation that it will lead to improved performance. Firm performance is measured in terms of profits taken gross of interest, depreciation and taxes.

Akintoye and Skitmore (1991) explained that profitability is said to be a function of the following:

- Sales volume (or work done), also referred to as turnover
- The capital investment necessary to support the turnover
- The profit margin earned

Akintoye and Skitmore further assert that profitability may be expressed either as a profit percentage of turnover (POT) or return on capital investment (ROI), and that both of these, including pre-tax return on net assets employed and return on equity have been used in studies of profitability in the construction industry. However, they argue against the use of ROI (total assets less current liabilities) as a measure of profitability in the construction industry. This is because construction firms may not necessarily increase investment in assets even if there are increases in workload. This is due to the practice of subcontracting within the industry. Hence, they argued that profit generally, measured in terms of excess income over expenditure is the most important criterion for an economic action within the construction industry.

Pandya and Rao (1998) asserted that in measuring firm performance, management researchers prefer accounting variables such as return on equity (ROE), return on investment (ROI), and return on assets (ROA) along with their variability as measures of risk. Earlier studies have used accounting rates of returns such as return on capital employed (ROCE), return on sales (ROS) and return on assets (ROA). Pandya and Rao argue that the idea behind these measures is perhaps to assess managerial performance in terms of how effective management is in using assets to generate accounting returns per unit of investment, sales or assets.

In their study Pandya and Rao like most other researchers (Qian, 1997;, Palepu, 1985; Hamilton and Shergil, 1993; Capar and Kotabe, 2003; Cheah *et al.*, 2004;, Mukherji, 1998; Kim *et al.*, 1989) used one or more of the following as measures of performance:

- Return on Equity: This is the ratio of net income (income available to common stockholders) to stockholders equity. It is a measure of company performance from the viewpoint of shareholders. It is essential in the calculation of the ROE to use the profit for ordinary shareholders, which is the profit after tax and after interest charges (Weetman, 2003). It is expressed as:

$$ROE = \frac{\text{Profit After Tax}}{\text{Share Capital} + \text{Reserves}} \times 100\% \text{ (Weetman, 2003)}$$

- Return on Assets: This is the most frequently used performance measure in previous studies of diversification (Pandya and Rao, 1998). ROA is defined as the ratio of net income (income available to common stockholders) to the book value of total assets.

  It is expressed as:

$$ROA = \frac{\text{Profit before Interest and Tax}}{\text{Total Assets}} \times 100\% \text{ (Weetman, 2003)}$$

- Market Return: This is computed for a calendar year by taking the difference between the current year's ending stock price and the previous year's ending price, adding it to the dividend received by shareholders, and dividing the result by the previous year's ending price. From point of view of the investor, the market return answers the question "What have I gained from owning these shares?" (Weetman, 2003). The market return is expressed as

$$\text{Market Return} = \frac{(\text{Market Price of Share Today} - \text{Price Paid for Share}) + \text{Dividends Received}}{\text{Price Paid for Share}}$$

(Weetman, 2003)

Nguyen, Serror and Devinney (1990) employed measures of firm performance which included perceived market value as well as accounting-based indices. These measures are:

- The market-to-book value of the firm
- The ratio of the difference between market and book value to firm sales (relative excess valuation of the firm)
- The ratio of profits to firm equity

2.12 Other determinants of performance

Hamilton and Shergill (1993) argue that there are other variables that seem likely to have at least a concomitant if not a causal association with firm performance over the longer tem. They identified both company level variables and industry level variables.

2.12.1 Co mpany level variables

- Firm Size: Hamilton and Shergill found firm size to be a consistent positive influence on return on equity, return on assets and sales growth. This influence might be due to preferential access to capital markets and technical efficiencies due to increased capital intensity. It might also be due to economies scale enjoyed by large firms. In their study, firm size was measured by the natural logarithm of average total assets over the period of study.
- Risk: Again, Hamilton and Shergill measured a company's risk by the coefficient of variation of its earnings per share over the period considered in the study. They found that risk tends to be negatively related to financial performance.
- Leverage: Hamilton and Shergill argue that although the fastest growing firms might be expected to be operating with somewhat higher debt ratios, the impact of leverage on performance will depend on when it is measured and on the precise performance variable concerned. In this regard, firms with the highest leverage will suffer more in the downturn of the business cycle, and, for example, return on equity will be more affected than return on sales. Leverage was measured as the average of a firm's ratio of total debt to total assets. It was observed that leverage tends to be positively related to performance, particularly on profitability measures.

2.12.2 Industry level variables

- Technical Opportunity: Hamilton and Shergill agree that the technological character of an industry is reflected in its research and development intensity. Research and development intensity is measured by expressing research and development expenditure as a percentage of industry sales. They found that technical opportunity has no significant association with profitability but is positively associated with sales growth.
- Industry Concentration: In line with the argument posed by Ramanujam and Varadarajan (1989) that market structure differences are likely to have

significant influence on the strategy-performance relationship, Hamilton and Shergill found that industry concentration has a consistent positive influence on return on equity, return on assets and sales growth.

- Protection: In some cases, government can render protection to some industries by, for example, shielding them from foreign competition through export subsidies and import controls. Hamilton and Shergill argue that such high protection should lead to better profitability, faster growth and perhaps greater stability. As measures of protection, they used the effective tariff rates for import competing firms and effective rates of subsidy for the export sector. A weak correlation was observed between the rate of protection and each of return on equity, return on assets and risk.

2.13 Diversification-performance relationship

Kim, Hwang and Burgers (1989) noted that studies that sought to determine the impact of diversification on firm performance come largely from two streams of literature. One is the industrial organisation literature and the other strategic management. The two differ in their theoretical development of hypothesis as well as their reported findings.

The leading hypothesis in the industrial organisation literature has been based on the assumption that diversification increases market power and should therefore lead to greater profitability for the diversifier. However, empirical results in the industrial organisation literature have not found a positive relationship between the extent of diversification and profitability. Some studies have in fact established a negative relationship between the extent of diversification and profitability. Strategic management researchers argue that these results can be attributed to a failure by the industrial organisation researchers to differentiate between diversification across and diversification within industries (Kim, Hwang and Burgers, 1989).

Rather than emphasising on market power in its theoretical development, the strategic management literature focuses on economies of scope and synergies resulting from diversification. Accordingly, these researchers (e.g. Palepu, 1985, Rumelt, 1974, Montegomery, 1982) classify firms by the nature of their diversification strategies as well as the extent of their diversification. In this regard, firms are classified as related or unrelated diversifiers. The hypothesis here is based on the assumption that related diversifiers, obtaining economies of scope and synergies exhibit greater levels of

profitability than unrelated diversifiers. This hypothesis has been supported by numerous studies (Christenson and Montgomery, 1981; Palepu, 1985; Hamilton and Shergill, 1993). However, Kim, Hwang and Burgers (1989) submit that unrelated diversification can be associated with favourable profit performance when firms are well diversified internationally.

It is clear that the findings regarding the impact of diversification and firm performance are inconsistent at least in the non construction research fields.

2.13.1 The case of the construction industry

Winch (1989) noted that perhaps much of the published work on construction management focuses on the management of construction projects rather than on the firm. Expectedly therefore, not much literature was found on the impact of diversification on firm performance in the construction management literature.

Interestingly, much like the findings in other non construction industry research, theoretical analysis and empirical research findings on the impact of diversification and firm performance in the construction industry are also somewhat mixed.

Choi and Russel (2004) classified their sample into related and unrelated diversifiers using four qualitative diversification schemes: geographic expansion, increase of market share, vertical integration and the conglomerate type of diversification. Following this qualitative classification scheme, their analysis of market performance of firms in the United States construction industry, unlike results reported in other non construction research, indicated no significant performance difference between related and unrelated diversifiers. With regards to focused versus diversified firms, theories in general tend to support the idea that focused firms outperform those that diversify into unrelated business. Hillebrandt (1996) used time series data and examined the market strategies adopted by large UK contractors in the boom of the second half of the 1980s and in the recession of the first half of the 1990s. She found that diversification by contractors into other businesses has not been successful. However, Choi and Russel (2005) employed the entropy measure of diversification and found that the profitability growth rate of focused firms was lower than that of diversified firms at an insignificant level, implying that diversified firms have some growth advantage. Contrary to this however, Ofori and Chan (2000) found that Singaporean construction firms have grown by focusing their operations at home and into contracting. They reported that such firms have benefited

from remaining focused on construction despite the perceived risks and uncertainties highlighted in the literature due to the inherent fluctuations in constructions.

In general, Palich, Cardinal and Miller (2000), recognising that the inconsistencies in reported findings may be attributable to differences in methodologies adopted and sampling errors, conducted a study that synthesised over three decades of research on the impact of diversification on firm performance. They found that firm diversification is related to both accounting and market performance outcomes. For both the market and accounting based measures, diversification appears to be positive for firms up to a certain point. Beyond this point, diversification seems to cause problem. In general, they found that the relationship is an inverted-U with related diversification being superior to unrelated diversification.

2.14 Summary

It is clear that firms whether in construction or non construction adopt the diversification strategy both as a short term survival strategy and as a long term growth strategy. Construction firms diversify more into construction related businesses that are as irregular and inconsistent as construction itself. This has not been successful for them especially with regards to UK firms.

There are many measures of diversification and performance. The findings on the relationship between diversification and performance are inconsistent both within and outside the construction industry. These inconsistencies have been attributed to differences in methodologies and sampling errors.

Chapter three: Research methods

3.1 Introduction

This chapter considers features of the various research methods used in the study. First, the method used in measuring the extent of a firm's diversification is considered. The rationale for using the method is also outlined. Next the various measures of performance are highlighted. These measures include measures of management performance and measures of variability and risk.

Finally, the means by which the data will be analysed are considered. These involve the statistical tests that measure degree of association between two or more variables and those that measure significant differences between two or more groups.

3.2 Measurement of diversification

The entropy measure of diversification is the most robust since it has the ability to differentiate between related and unrelated diversification (Palepu, 1985). This requires the use of SIC codes to classify a firms business segments into either related or unrelated. However, the data set for this study does not classify business segments by their SIC codes. Hence the entropy measure could not be used in this study. This study used specialisation ratios to measure diversification. The measure is entirely objective and captures well the level of a firm's diversity (Chatterjee and Blocher, 1992).

3.3 Measurement of performance

Performance is measured using four financial ratios that seek to measure management performance. These measures are Return on Equity (ROE), Return on Total Assets (ROTA), Return on Capital Employed (ROCE) and Profit Margin (PM). These measures have been used to measure firm performance in the construction industry (Akintoye and Skitmore, 1991).

In this study, performance is also measured in terms of the variability and risk per unit of return of the financial ratios used. Variability is measured by the standard deviation while risk per unit of return is measured by the coefficient of variation (Pandya and Rao, 1998). The standard deviation is calculated using the "nonbiased" or "n-1" method. Excel uses the following formula to compute this.

$$SD = \sqrt{\left[\frac{n\sum x^2 - (\Sigma x)^2}{n(n-1)}\right]}$$ Where n = number of observations

The formula for computing the coefficient of variation (CV) is:

$$CV = \frac{SD}{\bar{X}}$$ (Frankfort-Nachmias and Nachmias, 1992)

Where SD = standard deviation and $\bar{X}$ = arithmetic mean.

3.4 Quantitative analysis

This research is primarily concerned with the performance of construction firms. Much of the data is therefore quantitative in nature and this requires quantitative analysis. Basic statistical analysis is carried out using either Microsoft excel or SPSS (version 10.00 for windows).

3.4.1 Test of association

The analysis of the nature of the relationship between the extent of diversity and firm performance is done using two non-parametric tests of association. These are the spearman's rho and the kendahll's tau-b. Non-parametric tests are employed because the parametric tests (e.g. Pearson product moment correlation) are based on a number of assumptions. Critical among these is the assumption that the sample follows a normal distribution (Naoum, 1998). A test of normality for the data set was conducted and the results as shown on table 3.4.1 revealed that the data set deviates significantly from a normal distribution. Figure 3.4.1 through to figure 3.4.4 show the normality curves of each of the variables. Since this assumption is not met, the non parametric spearman's rho and Kendahll's tau-b tests are employed.

Both spearman's rho and Kendall's tau-b use the rank of the data to calculate the correlation. However, while Kendall's tau-b measures the strength of association between the variables measured at the interval level, spearman's rho is a rank-order correlation coefficient which measures association at the ordinal level. Spearman's rho is a non-parametric version of Pearson product moment correlation that measures association based on the ranking of the data rather than the actual values (SPSS results coach, version 10). The formulae for computing spearman's rho and Kendall's tau-b are given below.

Spearman's rho;

$$r_s = 1 - \frac{6\sum D_i}{N^3 - N}$$ (Pagano, 1981)

Where D_i = difference between the ith pair of ranks
N = number of pairs of ranks.

Kendall's tau-b;

$$\tau b = \frac{Ns - Nd}{\sqrt{(Ns + Nd + Ty)(Ns + Nd + Tx)}}$$ (Frankfort-Nachmias and Nachmias, 1992)

Where;
Ns = pairs that display the same order on both X and Y
Nd = pairs an inverse order on X and Y
Tx = pairs tied on X
Ty = pairs tied on Y
Txy = pairs tied on X and on Y

Table 3.4.1: Test of normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ASR	.204	23	.014	.810	23	.010**
AROE	.253	23	.001	.753	23	.010**
AROTA	.084	23	.200*	.964	23	.546
AROCE	.167	23	.094	.917	23	.060
APM	.167	23	.095	.871	23	.010**

**. This is an upper bound of the true significance.

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 3.4.1: Normality curve (ASR)

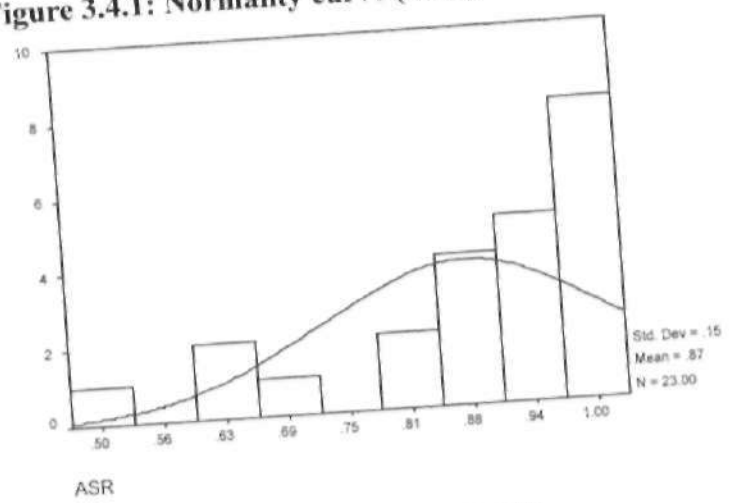


Figure 3.4.2: Normality curve (AROE)

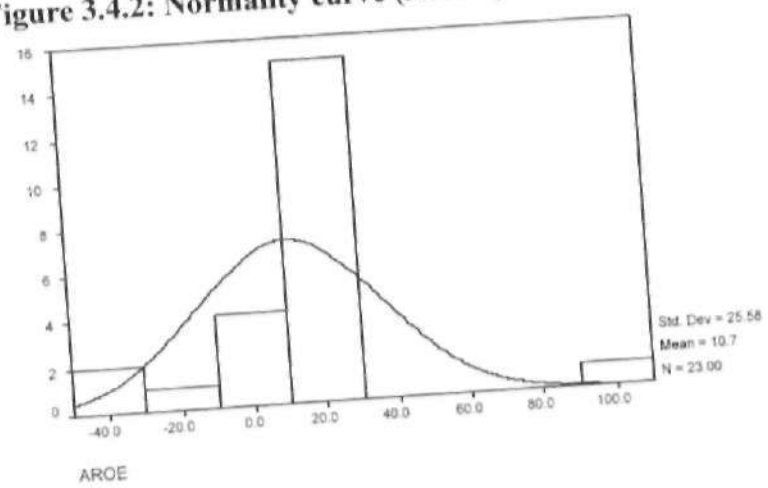


Figure 3.4.3: Normality curve (AROTA)

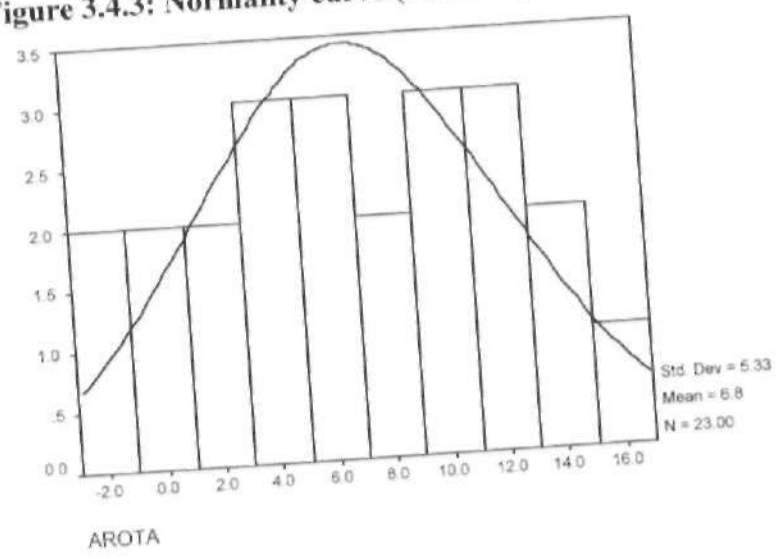


Figure 3.4.4: Normality curve (AROCE)

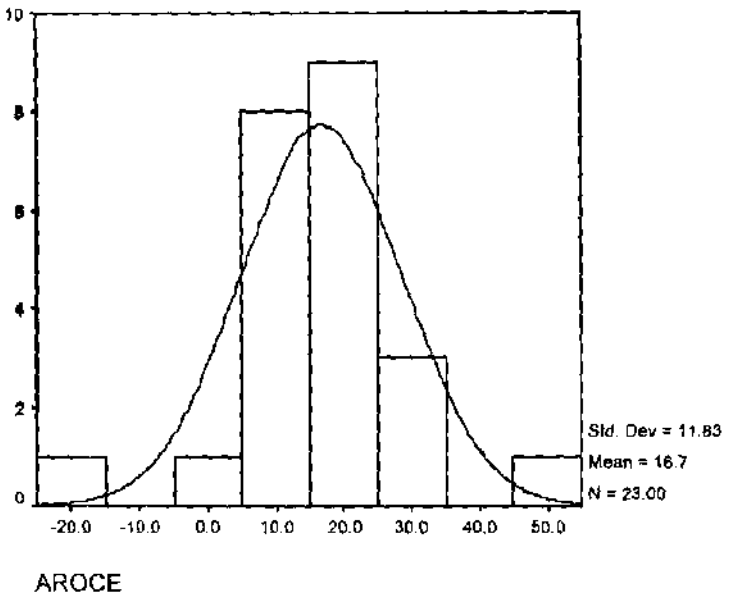
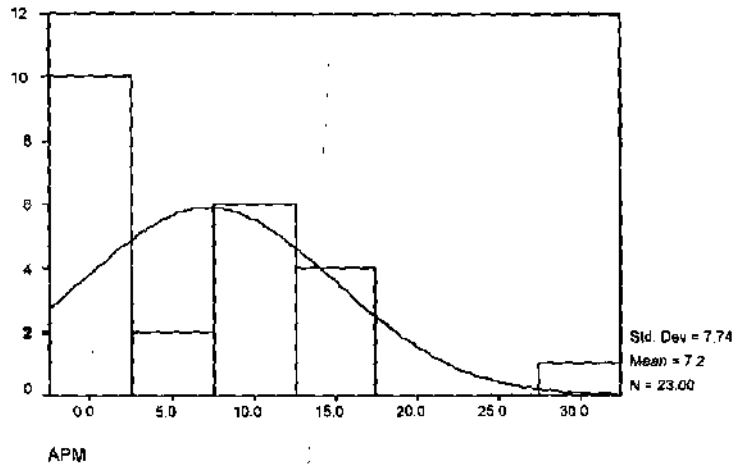


Figure 3.4.4: Normality curve (APM)



3.4.2 Test of differences

Performance differences across the undiversified, moderately diversified and highly diversified firms are analysed using the t-statistic and the trends in group-wise annual performance are presented in graphical forms. The t-statistic is parametric and is used to compare the means of two samples. The fundamental assumptions underlying the use of the t-test are:

- The population from which the samples are taken are normally distributed
- The variances of the samples compared are homogeneous.

(Pagano, 1981)

The data sets do not satisfy the underlying assumptions of normality. Yet the t-statistic is employed. This is because the t-statistic is a robust test implying that it is relatively

insensitive to violations of its assumptions (Pagano, 1981). In order to counter the effect of the assumption of homogeneity of variance, the statistic employed is the two sample t-statistic that assumes unequal variances. This is computed using the Microsoft Excel. This research effort recognises that other tests that measure differences between groups may also be used. Some of the ones considered are the analysis of variance (ANOVA) and the Mann-Whitney U test. These tests have their weaknesses. ANOVA is not a robust test (Pandya and Rao, 1998) and Mann-Whitney U test is less powerful than the t-test (Pagano, 1981). Excel uses the following formula to compute t:

$$t' = \frac{\bar{x} - \bar{y} - \Delta_0}{\sqrt{\frac{S_1^2}{m} + \frac{S_2^2}{n}}}$$

where $\bar{x}$ = mean for sample 1
$\bar{y}$ = mean for sample 2
S_1^2 = variance of sample 1
S_2^2 = variance of sample 2
Δ_0 = hypothesised mean difference
m and n = numbers of subjects in samples 1 and 2 respectively

3.5 Summary

This research effort employs the use of specialisation ratios to measure the extent of a firm's diversification. Performance is measured in two-fold. First management performance is measured based on return on equity, return on total assets, return on capital employed and profit margin. Secondly performance is measured based on the variability and risk per unit of return of these measures of management performance.

The statistics used to measure the degree of association between extent of diversification and performance are non parametric. These are the spearman's rho and the Kendahll's tau-b. The t- statistic is a robust test and is therefore used in testing for significant differences between the undiversified, moderately diversified and highly diversified firms.

Chapter four: Data collection and analysis

4.1 Introduction

This chapter reviews the nature of the data, describes the source of the data and the strategy adopted in searching for the data. It presents the findings and analysis of performance of three diversification groups, classified based on their specialisation ratios – undiversified, moderately diversified and highly diversified groups. The chapter evaluates group-wise performance based on four measures – return on equity (ROE), return on total Assets (ROTA), return on capital employed (ROCE) and Profit margin. The variability and risk per unit of average return of each of the performance variables are also analysed.

Statistical tests employed non-parametric two tailed correlation (Kendall' tau-b and Spearman's rho) and one tailed two sample t-tests assuming unequal variance. All tests are at 0.05 significant level unless where otherwise stated.

4.2 Nature of the data

The data required for the study takes the form of key financials for the companies considered, over a ten year period (1995 - 2004). The choice of the period (1995 - 2004) is informed principally by the economic stability in the United Kingdom during the period. This will strengthen the validity of the results since economic booms and recession which would have affected firms' strategy and performance are silent during this period.

Principally, the data required are the monetary value of sales from each firm's business segment, each firm's equity capital, and profit, for each year during the period considered (1995 - 2004). Normally, such financial data are available in the company's annual reports.

4.2.1 Source of data

Data for the study was collected wholly from the OSIRIS data base. OSIRIS provides financials, ownership, news, ratings, earnings and stock data for the world's publicly quoted companies, including banks and insurance firms from over 120 countries. The industrial company financial data on OSIRIS is provided by World'Vest Base (WVB) and five regionally specialized providers; Korea Information Service (KIS), Teikoku Databank (Japan), Huaxia International Business Credit Consulting Company (China),

Multex (USA) and Edgar Online (USA). The combined industrial company dataset contains standardized and as reported financials for up to 20 years on approximately 24,700 listed companies, 900 unlisted companies, and 2,600 de-listed companies (http://osiris.bvdep.com)

According to the OSIRIS website, all financial information is complemented with data from the following sources to make OSIRIS a comprehensive public company research and analysis tool:

- Bureau van Dijk - *Ownership Database*
- Dow Jones - *Dow Jones Global Indexes*
- Edgar Online - *SEC Filings*
- Fininfo - *Stock data*
- Fitch Ratings - *Ratings*
- JCF Group - *Earnings Estimates*
- Moody's - *Ratings*
- Reuters - *News*
- Standard and Poor's - *Ratings*

4.2.2 The search strategy used

Because OSIRIS keeps financial information on a wide range of companies from varying industries in different countries around the globe, it was necessary to carry out a search for companies that will form the basis for analysis. All companies in the sample are listed companies whose address of incorporation is the United Kingdom. In addition, all companies are active and fall within the Industry classification benchmark 2357(Heavy Construction) or 3728 (Home Construction). Although the search criteria also screened only companies that have available accounts covering the period of the study, four of the twenty seven resulting companies had missing data and were therefore eliminated from the sample. Any biases that might have been caused by this were unavoidable. Table 4.2.1 below gives the sequence and criteria of the search together with the result of each step.

Table 4.2.1: Search criteria

Selected criteria	Specified values or options	Step result	Search result
Listed	Listed	31546	31546
World Region/Country	Address of incorporation : United Kingdom (GB)	3632	1878
Years with available accounts	2004, 2003, 2002, 2001, 2000...1995	7165	588
Active/Inactive	Active	32475	588
Industry Classification Benchmark	2357 - Heavy Construction, 3728 - Home Construction	1215	27

It is interesting to note that the twenty-two (95%) of the twenty-three companies used in the analysis fall within the builders' magazine top one hundred UK construction companies ranking. The ranking was as at 2003 and was based on turnover. This is available on the builders' website (http://www.building.co.uk).

Fourteen (61%) of the companies fall within the top twenty-five while twenty-one (91%) of the twenty-three companies used fall within the top fifty in the ranking. The data used for the study is therefore a fair representation of the UK top construction companies.

4.3 Data analysis (product diversification)

4.3.1 Relationship between extent of diversification and performance

Null hypothesis (H1o): There is no negative linear relationship between a firm's extent of product diversity and its average performance.

In order to test the hypothesis, each firm's level of diversity was computed. This was achieved by calculating each firm's average specialisation ratio (a measure of diversity) over the period 1995 – 2004. The specialisation ratio was computed as the ratio of a firm's sales from its largest single business unit to the total sales of the firm for each year. A ten-year average was then computed for each company. Tables 4.3.1, 4.3.2 and 4.3.3 illustrate the computations for three of the twenty-three companies.

To compute the SR of Balfour Beatty Plc for the year 2001(refer to table 4.3.1) for example, sales figure of the business unit that recorded the highest sales (civil Engineering with a sales of 1, 150,000) was divided by the total sales of the firm in that year (3,057,000). The same was repeated for all the years and an average was then computed for the whole period to get the Average specialisation ratio (ASR). ASR values for other companies were computed in the same way. The computations for the

other companies are not presented only in the interest of brevity. The performance measures (i.e. ROE, ROTA, ROCE and PM) were obtained from the records of the OSIRIS database.

BALFOUR BEATTY PLC							
(previous name: BICC PLC until 5/10/2000)							
SEGMENT DATA							
Business lines							
	Sales	Total Sales	Specialisation Ratios	ROE%	ROTA%	ROCE %	Profit Margin%
12/31/2004 (in th GBP)							
CIVIL ENGINEERING	1,443,000	4,120,000	0.38	44.55	11.36	31.32	7.34
INVESTMENTS AND DEVELOPMENTS	288,000						
BUILDING	1,586,000						
RAIL ENGINEERING	803,000						
12/31/2003 (in th GBP)							
CIVIL ENGINEERING	1,393,000	3,575,000	0.39	29.87	6.68	31.56	3.73
INVESTMENTS AND DEVELOPMENTS	216,000						
BUILDING	1,093,000						
RAIL ENGINEERING	873,000						
12/31/2002 (in th GBP)							
CIVIL ENGINEERING	1,347,000	3,441,000	0.39	19.17	5.51	30.07	2.84
INVESTMENTS AND DEVELOPMENTS	133,000						
BUILDING	1,123,000						
RAIL ENGINEERING	838,000						
12/31/2001 (in th GBP)							
CIVIL ENGINEERING	1,150,000	3,057,000	0.38	32.45	6.91	34.95	3.80
INVESTMENTS AND DEVELOPMENTS	135,000						
BUILDING	1,074,000						
RAIL ENGINEERING	698,000						
12/31/2000 (in th GBP)							
CIVIL ENGINEERING	1,011,000	2,566,000	0.40	34.62	7.22	42.11	4.01
INVESTMENTS AND DEVELOPMENTS	99,000						
BUILDING	1,017,000						
RAIL ENGINEERING	439,000						
12/31/1999 (in th GBP)							
CABLES & WIRES	139,000	253,000	0.55	-481.71	-33.33	-117.19	-14.16
INVESTMENTS AND DEVELOPMENTS	114,000						
12/31/1998 (in th GBP)							
CABLES & WIRES	139,000	231,000	0.60	-77.39	-6.34	-3.15	-3.11
INVESTMENTS AND DEVELOPMENTS	92,000						
12/31/1997 (in th GBP)							
CIVIL ENGINEERING	2,202,000	4,537,000	0.49	-22.31	-1.37	2.76	-0.72
CABLES & WIRES	1,660,000						
INVESTMENTS AND DEVELOPMENTS	118,000						
METAL MANUFACTURING OTHER	557,000						
12/31/1996 (in th GBP)							
CIVIL ENGINEERING	2,118,000	4,573,000	0.53	-2.41	2.67	11.72	1.51
CABLES & WIRES	2,416,000						
INVESTMENTS AND DEVELOPMENTS	39,000						
12/31/1995 (in th GBP)							
CIVIL ENGINEERING	1,701,000	4,304,000	0.59	-30.82	-2.72	-1.02	-1.65
CABLES & WIRES	2,556,000						
INVESTMENTS AND DEVELOPMENTS	47,000						
		Average SR =	0.47				
		Status =	Highly Diversified				
			Averages	-45.40	-0.34	6.31	0.36

Table 4.3.1: Computation of ASR – Highly Diversified

MONTPELLIER GROUP PLC							
(previous name: YJL PLC until 4/4/2001)							
SEGMENT DATA							
Business lines							
	Sales	Total Sales	Specialisation Ratios	ROE%	ROTA %	ROCE %	Profit Margin%
9/30/2004 (in th GBP)							
CONSTRUCTION AND PLANT HIRE	454,718	461,695	0.98	-137.73	-4.17	-22.56	-1.51
REAL ESTATE MNG/DEVELOP	6,977						
9/30/2003 (in th GBP)							
CONSTRUCTION AND PLANT HIRE	431,506	436,529	0.99	14.68	2.56	11.82	1.08
REAL ESTATE MNG/DEVELOP	5,023						
9/30/2002 (in th GBP)							
CONSTRUCTION AND PLANT HIRE	438,777	447,856	0.98	14.76	2.88	13.14	1.09
REAL ESTATE MNG/DEVELOP	9,079						
9/30/2001 (in th GBP)							
CONSTRUCTION AND PLANT HIRE	295,206	300,107	0.98	15.23	2.24	14.30	1.14
REAL ESTATE MNG/DEVELOP	4,901						
9/30/2000 (in th GBP)							
REAL ESTATE MNG/DEVELOP	195,249	195,249	1.00	6.35	2.15	13.04	1.04
9/30/1999 (in th GBP)							
REAL ESTATE MNG/DEVELOP	243,730	243,730	1.00	41.45	10.56	31.91	3.49
9/30/1998 (in th GBP)							
REAL ESTATE MNG/DEVELOP	266,827	266,827	1.00	-28.06	-2.79	-5.97	-1.20
9/30/1997 (in th GBP)							
REAL ESTATE MNG/DEVELOP	226,736	226,736	1.00	-18.07	-1.33	0.14	-0.68
9/30/1996 (in th GBP)							
CONSTRUCTION AND PLANT HIRE	168,885	265,625	0.64	-71.45	-8.95	-16.42	-4.61
RESIDENTIAL CONSTRUCTION	96,740						
9/30/1995 (in th GBP)							
CONSTRUCTION AND PLANT HIRE	211,445	317,842	0.67	-111.58	-17.37	-29.48	-10.74
RESIDENTIAL CONSTRUCTION	106,397						
		Average SR =	0.92				
		Status =	MD				
			Averages	-27.44	-1.42	0.99	-1.09

Table 4.3.2: Computation of ASR – moderately diversified

BERKELEY GROUP HOLDINGS PLC (THE)							
Segment Data							
Business lines							
	Sales	Total sales	*Specialisation ratios*	ROE%	ROTA%	ROCE%	*Profit Margin%*
4/30/2004 (in th GBP)							
COMMERCIAL PROPERTY	142,281	1,272,443	0.89	14.19	14.68	19.52	18.09
RESIDENTIAL CONSTRUCTION	1,130,162						
4/30/2003 (in th GBP)							
COMMERCIAL PROPERTY	20,778	1,150,840	0.98	14.65	13.87	18.35	19.22
RESIDENTIAL CONSTRUCTION	1,130,062						
4/30/2002 (in th GBP)							
COMMERCIAL PROPERTY	59,239	1,085,098	0.95	14.13	12.75	18.09	20.08
RESIDENTIAL CONSTRUCTION	1,025,859						
4/30/2001 (in th GBP)							
COMMERCIAL PROPERTY	77,858	908,621	0.91	14.50	12.91	20.16	20.36
RESIDENTIAL CONSTRUCTION	830,763						
4/30/2000 (in th GBP)							
COMMERCIAL PROPERTY	38,816	835,053	0.95	13.44	13.08	19.68	17.97
RESIDENTIAL CONSTRUCTION	796,237						
4/30/1999 (in th GBP)							
COMMERCIAL PROPERTY	18,559	697,325	0.97	11.81	12.34	16.99	15.84
RESIDENTIAL CONSTRUCTION	678,766						
4/30/1998 (in th GBP)							
COMMERCIAL PROPERTY	10,129	599,596	0.98	11.88	12.33	17.39	16.73
RESIDENTIAL CONSTRUCTION	589,467						
4/30/1997 (in th GBP)							
COMMERCIAL PROPERTY	762	485,317	1.00	12.59	12.19	19.13	15.47
RESIDENTIAL CONSTRUCTION	484,555						
4/30/1996 (in th GBP)							
COMMERCIAL PROPERTY	10,703	334,251	0.97	9.06	9.39	13.62	12.98
RESIDENTIAL CONSTRUCTION	323,548						
4/30/1995 (in th GBP)							
COMMERCIAL PROPERTY	15,918	283,429	0.94	11.16	11.58	16.57	13.27
RESIDENTIAL CONSTRUCTION	267,511						
		Average SR =	0.96				
		Status =	Undiversified				
			Averages	12.74	12.51	17.95	17.00

Table 4.3.3: Computation of ASR - undiversified

The measures of performance used are the average return on equity (AROE), average return on total assets (AROTA), average return on Capital Employed (AROCE) and Average Profit Margin (APM). These measures were computed for each firm, for each year, over the period considered. Table 4.3.4 below shows each firm's average specialisation ratio and its average performance measures. It also shows each firm's ranking based on builders Magazine top 100 UK construction firms ranking.

Company Name	ASR	AROE%	ARTA%	AROCE%	APM%	Ranking
KELLER GROUP PLC	0.97	18.31	9.77	21.88	5.11	32
HENRY BOOT PLC	1.00	12.65	9.20	16.00	9.47	97
BIRSE GROUP PLC	0.97	-33.97	-0.99	-16.40	-0.35	37
PERSIMMON PLC	1.00	15.44	11.69	18.60	12.84	8
WESTBURY PLC	1.00	12.86	9.25	17.02	10.08	19
BARRATT DEVELOPMENTS PLC	1.00	17.55	12.46	23.75	11.12	5
MCCARTHY & STONE	1.00	17.67	16.77	25.26	31.26	52
BELLWAY PLC	1.00	16.70	13.92	21.53	14.45	17
BERKELEY GROUP HOLDINGS PLC (THE)	0.96	12.74	12.51	17.95	17.00	11
WILSON BOWDEN PLC	0.83	16.27	13.87	21.45	16.44	14
MONTPELLIER GROUP PLC	0.92	-27.44	-1.42	0.99	-1.09	40
GLEESON (M J) GROUP PLC	0.94	7.07	5.11	11.72	3.85	26
COSTAIN GROUP PLC	0.90	94.60	-1.53	48.12	-1.35	21
GALLIFORD TRY PLC	0.92	13.37	4.26	18.46	1.82	23
MOWLEM PLC	0.86	4.36	2.34	10.47	0.95	6
OPUS INTERNATIONAL GROUP PLC	0.87	8.73	8.08	13.40	9.25	-
MORGAN SINDALL PLC	0.79	23.25	6.43	31.01	2.02	15
KIER GROUP PLC	0.93	24.81	4.03	26.42	1.73	9
ROK PROPERTY SOLUTIONS PLC	0.86	12.13	4.44	12.66	1.82	42
LAING (JOHN) PLC	0.60	2.00	2.15	12.07	2.41	10
BALFOUR BEATTY PLC	0.47	-45.40	-0.34	6.31	0.36	2
TAYLOR WOODROW PLC	0.62	11.01	7.97	14.00	8.74	4
CREST NICHOLSON PLC	0.67	12.11	6.43	12.49	7.84	31

Table 4.3.4: Firms' diversity and performance (1995 - 2004)

To test the null hypothesis, two non-parametric tests of linear correlation were employed. These tests are the Kendall's tau-b and the Spearman's rho. For both tests, the ASR is correlated against each of the performance measures.

4.3.2 Correlation between ASR and AROE

Table 4.3.5 shows the results of the correlation between ASR and AROE. The Kendall's tau-b statistic shows a correlation coefficient of 0.258 with a significance level of 0.093. The positive sign of correlation coefficient implies that ASR is positively related to AROE. The small absolute value of the coefficient implies that the strength of the relationship is weak and the high significance level implies that the correlation is not significant and ASR and AROE are not linearly related. According to the test, the

significance level has to be lower than 0.05 for the association between the two variables to be significant and linear (SPSS version 10).

Table 4.3.5: Correlation between ASR and AROE

Correlations (ASR and AROE)

			ASR	AROE
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.258
		Sig. (2-tailed)	.	.093
		N	23	23
	AROE	Correlation Coefficient	.258	1.000
		Sig. (2-tailed)	.093	.
		N	23	23
Spearman's rho	ASR	Correlation Coefficient	1.000	.378
		Sig. (2-tailed)	.	.076
		N	23	23
	AROE	Correlation Coefficient	.378	1.000
		Sig. (2-tailed)	.076	.
		N	23	23

It is important to note that by its very definition, ASR of undiversified firms is higher than that of moderately diversified firms which in turn is higher than that of highly diversified firms. In essence, the level of diversity increases as the ASR decreases. Hence, the positive correlation observed between ASR and AROE implies in effect a negative correlation between a firm's level of diversity and its performance based on AROE. The result of the Spearman's rho is in the same direction. The relationship is therefore negative, insignificant and non-linear. Based on these, the null hypothesis has to be accepted. Hence, there is no negative linear relationship between a firm's level of diversity and its performance based on AROE.

4.3.3 Correlation between ASR and AROTA

The correlation coefficients of both the Kendall's tau-b and Spearman's rho are positive, implying that the relationship between ASR and AROTA is in the positive direction. Again, since a firm's ASR and its average level of diversity have an inverse relationship, the association between a firm's level of diversity and its AROTA is negative. The strength of the relationship is indicated by the absolute values of the correlation coefficients (0.362 and 0.510 for Kendall's tau-b and Spearman's rho respectively). Both coefficients indicate that the strength of association between ASR

and AROTA is greater than that between ASR and AROE. Table 4.3.6 shows the results of the test of correlation between ASR and AROTA.

Table 4.3.6: Correlation between ASR and AROTA

Correlations (ASR and AROTA)

			ASR	AROTA
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.362*
		Sig. (2-tailed)	.	.019
		N	23	23
	AROTA	Correlation Coefficient	.362*	1.000
		Sig. (2-tailed)	.019	.
		N	23	23
Spearman's rho	ASR	Correlation Coefficient	1.000	.510*
		Sig. (2-tailed)	.	.013
		N	23	23
	AROTA	Correlation Coefficient	.510*	1.000
		Sig. (2-tailed)	.013	.
		N	23	23

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

The low values of the significant level indicate that the relationship between the two variables is significant and linear. It follows therefore that the relationship between a firm's level of diversity and its performance based on AROTA is negative, significant and linear, though not very strong because of relatively low values for the correlation coefficient. The results are significant at the 10% confidence level. Based on these, the null hypothesis has to be rejected and the alternative hypothesis has to be accepted.

4.3.4 Correlation between ASR and AROCE

Table 4.3.7 shows the results of the tests of correlation between ASR and AROCE. Although the results show a positive relationship between ASR and AROCE, the strength of the relationship is weak and insignificant and non-linear. Based on this, the null hypothesis has to be accepted.

Table 4.3.7: Correlation between ASR and AROCE

Correlations (ASR and AROCE)

			ASR	AROCE
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.226
		Sig. (2-tailed)	.	.142
		N	23	23
	AROCE	Correlation Coefficient	.226	1.000
		Sig. (2-tailed)	.142	.
		N	23	23
Spearman's rho	ASR	Correlation Coefficient	1.000	.330
		Sig. (2-tailed)	.	.124
		N	23	23
	AROCE	Correlation Coefficient	.330	1.000
		Sig. (2-tailed)	.124	.
		N	23	23

4.3.5 Correlation between ASR and AROCE

Again, the results of correlation between ASR and APM as shown on Table 4.3.8 are in the same direction as the correlation between ASR and AROTA. Hence, with regards to APM, the null hypothesis has to be rejected and the research hypothesis has to be accepted.

Table 4.3.8: Correlation between ASR and APM

Correlations (ASR and APM)

			ASR	APM
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.312*
		Sig. (2-tailed)	.	.042
		N	23	23
	APM	Correlation Coefficient	.312*	1.000
		Sig. (2-tailed)	.042	.
		N	23	23
Spearman's rho	ASR	Correlation Coefficient	1.000	.450*
		Sig. (2-tailed)	.	.031
		N	23	23
	APM	Correlation Coefficient	.450*	1.000
		Sig. (2-tailed)	.031	.
		N	23	23

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

Overall, the results indicate that firms with low average diversity (high ASR) are associated with high average performance based on AROTA and APM. The results are less clear in terms of AROE and AROCE. By pulling the results of the correlation between ASR and the four measures of performance together, it can be concluded that

in general, there is a negative linear relationship between a firm's average level of diversity and average performance based on AROTA and APM. Based on these measures, the null hypothesis is rejected. However, the null hypothesis is accepted with regards to the nature of relationship between diversity and performance based on AROE and AROCE.

4.4 Analyses of performance differences (based on product diversification)

Analyses of the performance differences across the three diversification groups require a test of the null hypotheses H3o and H4o. In order to test these hypotheses, all firms in the sample were first classified into one of three groups; undiversified, moderately diversified and highly diversified. The classification was based on Rumelt's specialisation scheme. Tables 4.4.1, 4.4.2 and 4.4.3 show the results of the classification.

Table 4.4.1: The undiversified group

Classification Based on Rumelt's Scheme (1995 - 2004): Undiversified Group ($ASR \geq 0.95$)	
Company Name	ASR
KELLER GROUP PLC	0.97
HENRY BOOT PLC	1.00
BIRSE GROUP PLC	0.97
PERSIMMON PLC	1.00
WESTBURY PLC	1.00
BARRATT DEVELOPMENTS PLC	1.00
MCCARTHY & STONE	1.00
BELLWAY PLC	1.00
BERKELEY GROUP HOLDINGS PLC (THE)	0.96

Figure 4.4.1: Trend in diversification – undiversified firms

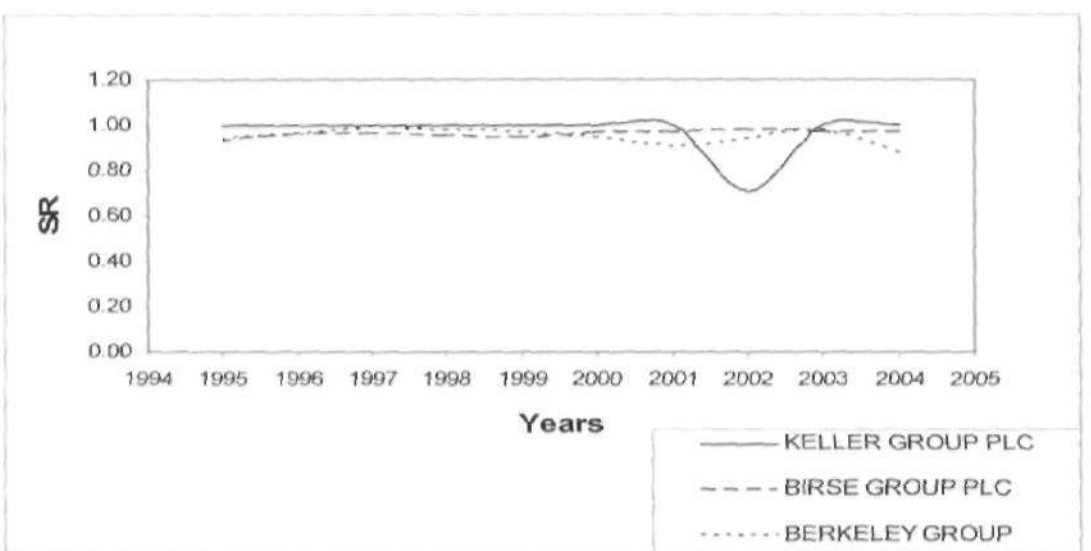


Figure 4.4.1 shows the trend in diversification among undiversified firms. The trend in diversification of six of the firms was not shown because these firms have a constant SR value of 1 throughout the ten-year period. Figures 4.4.2 and 4.4.3 show the trend in diversification of moderately diversified and highly diversified firms respectively.

Table 4.4.2: The moderately diversified group

Classification Based on Rumelt's Scheme (1995 - 2004): Moderately diversified Group ($0.7 \leq ASR < 0.95$)	
Company Name	ASR
WILSON BOWDEN PLC	0.83
MONTPELLIER GROUP PLC	0.92
GLEESON (M J) GROUP PLC	0.94
COSTAIN GROUP PLC	0.90
GALLIFORD TRY PLC	0.92
MOWLEM PLC	0.86
OPUS INTERNATIONAL GROUP PLC	0.87
MORGAN SINDALL PLC	0.79
KIER GROUP PLC	0.93
ROK PROPERTY SOLUTIONS PLC	0.86

Figure 4.4.2: Trend in diversification – moderately diversified firms

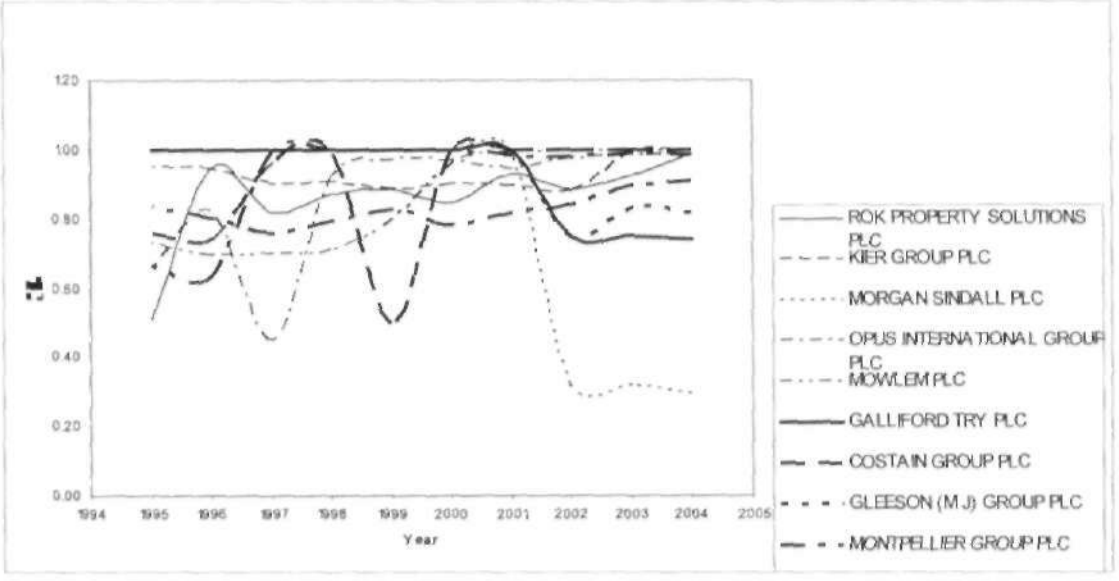
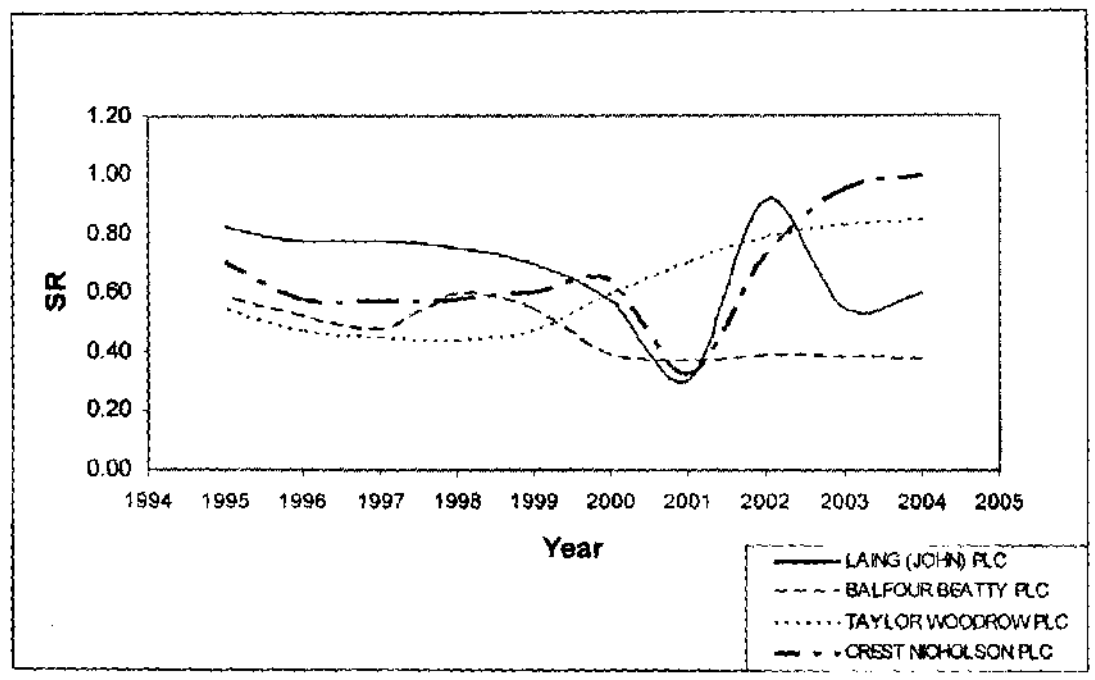


Table 4.4.3: The highly diversified group

Classification Based on Rumelt's Scheme (1995 - 2004): Highly diversified Group ($ASR < 0.7$)	
Company Name	ASR
LAING (JOHN) PLC	0.68
BALFOUR BEATTY PLC	0.47
TAYLOR WOODROW PLC	0.62
CREST NICHOLSON PLC	0.67

Figure 4.4.3: Trend in diversification – Highly diversified firms



By Rumelt's classification scheme, 39.1% (9 firms) of the firms studied are focused (undiversified), 43.5% (10 firms) are moderately diversified and 17.4% (4 firms) are highly diversified.

Once the firms were classified into the three diversification groups, each group's average annual performance was determined. This was achieved by calculating each group's average annual return on equity (AROE), return on total assets (AROTA), return on capital employed (AROCE) and average profit margin (APM). Tables 4.4.4 through to table 4.4.7 show the computations of the average annual performance measures of the undiversified group. Tables 4.4.8 through to table 4.4.11 show the computations for the moderately diversified group while table 4.4.12 through to 4.4.15 show the computations of the highly diversified group.

Table 4.4.4: Average annual performance of the undiversified group (ROE)

Yearly Performance of the groups Undiversified Group: ROE%										
COMPANY	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
KELLER GROUP PLC	13.96	2.45	17.11	18.50	17.21	23.86	23.77	24.97	24.14	17.13
HENRY BOOT PLC	8.26	22.28	13.70	11.97	12.00	11.99	12.18	11.71	11.21	11.22
BIRSE GROUP PLC	28.27	10.54	62.26	-455.00	9.18	6.24	12.82	7.23	4.00	-25.22
PERSIMMON PLC	22.67	20.79	18.84	14.68	17.35	15.85	13.97	12.86	9.21	8.13
WESTBURY PLC	16.95	15.25	15.07	14.86	14.37	13.38	13.44	10.92	6.02	8.31
BARRATT DEVELOPMENTS PLC	23.34	22.71	20.82	20.08	18.95	17.02	15.80	12.88	10.72	13.17
MCCARTHY & STONE	28.91	26.28	21.51	20.35	21.34	17.10	14.59	11.49	7.28	7.81
BELLWAY PLC	21.03	20.94	18.68	17.59	17.88	15.68	15.77	15.15	11.31	12.97
BERKELEY GROUP HOLDINGS PLC (THE)	14.19	14.65	14.13	14.50	13.44	11.81	11.88	12.59	9.06	11.16
Average ROE	**19.73**	**17.32**	**22.46**	**-35.83**	**15.75**	**14.77**	**14.91**	**13.31**	**10.33**	**7.19**

Table 4.4.5: Average annual performance of the undiversified group (ROTA)

Yearly Performance of the groups										
Undiversified Group: ROTA%										
COMPANY	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
KELLER GROUP PLC	8.22	4.69	8.49	8.44	8.82	13.43	12.68	12.09	10.89	9.99
HENRY BOOT PLC	7.94	17.84	10.28	8.26	7.53	7.89	8.97	7.81	7.81	7.63
BIRSE GROUP PLC	1.13	0.71	3.77	-19.39	2.43	1.41	2.76	1.20	0.68	-4.64
PERSIMMON PLC	19.23	17.25	14.50	9.69	13.20	11.75	9.68	9.49	5.92	6.20
WESTBURY PLC	11.73	9.05	11.25	11.16	10.69	9.54	9.66	7.99	4.54	6.89
BARRATT DEVELOPMENTS PLC	16.18	15.13	13.45	13.60	13.47	12.29	12.10	10.68	8.58	9.08
MCCARTHY & STONE	25.36	24.31	20.44	18.52	20.26	17.89	15.28	12.00	7.12	6.52
BELLWAY PLC	17.23	16.99	14.65	14.67	15.44	12.74	13.29	12.78	9.83	11.59
BERKELEY GROUP HOLDINGS PLC (THE)	14.68	13.87	12.75	12.91	13.08	12.34	12.33	12.19	9.39	11.58
Average ROTA	13.52	13.32	12.18	8.65	11.66	11.03	10.75	9.58	7.20	7.20

Table 4.4.6: Average annual performance of the undiversified group (ROCE)

Yearly Performance of the groups Undiversified Group: ROCE%										
COMPANY	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
KELLER GROUP PLC	16.99	11.41	17.49	18.10	20.46	28.93	27.59	28.34	26.51	31.75
HENRY BOOT PLC	12.53	24.20	16.91	15.46	14.32	17.09	17.01	14.70	14.23	14.62
BIRSE GROUP PLC	11.79	7.80	41.84	-268.35	12.99	10.66	13.23	7.82	6.12	-0.75
PERSIMMON PLC	28.33	25.48	22.47	16.12	20.28	18.23	17.44	15.75	10.33	10.29
WESTBURY PLC	20.12	23.28	19.34	19.01	18.33	18.71	16.31	15.50	8.04	11.13
BARRATT DEVELOPMENTS PLC	31.26	30.36	25.98	26.76	25.74	24.44	22.04	18.40	16.15	15.69
MCCARTHY & STONE	41.96	37.25	31.06	28.11	29.17	25.00	21.29	17.76	11.08	9.91
BELLWAY PLC	25.08	24.31	23.96	23.49	23.54	20.21	21.12	20.55	15.47	17.08
BERKELEY GROUP HOLDINGS PLC (THE)	19.52	18.35	18.09	20.16	19.68	16.99	17.39	19.13	13.62	15.95
Average ROCE	**23.06**	**22.49**	**24.13**	**-11.24**	**20.50**	**20.03**	**19.27**	**17.55**	**13.51**	**13.96**

Table 4.4.7: Average annual performance of the undiversified group (PM)

Yearly Performance of the groups Undiversified Group: Profit Margin%										
COMPANY	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
KELLER GROUP PLC	4.41	2.60	5.36	5.31	4.94	6.04	6.26	5.74	5.34	5.10
HENRY BOOT PLC	18.80	28.27	7.89	5.79	5.44	5.48	6.15	6.24	5.79	4.85
BIRSE GROUP PLC	0.47	0.25	1.38	-7.02	1.13	0.61	1.16	0.49	0.31	-2.29
PERSIMMON PLC	21.56	18.15	15.01	11.29	14.02	11.72	10.58	9.60	7.33	9.12
WESTBURY PLC	12.12	10.53	12.69	12.65	11.25	10.20	10.05	7.96	5.94	7.45
BARRATT DEVELOPMENTS PLC	14.61	13.30	12.23	11.82	11.51	11.10	10.48	9.81	8.21	8.13
MCCARTHY & STONE	45.90	44.34	39.50	35.74	35.86	31.03	26.24	22.93	17.57	13.49
BELLWAY PLC	18.81	17.74	16.22	14.58	14.05	13.49	13.65	12.65	10.55	12.73
BERKELEY GROUP HOLDINGS PLC (THE)	18.09	19.22	20.08	20.36	17.97	15.84	16.73	15.47	12.98	13.27
Average Profit Margin	**17.20**	**17.16**	**14.48**	**12.28**	**12.91**	**11.72**	**11.26**	**10.10**	**8.22**	**7.98**

Table 4.4.8: Average annual performance of the moderately diversified group (ROE)

Yearly Performance of the groups Moderately Diversified Group: ROE%	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
ROK PROPERTY SOLUTIONS PLC	22.12	24.82	11.16	14.72	1.83	12.70	11.70	9.43	7.44	5.38
KIER GROUP PLC	24.57	25.48	27.25	27.68	29.44	29.55	27.91	19.93	17.92	18.40
MORGAN SINDALL PLC	19.36	18.83	14.60	22.03	24.40	20.80	32.08	31.51	28.99	19.90
OPUS INTERNATIONAL GROUP PLC	9.36	20.26	22.43	2.02	21.18	14.83	-50.58	3.79	20.94	23.05
MOWLEM PLC	-6.42	18.22	13.71	12.76	8.23	13.77	16.67	-18.68	11.32	-26.01
GALLIFORD TRY PLC	21.61	15.95	22.87	7.11	20.58	14.43	12.55	8.53	4.88	5.17
COSTAIN GROUP PLC	-41.30	-35.97	-44.81	202.44	20.08	17.07	0.54	-41.88	390.18	479.60
GLEESON (M J) GROUP PLC	8.80	3.90	6.81	9.20	8.54	7.52	7.97	6.21	5.92	5.83
MONTPELLIER GROUP PLC	-137.73	14.68	14.76	15.23	6.35	41.45	-28.06	-18.07	-71.45	-111.58
WILSON BOWDEN PLC	19.24	20.01	19.40	17.75	18.12	17.51	17.74	15.10	10.19	7.61
Average ROE	**-6.04**	**12.62**	**10.82**	**33.09**	**15.88**	**18.96**	**4.85**	**1.59**	**42.63**	**42.74**

Table 4.4.9: Average annual performance of the moderately diversified group (ROTA)

Yearly Performance of the groups Moderately Diversified Group: ROTA%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
ROK PROPERTY SOLUTIONS PLC	5.76	7.07	3.40	6.40	0.31	5.36	5.24	4.25	3.86	2.72
KIER GROUP PLC	5.63	5.01	4.76	4.44	4.10	3.66	3.31	3.34	2.93	3.11
MORGAN SINDALL PLC	6.73	6.01	4.94	7.19	7.60	6.22	8.16	7.14	5.56	4.74
OPUS INTERNATIONAL GROUP PLC	6.27	15.27	15.56	2.48	14.78	3.63	-13.57	4.68	12.52	19.16
MOWLEM PLC	-1.80	5.78	4.54	4.28	3.14	5.74	5.98	-2.04	2.85	-5.11
GALLIFORD TRY PLC	7.48	4.62	7.02	1.95	6.32	4.75	4.26	3.18	1.50	1.52
COSTAIN GROUP PLC	7.63	7.25	5.54	4.90	4.03	4.06	0.23	-2.57	-16.34	-30.01
GLEESON (M J) GROUP PLC	4.29	2.68	4.59	5.92	5.62	5.87	6.41	5.16	5.18	5.40
MONTPELLIER GROUP PLC	-4.17	2.56	2.88	2.24	2.15	10.56	-2.79	-1.33	-8.95	-17.37
WILSON BOWDEN PLC	16.72	15.09	14.62	14.57	15.38	14.94	15.29	13.94	9.74	8.41
Average ROTA	**5.45**	**7.13**	**6.79**	**5.44**	**6.34**	**6.48**	**3.25**	**3.58**	**1.89**	**-0.74**

Table 4.4.10: Average annual performance of the moderately diversified group (ROCE)

Yearly Performance of the groups Moderately Diversified Group: ROCE%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
ROK PROPERTY SOLUTIONS PLC	19.97	22.22	8.98	14.98	0.95	14.09	15.44	12.40	9.91	7.66
KIER GROUP PLC	23.97	21.28	28.54	30.01	30.41	31.60	31.52	23.64	22.36	20.87
MORGAN SINDALL PLC	31.98	29.98	24.16	32.68	33.86	26.74	42.58	38.15	28.54	21.45
OPUS INTERNATIONAL GROUP PLC	10.45	23.44	20.62	4.41	21.01	15.39	-22.36	10.28	17.99	32.80
MOWLEM PLC	-2.23	22.35	17.62	14.53	14.57	18.78	16.84	-2.63	12.49	-7.61
GALLIFORD TRY PLC	32.87	23.68	27.93	11.42	25.61	19.38	17.99	10.52	7.59	7.63
COSTAIN GROUP PLC	53.48	64.13	89.13	91.84	83.70	300.00	3.48	-6.20	-47.58	-150.77
GLEESON (M J) GROUP PLC	13.60	8.41	12.45	16.20	13.99	12.81	12.46	9.80	8.52	9.00
MONTPELLIER GROUP PLC	-22.56	11.82	13.14	14.30	13.04	31.91	-5.97	0.14	-16.42	-29.48
WILSON BOWDEN PLC	25.12	24.34	24.20	22.11	22.50	22.95	24.23	21.75	15.75	11.54
Average ROCE	**18.67**	**25.17**	**26.68**	**25.25**	**25.96**	**49.37**	**13.62**	**11.79**	**5.92**	**-7.69**

Table 4.4.11: Average annual performance of the moderately diversified group (PM)

Yearly Performance of the groups Moderately Diversified Group: Profit Margin%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
ROK PROPERTY SOLUTIONS PLC	2.10	2.66	2.04	3.00	0.11	1.86	1.93	1.72	1.57	1.21
KIER GROUP PLC	2.81	2.35	2.04	1.78	1.72	1.45	1.46	1.27	1.19	1.20
MORGAN SINDALL PLC	2.29	1.84	1.49	2.28	2.34	1.93	2.29	2.18	1.82	1.71
OPUS INTERNATIONAL GROUP PLC	6.10	13.72	15.70	2.59	12.09	4.54	-18.61	5.86	21.96	28.53
MOWLEM PLC	-0.74	2.26	1.71	1.74	1.13	2.55	2.65	-0.88	1.19	-2.07
GALLIFORD TRY PLC	3.30	2.12	2.78	0.86	2.61	1.95	2.14	1.27	0.60	0.54
COSTAIN GROUP PLC	2.90	2.58	2.16	1.88	1.69	1.70	0.13	-1.30	-8.35	-16.88
GLEESON (M J) GROUP PLC	2.73	1.52	2.60	4.40	4.53	4.38	5.03	4.76	4.28	4.30
MONTPELLIER GROUP PLC	-1.51	1.08	1.09	1.14	1.04	3.49	-1.20	-0.68	-4.61	-10.74
WILSON BOWDEN PLC	20.10	19.15	18.17	17.63	16.61	16.48	16.38	14.58	12.35	12.97
Average Profit Margin	**4.01**	**4.93**	**4.98**	**3.73**	**4.39**	**4.03**	**1.22**	**2.88**	**3.20**	**2.08**

Table 4.4.12: Average annual performance of the highly diversified group (ROE)

Yearly Performance of the groups										
Highly Diversified Group: ROE%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
LAING (JOHN) PLC	11.08	4.74	-26.20	-17.31	0.12	16.24	5.89	10.97	8.11	6.34
BALFOUR BEATTY PLC	44.55	29.87	19.17	32.45	34.62	-481.71	-77.39	-22.31	-2.41	-30.82
TAYLOR WOODROW PLC	16.02	12.66	11.03	9.95	15.75	11.28	9.98	9.17	8.66	5.64
CREST NICHOLSON PLC	16.72	17.32	16.96	15.37	15.59	14.12	10.76	8.35	3.56	2.31
Average ROE	**22.09**	**16.15**	**5.24**	**10.12**	**16.52**	**-110.02**	**-12.69**	**1.55**	**4.48**	**-4.13**

Table 4.4.13: Average annual performance of the highly diversified group (ROTA)

Yearly Performance of the groups										
Highly Diversified Group: ROTA%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
LAING (JOHN) PLC	3.23	3.18	-1.82	-3.46	0.73	6.28	2.57	4.07	3.64	3.12
BALFOUR BEATTY PLC	11.36	6.68	5.51	6.91	7.22	-33.33	-6.34	-1.37	2.67	-2.72
TAYLOR WOODROW PLC	11.52	8.37	9.10	8.60	12.24	8.00	6.95	6.03	5.33	3.58
CREST NICHOLSON PLC	7.85	8.77	7.87	6.84	8.10	7.71	6.02	5.63	3.38	2.12
Average ROTA	**8.49**	**6.75**	**5.17**	**4.72**	**7.07**	**-2.84**	**2.30**	**3.59**	**3.76**	**1.53**

Table 4.4.14: Average annual performance of the highly diversified group (ROCE)

Yearly Performance of the groups										
Highly Diversified Group: ROCE%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
LAING (JOHN) PLC	16.34	17.96	17.37	2.64	5.53	20.78	9.10	12.65	9.68	8.62
BALFOUR BEATTY PLC	31.32	31.56	30.07	34.95	42.11	-117.19	-3.15	2.76	11.72	-1.02
TAYLOR WOODROW PLC	20.17	13.56	14.11	15.08	20.04	13.89	12.53	11.48	10.96	8.22
CREST NICHOLSON PLC	12.85	15.95	13.68	13.89	16.01	15.25	11.69	11.47	8.09	5.98
Average ROCE	**20.17**	**19.76**	**18.81**	**16.64**	**20.92**	**-16.82**	**7.54**	**9.59**	**10.11**	**5.45**

Table 4.4.15: Average annual performance of the highly diversified group (PM)

Yearly Performance of the groups										
Highly Diversified Group: Profit Margin%										
	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
COMPANY										
LAING (JOHN) PLC	9.77	8.53	-2.54	-2.78	0.43	3.37	1.36	2.28	2.00	1.69
BALFOUR BEATTY PLC	7.34	3.73	2.84	3.80	4.01	-14.16	-3.11	-0.72	1.51	-1.65
TAYLOR WOODROW PLC	11.62	11.26	10.55	9.46	13.09	8.31	7.16	6.34	5.61	3.98
CREST NICHOLSON PLC	13.00	13.23	9.18	8.72	8.82	7.91	6.15	6.22	3.12	2.06
Average Profit Margin	**10.43**	**9.19**	**5.01**	**4.80**	**6.59**	**1.36**	**2.89**	**3.53**	**3.06**	**1.52**

Table 4.4.16: Summary of performance (ROE)

	Year	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Return on Equity	Undiversified Group	19.73	17.32	22.46	-35.83	15.75	14.77	14.91	13.31	10.33	7.19
	Moderately Diversified Group	-6.04	12.62	10.82	33.09	15.88	18.96	4.85	1.59	42.63	42.74
	Highly Diversified Group	22.09	16.15	5.24	10.12	16.52	-110.02	-12.69	1.55	4.48	-4.13

Table 4.4.17: Summary of performance (ROTA)

	Year	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Return on Total Assets	Undiversified Group	13.52	13.32	12.18	8.65	11.66	11.03	10.75	9.58	7.20	7.20
	Moderately Diversified Group	5.45	7.13	6.79	5.44	6.34	6.48	3.25	3.58	1.89	-0.74
	Highly Diversified Group	8.49	6.75	5.17	4.72	7.07	-2.84	2.30	3.59	3.76	1.53

Table 4.4.18: Summary of performance (ROCE)

	Year	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Return on Capital Employed	Undiversified Group	23.06	22.49	24.13	-11.24	20.50	20.03	19.27	17.55	13.51	13.96
	Moderately Diversified Group	18.67	25.17	26.68	25.25	25.96	49.37	13.62	11.79	5.92	-7.69
	Highly Diversified Group	20.17	19.76	18.81	16.64	20.92	-16.82	7.54	9.59	10.11	5.45

Table 4.4.19: Summary of performance (PM)

	Year	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Profit Margin	Undiversified Group	17.20	17.16	14.48	12.28	12.91	11.72	11.26	10.10	8.22	7.98
	Moderately Diversified Group	4.01	4.93	4.98	3.73	4.39	4.03	1.22	2.88	3.20	2.08
	Highly Diversified Group	10.43	9.19	5.01	4.80	6.59	1.36	2.89	3.53	3.06	1.52

4.4.1 Undiversified Vs moderately and highly diversified firms

Null hypothesis (H3o): There is no performance difference between undiversified firms and moderately and highly diversified firms.

To test the null hypothesis, the non parametric t-statistic was employed to compare the differences in means of the four performance measures between the undiversified group and the moderately diversified group, and between the undiversified group and the highly diversified group. First, performance was compared based on average annual ROE. Table 4.4.16 summarises the average annual ROE of the three diversification groups.

First, the average annual ROE of the undiversified group was compared with that of the moderately diversified group. The results are presented in table 4.4.20. All tests are at 5% significance level.

Table 4.4.20: Test statistic – undiversified Vs moderately diversified (ROE)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

		Undiversified Group	*Moderately Diversified Group*
Mean		9.993555556	17.7136
Variance		278.0868405	283.5259485
Observations		10	10
Hypothesized	Mean		
Difference		0	
df		18	
t Stat		-1.030151991	
P(T<=t) one-tail		0.158291493	
t Critical one-tail		1.734063062	

According to the t-statistic, a significant difference exists between the two variables if the calculated value of t (t stat) is greater than or equal to the critical value. From the results, the value of the t stat (-1.030151991) is less than the critical value of t (1.734063062). Hence, it can be deduced from the results that there is no significant difference between the undiversified group and the moderately diversified group in terms of performance, based on average annual return on equity.

Table 4.4.21: Test statistic – undiversified Vs highly diversified (ROE)

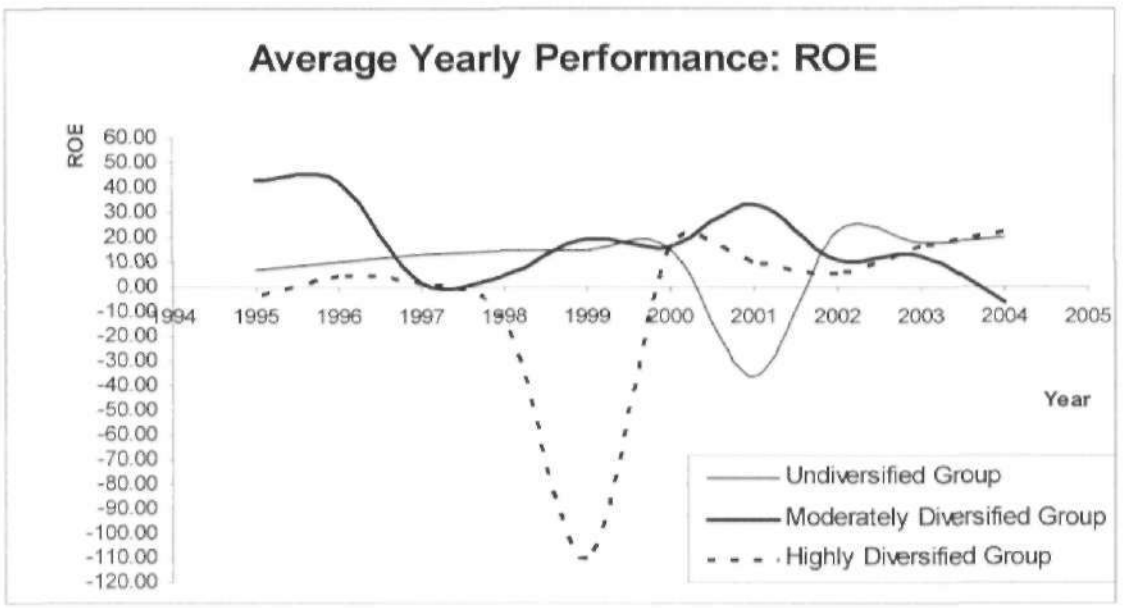
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Undiversified Group	*Highly Diversified Group*
Mean	9.993555556	-5.07
Variance	278.0868405	1466.541547
Observations	10	10
Hypothesized Mean Difference	0	
df	12	
t Stat	1.140449413	
P(T<=t) one-tail	0.138174924	
t Critical one-tail	1.782286745	

The results are in the same direction when the undiversified group is compared with the highly diversified group. The value of the calculated t is less than the t critical. Hence there is no performance difference between the undiversified and highly diversified groups. Therefore, the null hypothesis has to be accepted in both cases.

To appreciate the results of the t-statistic, figure 4.4.1 shows a graphic comparison of the average annual ROE of the three groups. There is apparently no clear mean difference between the undiversified group and any of the other groups. The value of the ROE in 1999 may be an outlier. Such outliers are dealt with in the second part of the analysis.

Figure 4.4.1: Average annual performance (ROE)



The second performance measure considered is the average annual return on total assets (AROTA). Table 4.4.17 summarises the average annual ROTA of the three diversification groups.

Table 4.4.22 shows the result of the test of the differences in means between the undiversified group and the moderately diversified group.

Table 4.4.22: Test statistic – undiversified Vs moderately diversified (ROTA)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Assets

	Undiversified Group	*Moderately Diversified Group*
Mean	*10.50844444*	*4.5601*
Variance	5.288418711	6.440515433
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	5.492459142	
P(T<=t) one-tail	1.61944E-05	
t Critical one-tail	1.734063062	

The calculated value of the t statistic (5.492459142) is higher than the critical value of t (1.734063062). This suggests that there is a significant difference between the mean of the undiversified group and that of the moderately diversified group. The very low significance value (1.61944E-05) suggests that the probability of the results being due to chance is less than 5%. We can therefore conclude with confidence that the undiversified group outperforms the moderately diversified group based on AROTA.

Table 4.4.23: Test statistic – undiversified Vs highly diversified (ROTA)

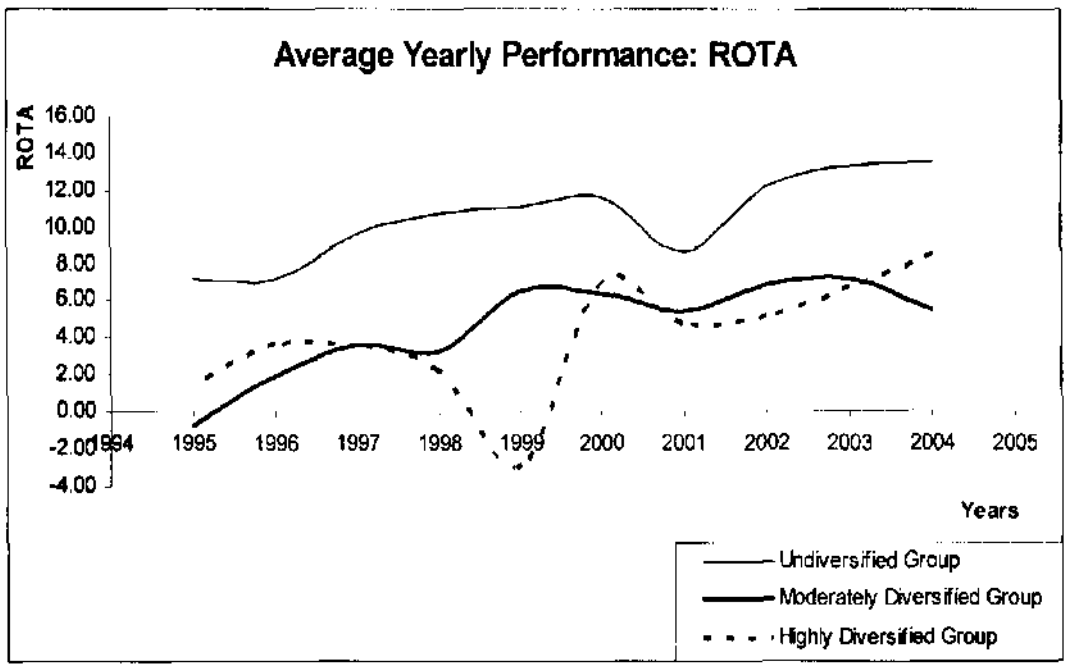
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Assets

	Undiversified Group	*Highly Diversified Group*
Mean	10.50844444	4.0535
Variance	*5.288418711*	*10.55271556*
Observations	10	10
Hypothesized Mean Difference	0	
df	16	
t Stat	5.128606416	
P(T<=t) one-tail	5.0532E-05	
t Critical one-tail	1.745884219	

The result is similar and in the same direction when the undiversified group is compared with the highly diversified group. Table 4.4.23 shows the result of this comparison. Since the undiversified group has the highest mean value, it has to be concluded that the moderately and highly diversified group perform less well than the undiversified group in terms of AROTA. Based on this, the null hypothesis has to be rejected and the research hypothesis has to be accepted.

To have a clearer picture of the performance differences across the groups, figure 4.4.2 below shows a graphic presentation of the average annual return on total assets.

Figure 4.4.2: Average annual performance (ROTA)



It is clear from the graph that the results of the t-test hold. The undiversified group has higher average annual ROTA than the other groups.

The next performance measure considered is the average annual return on capital employed (AROCE). Table 4.4.18 summarises the average annual ROCE of the three diversification groups.

Table 4.4.24 shows the result of the test of difference in means between the undiversified and moderately diversified groups.

Table 4.4.24: Test statistic – undiversified Vs moderately diversified (ROCE)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Undiversified Group	*Moderately Diversified Group*
Mean	16.32639198	19.4714
Variance	106.5440187	229.8909107
Observations	10	10
Hypothesized Mean Difference	0	
df	16	
t Stat	-0.542214614	
P(T<=t) one-tail	0.297571274	
t Critical one-tail	1.745884219	

From the results, the calculated value of t is less than the critical value. This implies that there is no significant difference between the two groups.

Table 4.4.25: Test statistic – undiversified Vs highly diversified (ROCE)

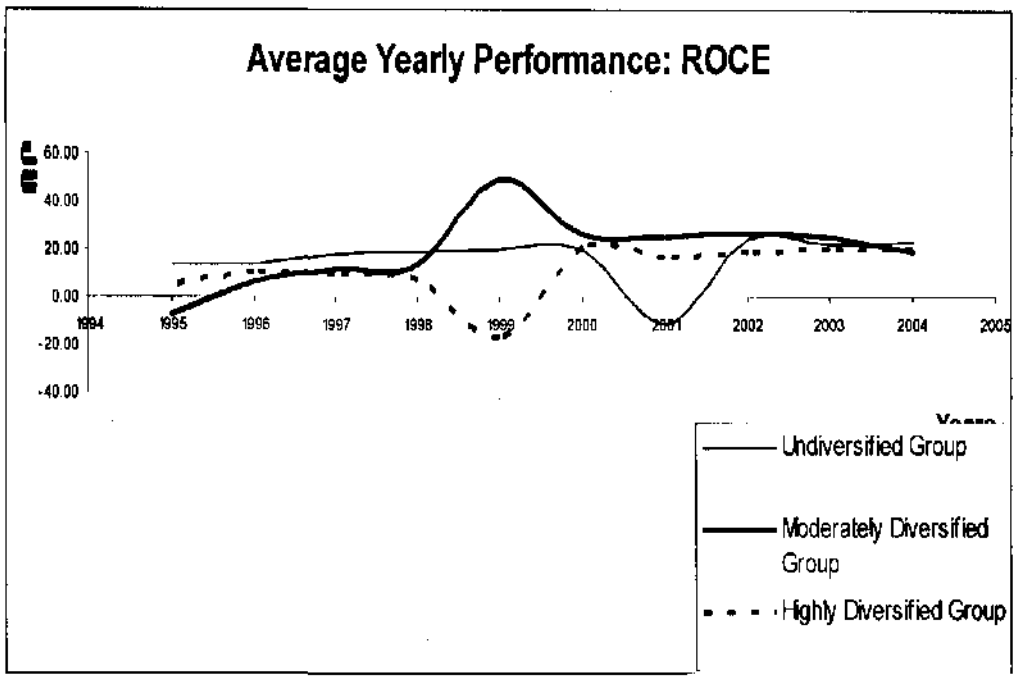
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Undiversified Group	*Highly Diversified Group*
Mean	16.32639198	11.2175
Variance	106.5440187	130.097575
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	1.050222163	
P(T<=t) one-tail	0.153756277	
t Critical one-tail	1.734063062	

When average annual performance of the undiversified group is compared with that of the highly diversified group, the calculated value of t is less than the critical value. Hence no significant difference exists between the means of the two groups. Therefore the null hypothesis has to be accepted in this regard.

Figure 4.4.3 shows a graphical presentation of the average annual ROCE of the three groups of diversification.

Figure 4.4.3: Average annual performance (ROCE)



It is apparent from figure 4.4.3 that there is no clear mean difference between the undiversified group and any of the other groups.

The last performance measure considered is the average annual profit margin. Table 4.4.19 summarises the average annual PM of the three diversification groups. Table 4.4.24 presents the results of the test of mean differences between the undiversified group and the moderately diversified group based on the profit margin.

Table 4.4.24: Test statistic – undiversified Vs moderately diversified (PM)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Moderately Diversified Group*
Mean	12.331	3.5439
Variance	10.46642317	1.4762701
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	8.04071057	
P(T<=t) one-tail	3.11212E-06	
t Critical one-tail	1.795883691	

The calculated value of the t statistic 8.04071057) is greater than the critical value of t. This implies that the difference in mean between the mean values of the two groups is

significant. Also, the very low p-value (3.11212E-06) indicates that it is unlikely that the result obtained is due to chance.

Table 4.4.25: Test statistic – undiversified Vs highly diversified (PM)

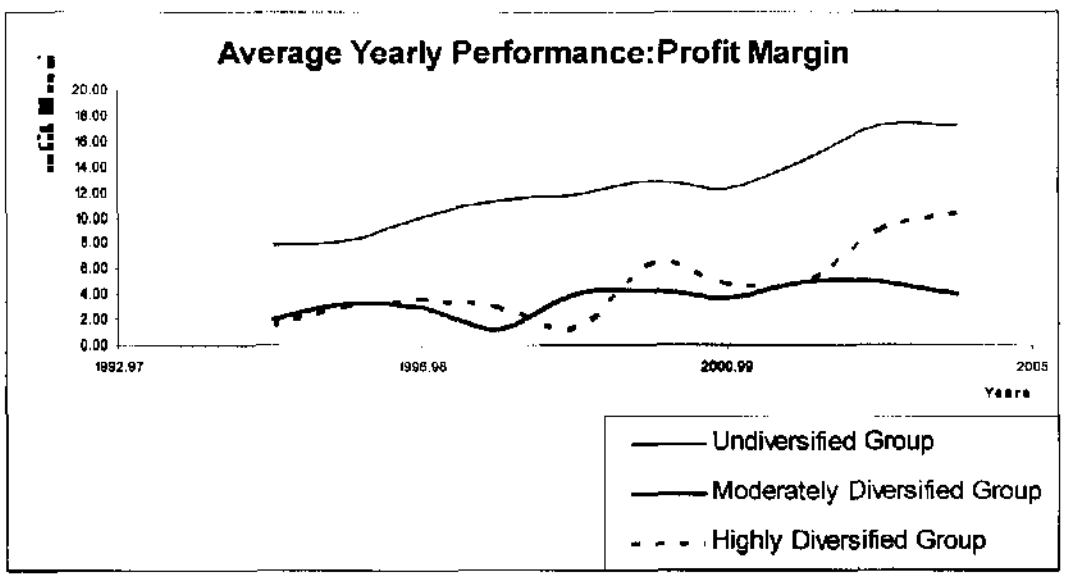
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Highly Diversified Group*
Mean	12.331	4.83725
Variance	10.46642317	9.455261736
Observations	**10**	10
Hypothesized Mean Difference	0	
df	**18**	
t Stat	5.30928657	
P(T<=t) one-tail	2.38854E-05	
t Critical one-tail	1.734063062	

Similarly, the results are in the same direction when the undiversified group is compared with the highly diversified group. The undiversified group outperforms both the moderately and highly diversified group. Therefore the null hypothesis has to be rejected in terms of the average annual profit margin.

Figure 4.4.4 shows the graphical presentation of the average annual profit margin of the three groups of diversification.

Figure 4.4.4: Average annual performance (PM)



The graphical presentation confirms the results of the t-test. The undiversified group outperforms both the moderately and highly diversified groups.

To sum up the results, the undiversified group was found to outperform the two other groups in terms of return on total assets (ROTA) and profit margin (PM). However, no significant difference was found between the undiversified group and any of the other groups in terms return on equity (ROE) and return on capital employed (ROCE). Overall, therefore, the undiversified group performs better than the moderately and highly diversified groups. Hence, the null hypothesis is rejected.

4.4.2 *Moderately diversified Vs highly diversified firms*

Null hypothesis (H4o): There is no performance difference between moderately diversified firms and highly diversified firms.

In order to test the null hypothesis, performance was first compared between the two groups based on average annual return on equity. Table 4.4.26 shows the result of the t-test.

Table 4.4.26: Test statistic – moderately diversified Vs highly diversified (ROE)

t-Test: Two-Sample Assuming Unequal Variances

Average Annual Return on Equity

	Moderately Diversified Group	*Highly Diversified Group*
Mean	17.7136	-5.07
Variance	283.5259485	1466.541547
Observations	10	10
Hypothesized Mean Difference	0	
df	12	
t Stat	1.722245061	
P(T<=t) one-tail	0.055337121	
t Critical one-tail	1.782286745	

The calculated value of t is just less than the critical value of t. The difference between the means of the groups is therefore insignificant. On this basis, the null hypothesis has to be accepted.

Performance of the two groups is further compared based on return on total assets, return on capital employed and profit margin. Table 4.4.27 through to table 4.4.29 show the results of the t-test respectively.

Table 4.4.27: Test statistic – moderately diversified Vs highly diversified (ROTA)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Assets

	Moderately Diversified Group	*Highly Diversified Group*
Mean	4.5601	4.0535
Variance	6.440515433	10.55271556
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	0.388621841	
P(T<=t) one-tail	0.351190013	
t Critical one-tail	1.739606432	

Table 4.4.28: Test statistic – moderately diversified Vs highly diversified (ROCE)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Moderately Diversified Group	*Highly Diversified Group*
Mean	19.4714	11.2175
Variance	229.8909107	130.097575
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	1.375672	
P(T<=t) one-tail	0.093389649	
t Critical one-tail	1.739606432	

Table 4.4.29: Test statistic – moderately diversified Vs highly diversified (PM)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Moderately Diversified Group	*Highly Diversified Group*
Mean	3.5439	4.83725
Variance	1.4762701	9.455261736
Observations	10	10
Hypothesized Mean Difference	0	
df	12	
t Stat	-1.237016679	
P(T<=t) one-tail	0.119871226	
t Critical one-tail	1.782286745	

The results are similar and in the same direction for all three performance variables. In each case, the t-stat is less than the critical value. Hence, based on all performance measures, there is no significant performance difference between the moderately

diversified group and the highly diversified group. Based on this, the null hypothesis is accepted.

4.5 Performance based on variability and risk per unit of return

The three groups of firms are further subjected into tests that measure the variability and risk per unit of return of each of the performance variables. The means, standard deviation and coefficient of variation of each of the performance variables of each diversification group were computed over the period of the study. The measure of variability is the standard deviation while the coefficient of variation is the measure of risk. First, ROE was considered.

Table 4.5.1: Variability and risk per unit of return on ROE

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	9	9.99	16.68	166.87
Moderately Diversified Group	10	17.71	16.84	95.06
Highly Diversified Group	4	-5.07	38.30	-755.33

Table 4.5.1 shows that highly diversified firms have the worst risk return profile as measured by the absolute value of the CV and highest variability as measured by the standard deviation. The variability of the ROE of both the moderately diversified and undiversified firms (16.84 and 16.68 respectively) is about the same. However, the moderately diversified group has better risk return profile than the undiversified group which in turn has better risk profile than the highly diversified firms.

Table 4.5.2: Variability and risk per unit of return on ROTA

	Number of Firms in Group	AROTA	SD	CV
Undiversified Group	9	10.51	2.30	21.88
Moderately Diversified Group	10	4.56	2.54	55.65
Highly Diversified Group	4	4.05	3.25	80.14

Table 4.5.2 shows a consistent result when variability and risk are measured in terms of ROTA. Undiversified firms have the lowest variability and lowest risk per unit of returns. The moderately diversified firms have better variability and better risk return profile than the highly diversified firms.

Table 4.5.3: Variability and risk per unit of return on ROCE

	Number of Firms in Group	AROCE	SD	CV
Undiversified Group	9	16.33	10.32	63.22
Moderately Diversified Group	10	19.47	15.16	77.87
Highly Diversified Group	4	11.22	11.41	101.68

In terms of ROCE, undiversified firms have the lowest variability and risk return. Moderately diversified firms have lower risk return but higher variability than highly diversified firms.

Table 4.5.4: Variability and risk per unit of return on PM

	Number of Firms in Group	APM	SD	CV
Undiversified Group	9	12.33	3.24	26.24
Moderately Diversified Group	10	3.54	1.22	34.28
Highly Diversified Group	4	4.84	3.07	63.57

Table 4.5.4 shows that undiversified firms have the highest variability and the lowest risk per unit of average return. While the moderately diversified firms are better than highly diversified firms both in terms of variability and risk.

Overall, undiversified firms perform better in terms of their risk return profile based on ROTA, ROCE and Profit margin. They also perform better than the other groups in terms of variability based on ROE, ROTA and ROCE. Moderately diversified firms have better risk return profile than highly diversified firms based on all four performance measures. They also perform better in terms of variability based on ROE, ROTA and profit margin. Highly diversified firms have the worst risk return profile based on all four performance measures and the worst variability based on ROE and ROTA.

4.6 Geographic diversification

4.6.1 Relationship between extent of geographic diversification and performance

Null hypothesis (H2o): There is no negative linear relationship between a firm's extent of geographic diversity and its average performance.

The test of the null hypothesis requires a test of correlation between ASR (GEO) (measure of geographic spread) and each of the four performance measures considered. Overall, 21 firms had complete data for the period considered in the study and therefore constitute the sample for the study. Table 4.6.1 shows the 21 firms used, there SR values and ranking based on the builder's magazine top 100 UK construction company ranking.

20 firms (95%) out of the 21 firms in the sample fall within the UK top 100 construction companies. Of these, 12 (57%) fall within the first twenty-five while 18 fall within the first 50 (86%) in the builders' magazine ranking.

Table 4.6.1: Firms' geographic diversity and performance (1995 - 2004)

Company Name	ASR (GEO)	AROE%	ARTA%	AROCE%	APM%	Ranking
KELLER GROUP PLC	0.43	18.31	9.77	21.88	5.11	32
HENRY BOOT PLC	1.00	12.65	9.20	16.00	9.47	97
BIRSE GROUP PLC	1.00	-33.97	-0.99	-16.40	-0.35	37
PERSIMMON PLC	1.00	15.44	11.69	18.60	12.84	8
WESTBURY PLC	1.00	12.86	9.25	17.02	10.08	19
BARRATT DEVELOPMENTS PLC	0.93	17.55	12.46	23.75	11.12	5
MCCARTHY & STONE	0.99	17.67	16.77	25.26	31.26	52
BELLWAY PLC	1.00	16.70	13.92	21.53	14.45	17
BERKELEY GROUP HOLDINGS PLC (THE)	1.00	12.74	12.51	17.95	17.00	11
WILSON BOWDEN PLC	1.00	16.27	13.87	21.45	16.44	14
GLEESON (M J) GROUP PLC	0.98	7.07	5.11	11.72	3.85	26
COSTAIN GROUP PLC	0.78	94.60	-1.53	48.12	-1.35	21
MOWLEM PLC	0.72	4.36	2.34	10.47	0.95	6
OPUS INTERNATIONAL GROUP PLC	0.72	8.73	8.08	13.40	9.25	-
REDROW PLC	1.00	20.39	15.877	24.395	15.774	27
KIER GROUP PLC	0.93	24.81	4.03	26.42	1.73	9
ROK PROPERTY SOLUTIONS PLC	1.00	12.13	4.44	12.66	1.82	42
LAING (JOHN) PLC	1.08	2.00	2.15	12.07	2.41	10
BALFOUR BEATTY PLC	0.81	-45.40	-0.34	6.31	0.36	2
TAYLOR WOODROW PLC	0.64	11.01	7.97	14.00	8.74	4
CREST NICHOLSON PLC	1.00	12.11	6.43	12.49	7.84	31

4.6.2 Correlation between ASR (Geo) and AROE

Table 4.6.2 shows the result of correlation between average specialisation ratio based on geographic spread and average return on equity. Both Kendall's tau-b and spearman's rho show a negative association between ASR (GEO) and AROE. However, since ASR is by definition negatively associated with degree of diversity, it follows that degree of

geographic spread is positively related to performance based on ROE. The strength of the association is weak and the high significant value indicates that although the two variables may be correlated, the relationship is not linear. Based on this, the null hypothesis is accepted.

Table 4.6.2: Correlation between ASR (Geographic) and AROE

Correlations (ASR (GEO) and ROE)

			ASR (GEO)	AROE
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	-.103
		Sig. (2-tailed)	.	.542
		N	21	21
	AROE	Correlation Coefficient	-.103	1.000
		Sig. (2-tailed)	.542	.
		N	21	21
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	-.087
		Sig. (2-tailed)	.	.707
		N	21	21
	AROE	Correlation Coefficient	-.087	1.000
		Sig. (2-tailed)	.707	.
		N	21	21

4.6.3 Correlation between ASR (Geo) and AROTA

The results of the correlation between ASR (GEO) and AROTA are shown on table 4.6.3. While the results indicate a positive and stronger relationship, these results are statistically insignificant.

Table 4.6.3: Correlation between ASR (Geographic) and ROTA

Correlations (ASR (GEO) and ROTA)

			ASR (GEO)	AROTA
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	.146
		Sig. (2-tailed)	.	.386
		N	21	21
	AROTA	Correlation Coefficient	.146	1.000
		Sig. (2-tailed)	.386	.
		N	21	21
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	.205
		Sig. (2-tailed)	.	.373
		N	21	21
	AROTA	Correlation Coefficient	.205	1.000
		Sig. (2-tailed)	.373	.
		N	21	21

The high significant values indicate that while a correlation may exist between geographic diversity and performance based on ROTA, the relationship is not linear. Hence the null hypothesis is accepted.

4.6.4 Correlation between ASR (Geo) and AROCE

The results of the association between geographic diversity and performance based on ROCE are shown on table 4.6.4.

Table 4.6.4: Correlation between ASR (Geographic) and AROCE

Correlations (ASR (GEO) and ROCE)

			ASR (GEO)	AROCE
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	-.124
		Sig. (2-tailed)	.	.460
		N	21	21
	AROCE	Correlation Coefficient	-.124	1.000
		Sig. (2-tailed)	.460	.
		N	21	21
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	-.116
		Sig. (2-tailed)	.	.616
		N	21	21
	AROCE	Correlation Coefficient	-.116	1.000
		Sig. (2-tailed)	.616	.
		N	21	21

The results are similar and in the same direction to the results obtained when ASR (GEO) was compared with ROE. Therefore the null hypothesis is accepted in this case too.

4.6.5 Correlation between ASR (Geographic) and APM

Table 4.6.5 shows the results of correlation between ASR (GEO) and performance based on average profit margin.

Table 4.6.5: Correlation between ASR (Geographic) and APM

Correlations (ASR (GEO) and Profit Margin)

			ASR (GEO)	APM
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	.243
		Sig. (2-tailed)	.	.148
		N	21	21
	APM	Correlation Coefficient	.243	1.000
		Sig. (2-tailed)	.148	.
		N	21	21
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	.331
		Sig. (2-tailed)	.	.143
		N	21	21
	APM	Correlation Coefficient	.331	1.000
		Sig. (2-tailed)	.143	.
		N	21	21

The results are similar and in the same direction as those obtained when ASR (GEO) was compared with ROTA. Again, the null hypothesis has to be accepted.
Pulling all the correlation results together, it is clear that the relationship between geographic spread and performance is weak, statistically insignificant and not linear. Hence no linear relationship exists between a firm's level of geographic spread and its performance.

4.7 Analyses of performance differences (based on geographic diversification)

The impact of geographic diversification on firm performance was analysed by testing the null hypotheses H5o and H6o. The hypotheses relating to these are:
Null hypothesis (H5o): There is no performance difference between geographically undiversified firms and geographically moderately and highly diversified firms.
Null hypothesis (H6o): There is no performance difference between the geographically moderately diversified firms and geographically highly diversified firms.

In order to test the hypotheses, all firms in the sample were classified into undiversified, moderately diversified and highly diversified groups. Tables 4.7.1, 4.7.1 and 4.7.3 show the groupings based on Rumelt's classification scheme. Figure 4.7.1 shows the trend in diversification among undiversified firms. Ten of the firms have a constant SR of 1.00 throughout the years and are therefore not shown. Figures 4.7.2 and 4.7.3 show the trend in diversification among moderately and highly diversified firms respectively.

Table 4.7.1: The undiversified group (Geographic)

Classification Based on Rumelt's Scheme (1995 - 2004): Undiversified Group ($ASR \geq 0.95$)	
Company	ASR
ROK PROPERTY SOLUTIONS PLC	1.00
LAING (JOHN) PLC	1.08
HENRY BOOT PLC	1.00
BIRSE GROUP PLC	1.00
GLEESON (M J) GROUP PLC	0.98
REDROW PLC	1.00
PERSIMMON PLC	1.00
CREST NICHOLSON PLC	1.00
WESTBURY PLC	1.00
WILSON BOWDEN PLC	1.00
MCCARTHY & STONE	0.99
BELLWAY PLC	1.00
BERKELEY GROUP HOLDINGS PLC (THE)	1.00

Figure 4.7.1: Trend in geographic diversification – Undiversified firms

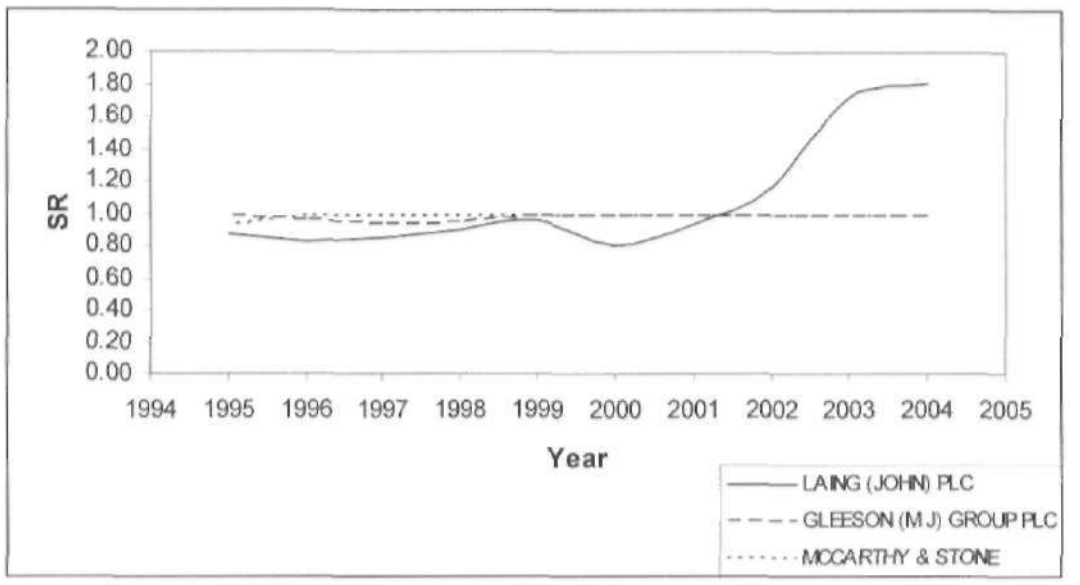


Table 4.7.2: The moderately diversified group (Geographic)

Classification Based on Rumelt's Scheme (1995 - 2004): Moderately diversified Group ($0.7 \leq ASR < 0.95$)	
Company	ASR
KIER GROUP PLC	0.93
OPUS INTERNATIONAL GROUP PLC	0.72
MOWLEM PLC	0.72
BALFOUR BEATTY PLC	0.81
COSTAIN GROUP PLC	0.78
BARRATT DEVELOPMENTS PLC	0.93

Figure 4.7.2: Trend in geographic diversification – Moderately diversified firms

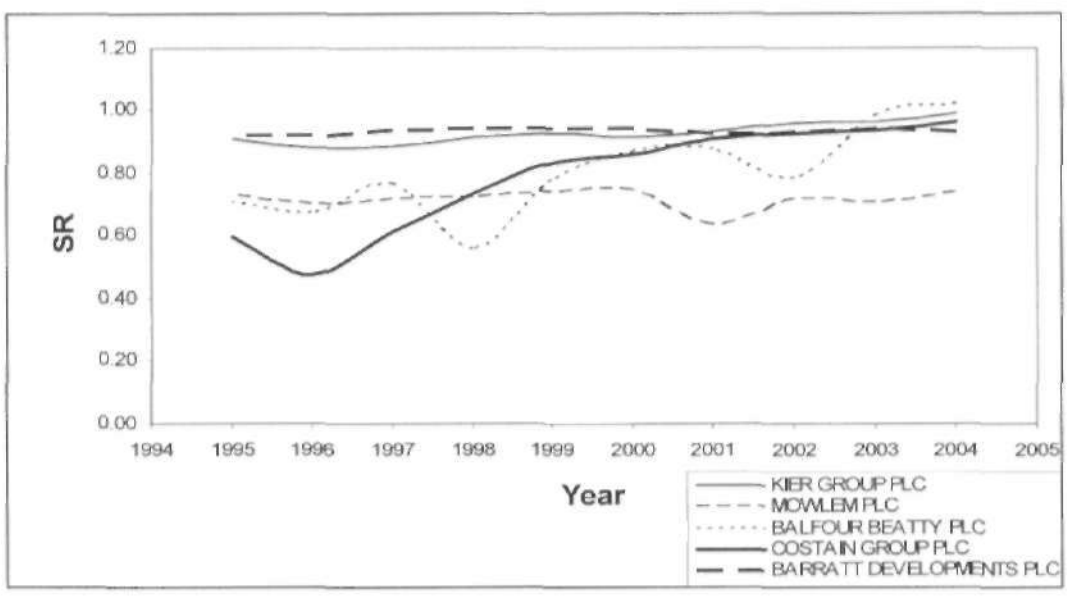
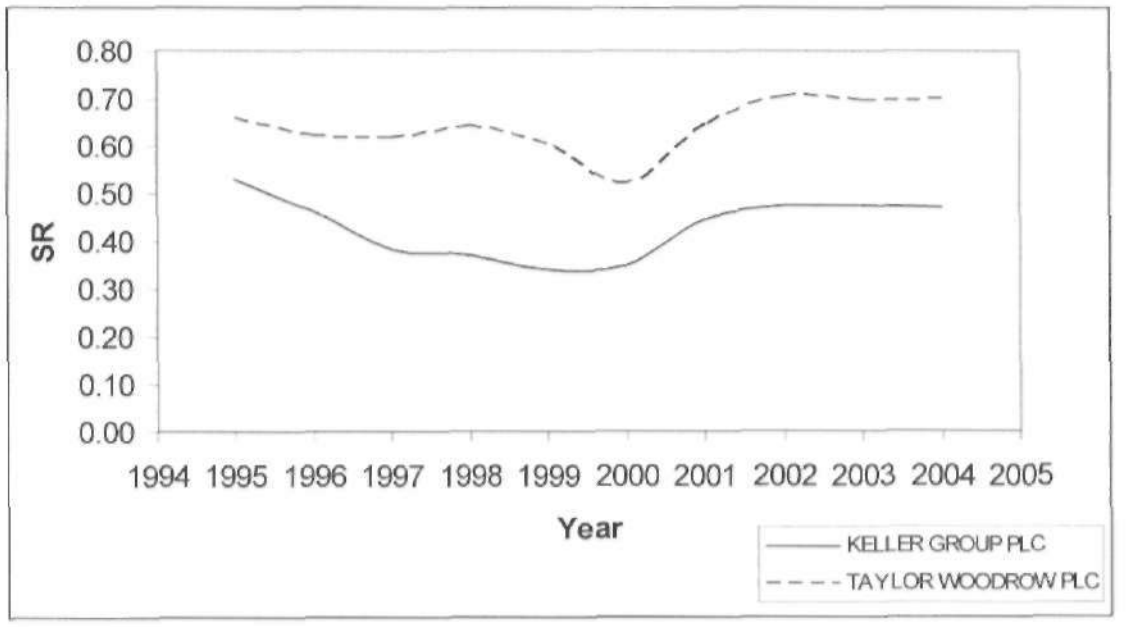


Table 4.7.3: The highly diversified group (Geographic)

Classification Based on Rumelt's Scheme (1995 - 2004): Highly diversified Group ($ASR < 0.7$)	
Company	ASR
KELLER GROUP PLC	0.43
TAYLOR WOODROW PLC	0.64

Figure 4.7.3: Trend in geographic diversification – Highly diversified firms



Of the twenty-one firms in the sample, 13 (62%) are highly geographically undiversified, 6 (29%) are moderately diversified and 2 (9%) are highly diversified. The average annual performance of each group was computed over the period (1995 - 2004) based on ROE, ROTA, ROCE and profit margin. Tables 4.7.4, 4.7.5, 4.7.6 and 4.7.7 present the average annual performance of each group based on each of the performance measures.

Table 4.7.4: Summary of performance (ROE) (Geographic)

	Year	2004	2002	2001	2000	1999	1998	1997	1996	1995
Return on Equity	**Undiversified Group**	18.56	16.75	-22.64	13.01	13.77	12.88	11.36	8.18	6.14
	Moderately Diversified Group	9.02	9.76	49.57	22.08	-64.91	-11.18	-7.71	74.78	79.57
	Highly Diversified Group	14.99	14.07	14.23	16.48	17.57	16.88	17.07	16.40	11.39

Table 4.7.5: Summary of performance (ROTA) (Geographic)

	Year	2004	2002	2001	2000	1999	1998	1997	1996	1995
Return on Total Assets	**Undiversified Group**	11.67	10.20	7.87	10.00	10.05	9.53	8.51	6.45	6.36
	Moderately Diversified Group	7.55	8.23	6.10	7.79	-0.66	0.29	2.12	2.20	-1.08
	Highly Diversified Group	9.87	8.80	8.52	10.53	10.72	9.82	9.06	8.11	6.79

Table 4.7.6: Summary of performance (ROCE) (Geographic)

	Year	2004	2002	2001	2000	1999	1998	1997	1996	1995
Return on Capital Employed	**Undiversified Group**	21.00	21.63	-3.87	17.17	18.32	17.00	15.39	11.41	10.97
	Moderately Diversified Group	24.71	35.33	33.75	36.26	45.50	8.06	7.71	5.52	-15.01
	Highly Diversified Group	18.58	15.80	16.59	20.25	21.41	20.06	19.91	18.74	19.98

Table 4.7.7: Summary of performance (PM) (Geographic)

	Year	2004	2002	2001	2000	1999	1998	1997	1996	1995
Profit Margin	**Undiversified Group**	15.54	12.08	10.88	11.29	10.66	10.08	9.16	7.45	7.31
	Moderately Diversified Group	5.50	6.11	3.94	5.36	1.20	-1.17	2.34	4.29	2.88
	Highly Diversified Group	8.02	7.96	7.39	9.02	7.18	6.71	6.04	5.48	4.54

4.7.1 Undiversified Vs moderately and highly diversified firms

Test of the Null hypothesis H5o

First, performance of the geographically undiversified group was compared with that of moderately and highly diversified group based on ROE. Table 4.7.8 shows the result of the t-test between undiversified and moderately diversified group while table 4.7.9 shows the results when performance was compared between the undiversified group and the highly diversified group.

Table 4.7.8: Test statistic – undiversified Vs moderately diversified (ROE) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Undiversified Group	*Moderately Diversified Group*
Mean	9.541846154	17.44066667
Variance	143.1707093	1842.269891
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	-0.560575091	
P(T<=t) one-tail	0.293713033	
t Critical one-tail	1.812461505	

Table 4.7.9: Test statistic – undiversified Vs highly diversified (ROE) (Geographic)

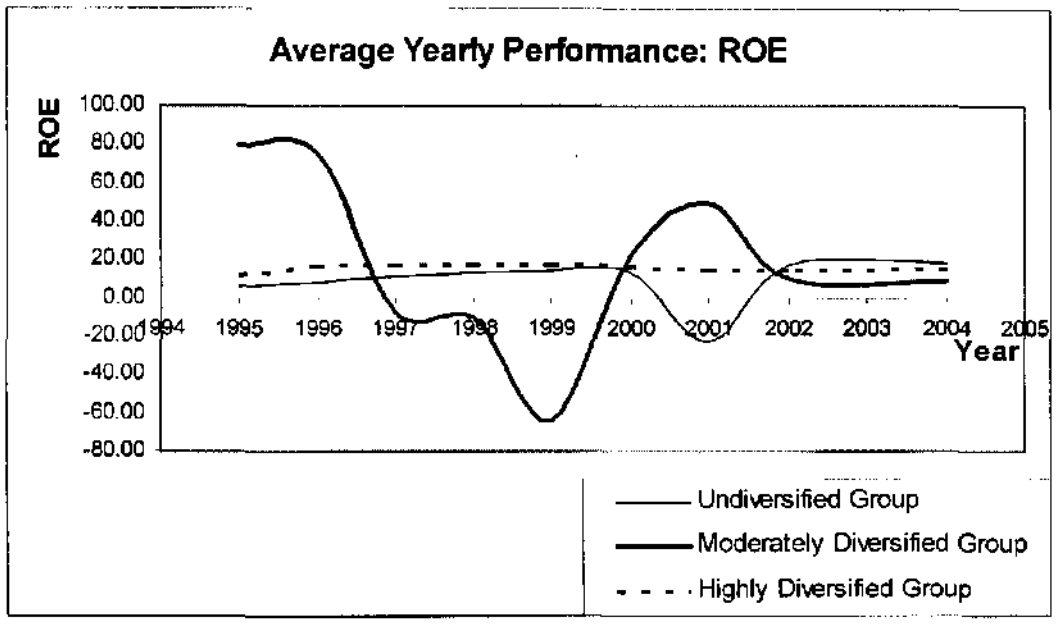
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Undiversified Group	*Highly Diversified Group*
Mean	9.541846154	14.662
Variance	143.1707093	9.708362222
Observations	10	10
Hypothesized Mean Difference	0	
df	10	
t Stat	-1.309510522	
P(T<=t) one-tail	0.109824193	
t Critical one-tail	1.812461505	

In both cases, the calculated value of t is less than the critical value. This suggests that the differences in means are not statistically significant. Hence no performance difference exists between the geographically undiversified group and the moderately and highly diversified groups.

To appreciate the results, figure 4.7.1 shows a graphical presentation of the average annual ROE of the three groups of firms.

Figure 4.7.1: Average annual performance (ROE) (Geographic)



Next, performance is compared based on average annual return on total assets. Table 4.7.10 shows the result when performance is compared between the geographically undiversified and moderately diversified groups while table 4.7.11 shows the result of comparison between geographically undiversified and highly diversified group based on ROTA.

Table 4.7.10: Test statistic – undiversified Vs moderately diversified (ROTA) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Asset

	Undiversified Group	*Moderately Diversified Group*
Mean	9.248076923	4.171666667
Variance	3.715281427	15.99029877
Observations	10	10
Hypothesized Mean Difference	0	
df	13	
t Stat	3.616280418	
P(T<=t) one-tail	0.001566401	
t Critical one-tail	1.770931704	

Table 4.7.11: Test statistic – undiversified Vs highly diversified (ROTA) (Geographic)

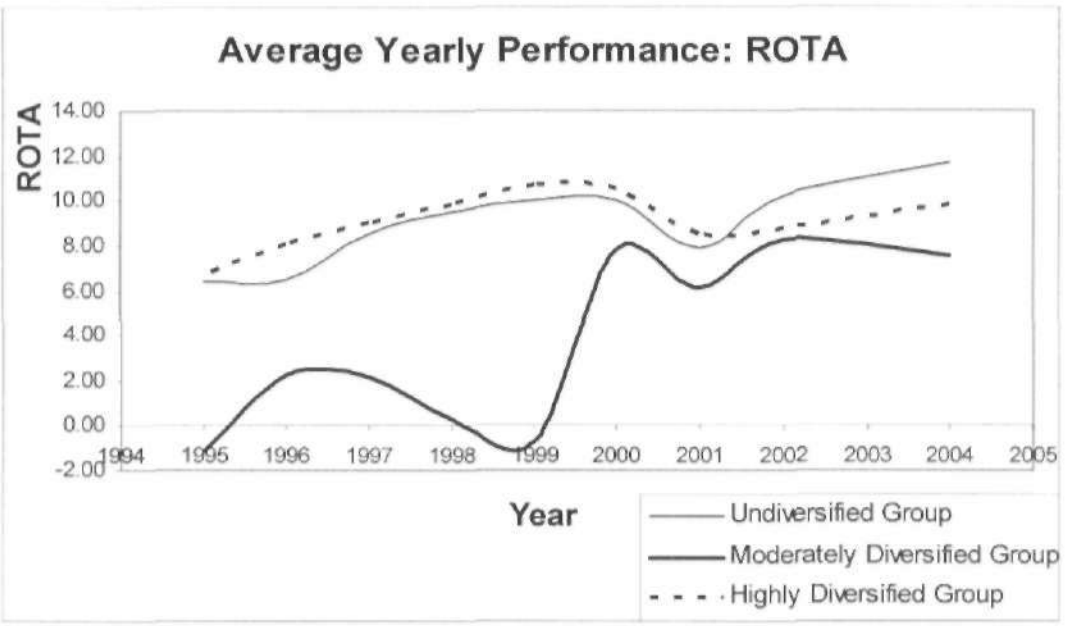
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Asset

	Undiversified Group	*Highly Diversified Group*
Mean	9.248076923	8.873
Variance	3.715281427	2.068578889
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	0.493186803	
P(T<=t) one-tail	0.314095404	
t Critical one-tail	1.739606432	

The results as shown on table 4.7.10 indicate that the geographically undiversified group outperform the moderately diversified group. The results are statistically significant. However, results shown on table 4.7.11 indicate no significant difference between geographically undiversified group and highly diversified group.

Figure 4.7.2 shows a graphic comparison of the average annual return on total assets

Figure 4.7.2: Average annual performance (ROTA) (Geographic)



Next, performance was compared based on ROCE. Table 4.7.12 shows the result when the geographically undiversified group was compared with moderately diversified group while table 4.7.13 shows the results when performance was compared between undiversified and highly diversified groups based on ROCE.

Table 4.7.12: Test statistic – undiversified Vs moderately diversified (ROCE) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Undiversified Group	*Moderately Diversified Group*
Mean	15.02148077	21.40172222
Variance	58.14068902	357.5958058
Observations	10	10
Hypothesized Mean Difference	0	
df	12	
t Stat	-0.98952789	
P(T<=t) one-tail	0.170969211	
t Critical one-tail	1.782286745	

Table 4.7.13: Test statistic – undiversified Vs highly diversified (ROCE) (Geographic)

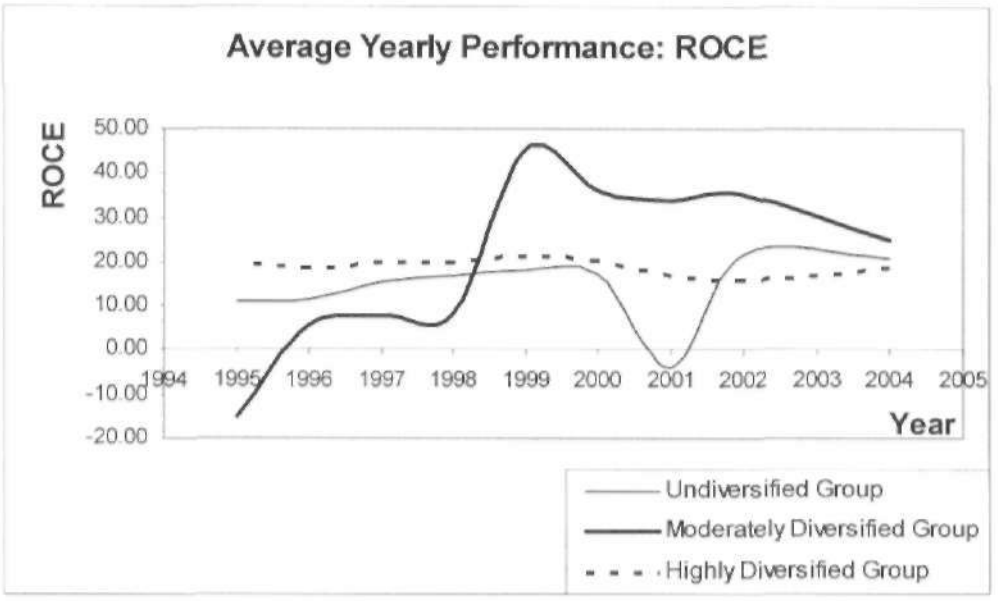
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Undiversified Group	*Highly Diversified Group*
Mean	15.02148077	18.38047222
Variance	58.14068902	7.243753465
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-1.313625851	
P(T<=t) one-tail	0.107855198	
t Critical one-tail	1.795883691	

In both cases, the results are similar and in the same direction as the results obtained when performance was compared based on ROE. No significant difference exists between the undiversified and moderately diversified group and the undiversified and highly diversified groups.

Figure 4.7.3 shows a graphical presentation of the average annual ROCE of the three diversification groups.

Figure 4.7.3: Average annual performance (ROCE) (Geographic)



The last performance measure considered is the average annual profit margin. Table 4.7.14 shows the result when the undiversified group was compared with the moderately diversified group while table 4.7.15 shows the result when the undiversified group was compared with highly diversified group.

Table 4.7.14: Test statistic – undiversified Vs moderately diversified (PM) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Moderately Diversified Group*
Mean	10.99153846	3.6765
Variance	8.041592899	5.730962623
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	6.2331754	
P(T<=t) one-tail	3.50779E-06	
t Critical one-tail	1.734063062	

Table 4.7.15: Test statistic – undiversified Vs highly diversified (PM) (Geographic)

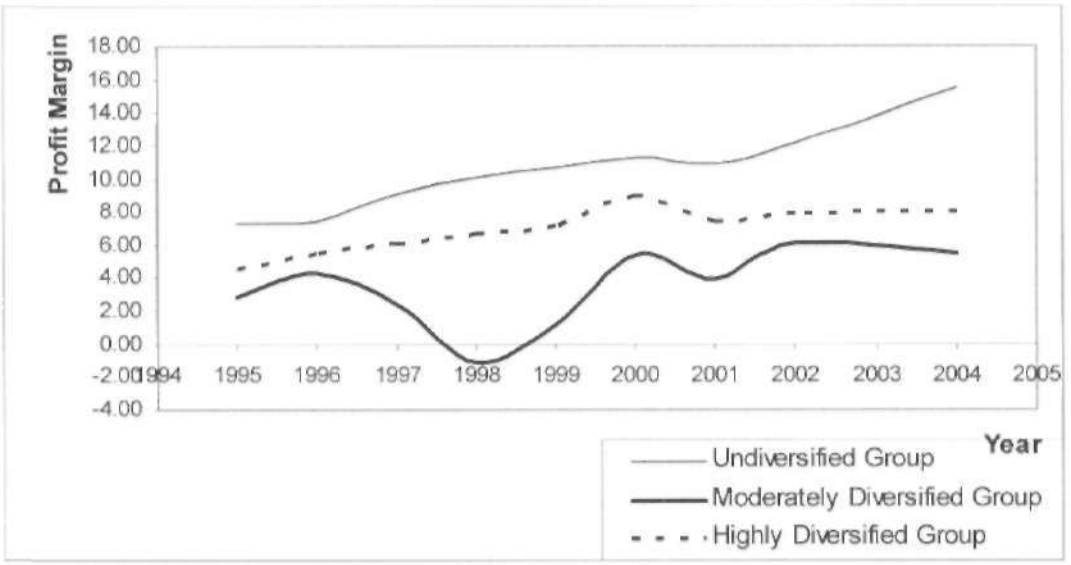
t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Highly Diversified Group*
Mean	10.99153846	6.924
Variance	8.041592899	1.723487778
Observations	10	10
Hypothesized Mean Difference	0	
df	13	
t Stat	4.116174239	
P(T<=t) one-tail	0.000607877	
t Critical one-tail	1.770931704	

The results as shown on tables 4.7.14 and 4.7.15 suggest that the geographically undiversified group outperforms both the moderately and highly diversified groups based on profit margin.

Figure 4.7.4 present the average annual profit margin of the three diversification groups.

Figure 4.7.4: Average annual performance (PM) (Geographic)



Pulling all the results together, it is clear that no difference exists between undiversified firms and moderately diversified firms and between undiversified firms and highly diversified firms when performance was compared based on ROE and ROCE. However, undiversified firms were found to outperform moderately diversified firms when performance was compared based on ROTA and PM. Also, no performance difference exists between undiversified firms and highly diversified firms based on ROTA.

However, undiversified firms outperform highly diversified firms based on profit margin. Based on these results, the null hypothesis is rejected.

4.7.2 Moderately diversified Vs highly diversified firms

Analysis of performance difference between the moderately diversified and highly diversified firms requires the test of the null hypothesis H5o. Performance between the two groups was first compared based on ROE. Table 4.7.16 shows the result. The results show no significant performance difference between the two groups based on ROE.

Table 4.7.16: Test statistic – moderately diversified Vs highly diversified (ROE) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Moderately Diversified Group	*Highly Diversified Group*
Mean	17.44066667	14.662
Variance	1842.269891	9.708362222
Observations	10	10
Hypothesized Mean Difference	0	
df	9	
t Stat	0.204182497	
P(T<=t) one-tail	0.421376694	
t Critical one-tail	1.833113856	

When performance was compared between the moderately diversified group and highly diversified group based on ROTA, the result as shown on table 4.7.17 indicate that the highly diversified group outperforms the moderately diversified group.

Table 4.7.17: Test statistic – moderately diversified Vs highly diversified (ROTA) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Asset

	Moderately Diversified Group	*Highly Diversified Group*
Mean	4.171666667	8.873
Variance	15.99029877	2.068578889
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-3.498449963	
P(T<=t) one-tail	0.002491935	
t Critical one-tail	1.795883691	

Based on ROCE, the results are similar and in the same direction as those obtained when performance of the two groups was compared based on ROE. Table 4.7.18 presents these results. No significant difference exists between the two groups based on ROCE.

Table 4.7.18: Test statistic – moderately diversified Vs highly diversified (ROCE) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Moderately Diversified Group	*Highly Diversified Group*
Mean	21.40172222	18.38047222
Variance	357.5958058	7.243753465
Observations	10	10
Hypothesized Mean Difference	0	
df	9	
t Stat	0.500190803	
P(T<=t) one-tail	0.314471094	
t Critical one-tail	1.833113856	

In terms of profit margin, the results as shown on table 4.7.19 indicate that the highly diversified group outperforms the moderately diversified group. These results are similar and in the same direction as those obtained when performance was compared between the two groups based on ROTA.

Table 4.7.19: Test statistic – moderately diversified Vs highly diversified (PM) (Geographic)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Moderately Diversified Group	*Highly Diversified Group*
Mean	3.6765	6.924
Variance	5.730962623	1.723487778
Observations	10	10
Hypothesized Mean Difference	0	
df	14	
t Stat	-3.761329196	
P(T<=t) one-tail	0.001052846	
t Critical one-tail	1.76130925	

To sum up the results, no performance difference exist between geographically moderately diversified firms and geographically highly diversified firms based on ROE

and ROCE. However, highly diversified firms were found to outperform moderately diversified firms based on ROTA and profit margin. Based on this, the null hypothesis is rejected.

4.8 Performance based on variability and risk per unit of return

Table 4.8.1: Variability and risk per unit of return on ROE (Geographic)

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	14	9.54	11.97	125.40
Moderately Diversified Group	5	17.44	42.92	246.10
Highly Diversified Group	2	14.66	3.12	21.25

Table 4.8.2: Variability and risk per unit of return on ROTA (Geographic)

	Number of Firms in Group	AROTA	SD	CV
Undiversified Group	14	9.25	1.93	20.84
Moderately Diversified Group	5	4.17	4.00	95.86
Highly Diversified Group	2	8.87	1.44	16.21

Table 4.8.3: Variability and risk per unit of return on ROCE (Geographic)

	Number of Firms in Group	AROCE	SD	CV
Undiversified Group	14	15.02	7.63	50.76
Moderately Diversified Group	5	21.40	18.91	88.36
Highly Diversified Group	2	18.38	2.69	14.64

Table 4.8.4: Variability and risk per unit of return on PM (Geographic)

	Number of Firms in Group	APM	SD	CV
Undiversified Group	14	10.99	2.84	25.80
Moderately Diversified Group	5	3.68	2.39	65.11
Highly Diversified Group	2	6.92	1.31	18.96

Tables 4.8.1, 4.8.2, 4.8.3 and 4.8.4 present the variability and risk per unit of return as measured by the standard deviation and coefficient of variation of each of the performance measures. The results show an inconsistent pattern. Highly diversified firms exhibit the lowest variability and the lowest risk on all four performance measures. However, geographically undiversified firms have lower variability and lower risk return profile than moderately diversified firms.

4.9 Further analyses – Screening for outliers

So far, the analysis of the data has been conducted on the assumption that all the data are reasonably normal. However, a closer look at the data set reveals that some firms have performance ratios that are way out of industry proportion. For example, while other firms have ROE of between 14 and 21, Birse group plc has an ROE of -455 in 2001. All firms that report such extreme ratios are considered outliers in this part of the analysis as they are likely to distort the results and are therefore eliminated. In all four firms (Birse, Costain, Montpellier and Balfour) are eliminated as outliers. The aim is to see how the results will vary from the former analysis both in terms of product and geographic diversification. Since the methodology remains the same, only the results will be displayed in this part.

First, the relationship between extent of product diversity and performance is considered. Table 4.9.1 through to table 4.9.4 show the results of the test of association between the two variables.

Table 4.9.1: Correlation between ASR and AROE (without outliers)

Correlations (ASR and ROE)

			ASR	AROE
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.313
		Sig. (2-tailed)	.	.069
		N	19	19
	AROE	Correlation Coefficient	.313	1.000
		Sig. (2-tailed)	.069	.
		N	19	19
Spearman's rho	ASR	Correlation Coefficient	1.000	.437
		Sig. (2-tailed)	.	.062
		N	19	19
	AROE	Correlation Coefficient	.437	1.000
		Sig. (2-tailed)	.062	.
		N	19	19

Table 4.9.2: Correlation between ASR and AROTA (without outliers)

Correlations (ASR and ROTA)

			ASR	AROTA
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.431*
		Sig. (2-tailed)	.	.013
		N	19	19
	AROTA	Correlation Coefficient	.431*	1.000
		Sig. (2-tailed)	.013	.
		N	19	19
Spearman's rho	ASR	Correlation Coefficient	1.000	.613**
		Sig. (2-tailed)	.	.005
		N	19	19
	AROTA	Correlation Coefficient	.613**	1.000
		Sig. (2-tailed)	.005	.
		N	19	19

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

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

Table 4.9.3: Correlation between ASR and AROCE (without outliers)

Correlations (ASR and ROCE)

			ASR	AROCE
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.289
		Sig. (2-tailed)	.	.094
		N	19	19
	AROCE	Correlation Coefficient	.289	1.000
		Sig. (2-tailed)	.094	.
		N	19	19
Spearman's rho	ASR	Correlation Coefficient	1.000	.405
		Sig. (2-tailed)	.	.086
		N	19	19
	AROCE	Correlation Coefficient	.405	1.000
		Sig. (2-tailed)	.086	.
		N	19	19

Table 4.9.4: Correlation between ASR and APM (without outliers)

Correlations (ASR and PM)

			ASR	APM
Kendall's tau_b	ASR	Correlation Coefficient	1.000	.357*
		Sig. (2-tailed)	.	.039
		N	19	19
	APM	Correlation Coefficient	.357*	1.000
		Sig. (2-tailed)	.039	.
		N	19	19
Spearman's rho	ASR	Correlation Coefficient	1.000	.521*
		Sig. (2-tailed)	.	.022
		N	19	19
	APM	Correlation Coefficient	.521*	1.000
		Sig. (2-tailed)	.022	.
		N	19	19

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

The results are similar and in the same direction as those obtained when the analysis was done including the outliers.

Results of tests of differences in group-wise performance based on ROE are presented in table 4.9.5 through to table 4.9.7.

Table 4.9.5: Test statistic – undiversified Vs moderately diversified (ROE) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Undiversified Group	*Moderately Diversified Group*
Mean	15.48875	13.747875
Variance	6.9957	14.10564377
Observations	10	10
Hypothesized Mean Difference	0	
df	16	
t Stat	1.198429614	
P(T<=t) one-tail	0.124100157	
t Critical one-tail	1.745884219	

Table 4.9.6: Test statistic – undiversified Vs highly diversified (ROE) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

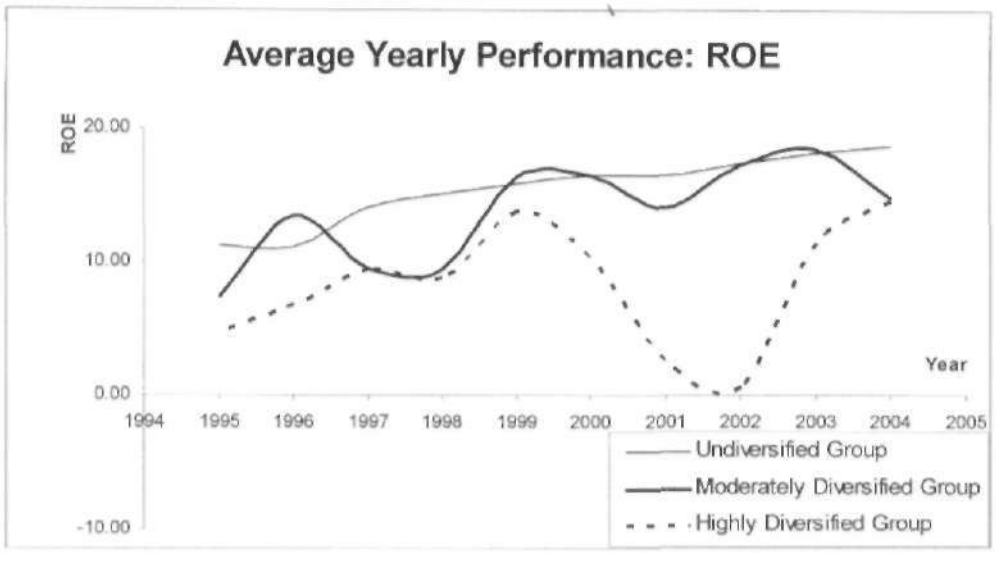
	Undiversified Group	*Highly Diversified Group*
Mean	15.48875	8.372666667
Variance	6.9957	21.55391309
Observations	10	10
Hypothesized Mean Difference	0	
df	14	
t Stat	4.211539825	
P(T<=t) one-tail	0.000435396	
t Critical one-tail	1.76130925	

Table 4.9.7: Test statistic – moderately diversified Vs highly diversified (ROE) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Moderately Diversified Group	*Highly Diversified Group*
Mean	13.747875	8.372666667
Variance	14.10564377	21.55391309
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	2.846474716	
P(T<=t) one-tail	0.005578498	
t Critical one-tail	1.739606432	

Figure 4.9.1: Average annual performance (ROE) (without outliers)



The results show no performance difference between undiversified and moderately diversified firms. This is similar to the result obtained in the former analysis. However, both undiversified and moderately diversified firms outperform highly diversified firms. This is different to what was obtained in the former analysis.

Table 4.9.8 through to table 4.9.10 show the results when performance was compared based on ROTA.

Table 4.9.8: Test statistic – undiversified Vs moderately diversified (ROTA) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Asset

	Undiversified Group	*Moderately Diversified Group*
Mean	11.94625	6.068875
Variance	5.428517708	1.262797726
Observations	10	10
Hypothesized Mean Difference	0	
df	13	
t Stat	7.185014512	
P(T<=t) one-tail	3.5512E-06	
t Critical one-tail	1.770931704	

Table 4.9.9: Test statistic – undiversified Vs highly diversified (ROTA) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Asset

	Undiversified Group	*Highly Diversified Group*
Mean	11.94625	5.518333333
Variance	5.428517708	2.503326543
Observations	10	10
Hypothesized Mean Difference	0	
df	16	
t Stat	7.217439446	
P(T<=t) one-tail	1.02637E-06	
t Critical one-tail	1.745884219	

Table 4.9.10: Test statistic –moderately diversified Vs highly diversified (ROTA) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Asset

	Moderately Diversified Group	*Highly Diversified Group*
Mean	6.068875	5.518333333
Variance	1.262797726	2.503326543
Observations	10	10
Hypothesized Mean Difference	0	
df	16	
t Stat	0.897104159	
P(T<=t) one-tail	0.19148183	
t Critical one-tail	1.745884219	

The results are similar and in the same direction as those obtained when performance was compared including the outliers.

Figure 4.9.2: Average annual performance (ROTA) (without outliers)

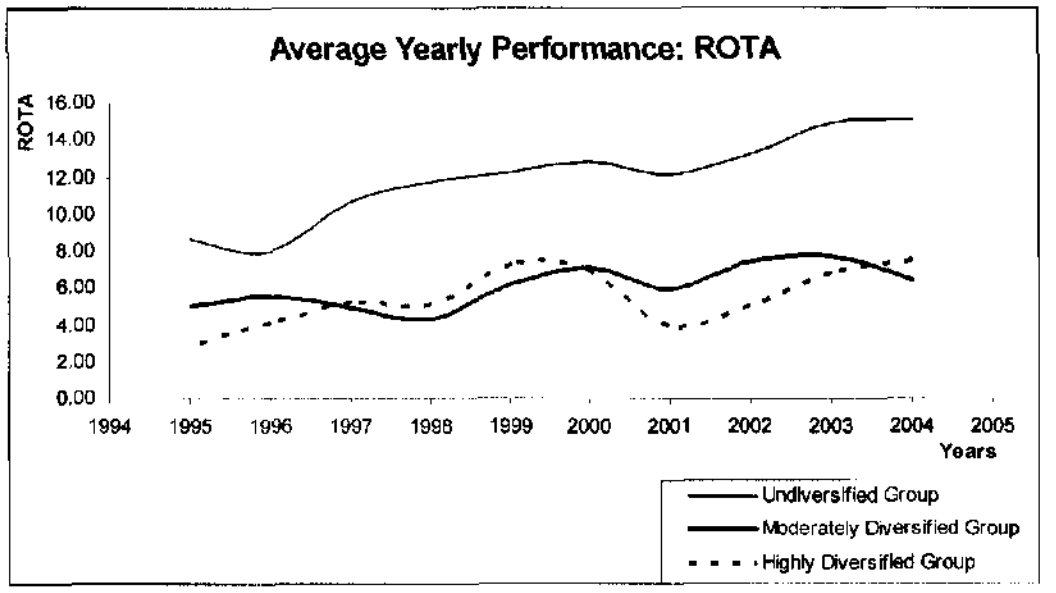


Table 4.9.11 through to table 4.9.13 show the results when performance was compared based on ROCE.

Table 4.9.11: Test statistic – undiversified Vs moderately diversified (ROCE) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Undiversified Group	*Moderately Diversified Group*
Mean	20.32777778	18.200125
Variance	10.65124032	8.21901092
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	1.548859107	
P(T<=t) one-tail	0.069409146	
t Critical one-tail	1.734063062	

Table 4.9.12: Test statistic – undiversified Vs highly diversified (ROCE) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

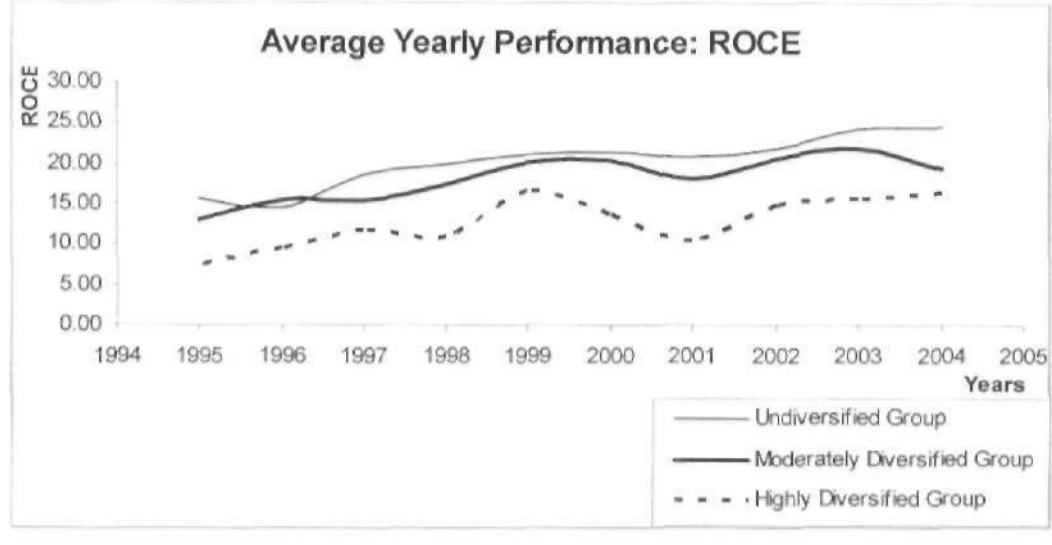
	Undiversified Group	*Highly Diversified Group*
Mean	20.32777778	12.85233333
Variance	10.65124032	9.958718642
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	5.207130414	
P(T<=t) one-tail	2.97142E-05	
t Critical one-tail	1.734063062	

Table 4.9.13: Test statistic –moderately diversified Vs highly diversified (ROCE) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Moderately Diversified Group	*Highly Diversified Group*
Mean	18.200125	12.85233333
Variance	8.21901092	9.958718642
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	3.96647445	
P(T<=t) one-tail	0.000452473	
t Critical one-tail	1.734063062	

Figure 4.9.3: Average annual performance (ROCE) (without outliers)



The results show no performance difference between undiversified and moderately diversified firms. This is similar and in the same direction as the result obtained in the initial analysis. However, the results are different from the initial ones as they indicate that both undiversified and moderately diversified firms outperform highly diversified firms.

Table 4.9.14 through to table 4.9.16 show the results when performance was compared based on profit margin.

Table 4.9.14: Test statistic – undiversified Vs moderately diversified (PM) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Moderately Diversified Group*
Mean	13.91625	4.73475
Variance	12.92849028	1.707316597
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	7.589362612	
P(T<=t) one-tail	5.37091E-06	
t Critical one-tail	1.795883691	

Table 4.9.15: Test statistic – undiversified Vs highly diversified (PM) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

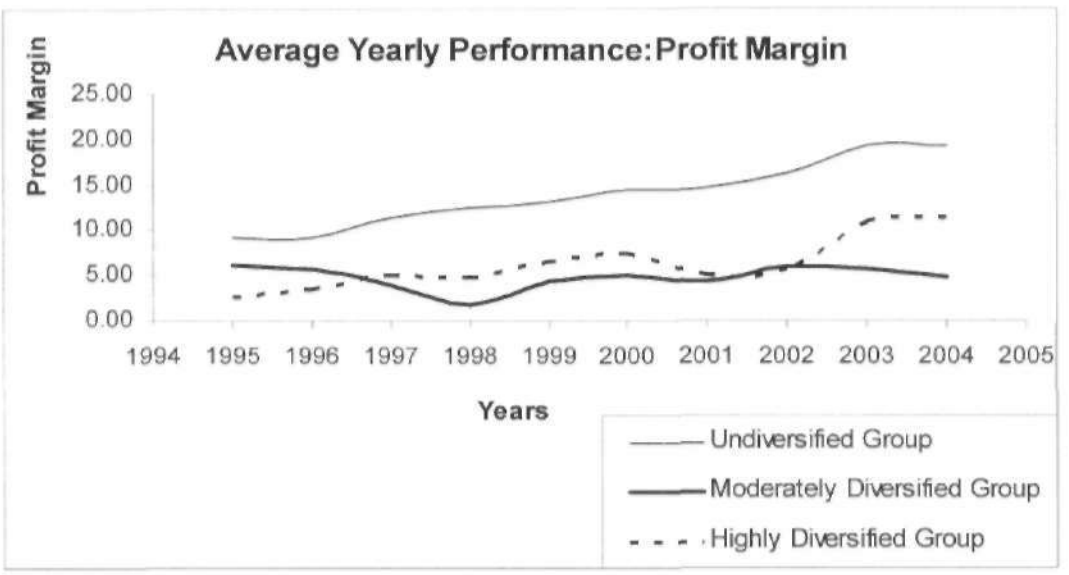
	Undiversified Group	*Highly Diversified Group*
Mean	13.91625	6.33
Variance	12.92849028	8.550760494
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	5.176277923	
P(T<=t) one-tail	3.79528E-05	
t Critical one-tail	1.739606432	

Table 4.9.16: Test statistic –moderately diversified Vs highly diversified (PM) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Moderately Diversified Group	*Highly Diversified Group*
Mean	4.73475	6.33
Variance	1.707316597	8.550760494
Observations	10	10
Hypothesized Mean Difference	0	
df	12	
t Stat	-1.575055183	
P(T<=t) one-tail	0.070613293	
t Critical one-tail	1.782286745	

Figure 4.9.4: Average annual performance (PM) (without outliers)



The results are similar and in the same direction as those obtained in the initial analysis.

Table 4.9.17: Variability and risk per unit of return on ROE (without outliers)

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	8	15.49	2.64	17.08
Moderately Diversified Group	8	13.75	3.76	27.32
Highly Diversified Group	3	8.37	4.64	55.45

Table 4.9.18: Variability and risk per unit of return on ROTA (without outliers)

	Number of Firms in Group	AROTA	SD	CV
Undiversified Group	8	11.95	2.33	19.50
Moderately Diversified Group	8	6.07	1.12	18.52
Highly Diversified Group	3	5.52	1.58	28.67

Table 4.9.19: Variability and risk per unit of return on ROCE (without outliers)

	Number of Firms in Group	AROCE	SD	CV
Undiversified Group	8	20.33	3.26	16.05
Moderately Diversified Group	8	18.20	2.87	15.75
Highly Diversified Group	3	12.85	3.16	24.55

Table 4.9.20: Variability and risk per unit of return on PM (without outliers)

	Number of Firms in Group	APM	SD	CV
Undiversified Group	8	13.92	3.60	25.84
Moderately Diversified Group	8	4.73	1.31	27.60
Highly Diversified Group	3	6.33	2.92	46.20

The results show that highly diversified firms have the worst risk return profile based on all performance measure and the worst variability based on ROE. These results are similar to those obtained in the initial analysis. Also, the results show that moderately diversified firms have better risk return profile than undiversified firms in terms of ROTA and ROCE. They also have better variability in terms of ROTA, ROCE and profit margin. Pulling the results of variability and risk return together, moderately diversified firms outperform undiversified firms.

Again, the same analysis was carried out in terms of geographic spread without the outliers. Table 4.9.21 through to table 4.9.24 show the results of association between extent of geographic spread and performance. The results are similar and in the same direction as those obtained in the initial analysis.

Table 4.9.21: Correlation between ASR (Geographic) and AROE (without outliers)

Correlations (ASR (Geo) and ROE)

			ASR (GEO)	AROE
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	-.083
		Sig. (2-tailed)	.	654
		N	18	18
	AROE	Correlation Coefficient	-.083	1.000
		Sig. (2-tailed)	.654	.
		N	18	18
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	-.074
		Sig. (2-tailed)	.	.771
		N	18	18
	AROE	Correlation Coefficient	-.074	1.000
		Sig. (2-tailed)	.771	.
		N	18	18

Table 4.9.22: Correlation between ASR (Geographic) and AROTA (without outliers)

Correlations (ASR (Geo) and ROTA)

			ASR (GEO)	AROTA
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	.098
		Sig. (2-tailed)	.	.597
		N	18	18
	AROTA	Correlation Coefficient	.098	1.000
		Sig. (2-tailed)	.597	.
		N	18	18
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	.131
		Sig. (2-tailed)	.	.603
		N	18	18
	AROTA	Correlation Coefficient	.131	1.000
		Sig. (2-tailed)	.603	.
		N	18	18

Table 4.9.23: Correlation between ASR (Geographic) and AROCE (without outliers)

Correlations (ASR (Geo) and ROCE)

			ASR (GEO)	AROCE
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	-.098
		Sig. (2-tailed)	.	.597
		N	18	18
	AROCE	Correlation Coefficient	-.098	1.000
		Sig. (2-tailed)	.597	.
		N	18	18
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	-.094
		Sig. (2-tailed)	.	.711
		N	18	18
	AROCE	Correlation Coefficient	-.094	1.000
		Sig. (2-tailed)	.711	.
		N	18	18

Table 4.9.24: Correlation between ASR (Geographic) and APM (without outliers)

Correlations (ASR (Geo) and PM)

			ASR (GEO)	APM
Kendall's tau_b	ASR (GEO)	Correlation Coefficient	1.000	.234
		Sig. (2-tailed)	.	.207
		N	18	18
	APM	Correlation Coefficient	.234	1.000
		Sig. (2-tailed)	.207	.
		N	18	18
Spearman's rho	ASR (GEO)	Correlation Coefficient	1.000	.306
		Sig. (2-tailed)	.	.217
		N	18	18
	APM	Correlation Coefficient	.306	1.000
		Sig. (2-tailed)	.217	.
		N	18	18

Table 4.9.25 through to table 4.9.27 show the results of differences in group-wise performance based on ROE. Again, the results are similar and in the same direction as obtained in the initial analysis.

Table 4.9.25: Test statistic – undiversified Vs moderately diversified (ROE) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances

Average Annual Return on Equity

	Undiversified Group	*Moderately Diversified Group*
Mean	14.06346154	10.21133333
Variance	9.718413314	76.70996099
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	1.31030549	
P(T<=t) one-tail	0.10839647	
t Critical one-tail	1.795883691	

Table 4.9.26: Test statistic – undiversified Vs highly diversified (ROE) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Undiversified Group	*Highly Diversified Group*
Mean	14.06346154	14.662
Variance	9.718413314	9.708362222
Observations	10	10
Hypothesized Mean Difference	0	
df	18	
t Stat	-0.429429329	
P(T<=t) one-tail	0.336353527	
t Critical one-tail	1.734063062	

Table 4.9.27: Test statistic –moderately diversified Vs highly diversified (ROE) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Equity

	Moderately Diversified Group	*Highly Diversified Group*
Mean	10.21133333	14.662
Variance	76.70996099	9.708362222
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	-1.513987018	
P(T<=t) one-tail	0.079110076	
t Critical one-tail	1.795883691	

Figure 4.9.5: Average annual performance (ROE) (Geographic) (without outliers)

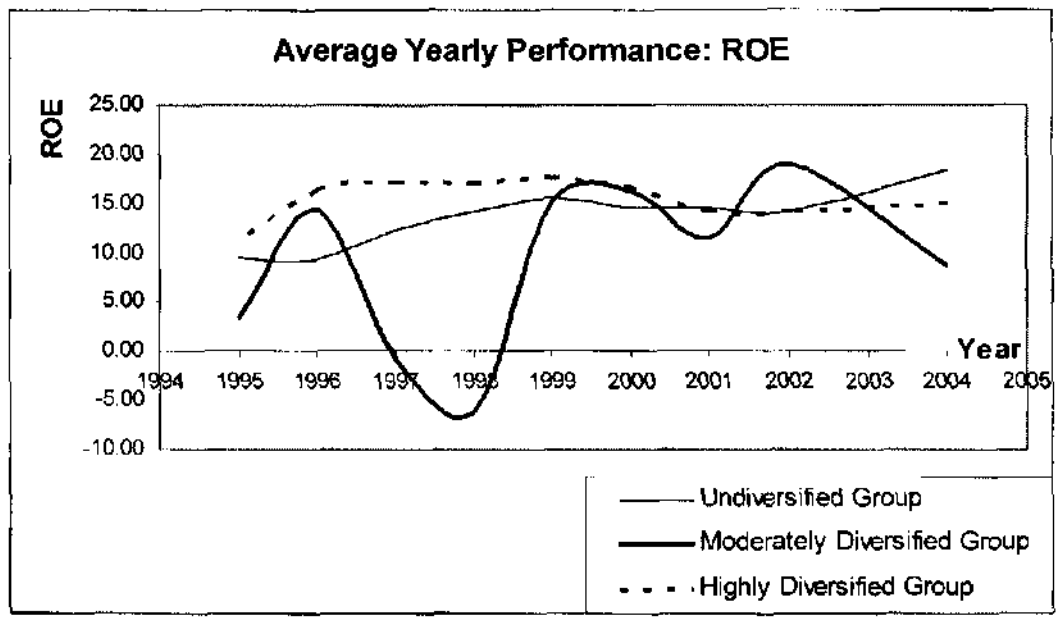


Table 4.9.28 through to table 4.9.30 show the results based on ROTA. Again the results are similar to those obtained in the initial analysis except that the result here shows no performance difference between undiversified and moderately diversified firms.

Table 4.9.28: Test statistic – undiversified Vs moderately diversified (ROTA) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Assets

	Undiversified Group	*Moderately Diversified Group*
Mean	9.634461538	7.623333333
Variance	3.367893465	9.950958025
Observations	10	10
Hypothesized Mean Difference	0	
df	14	
t Stat	1.742634744	
P(T<=t) one-tail	0.05165487	
t Critical one-tail	1.76130925	

Table 4.9.29: Test statistic – undiversified Vs highly diversified (ROTA) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Assets

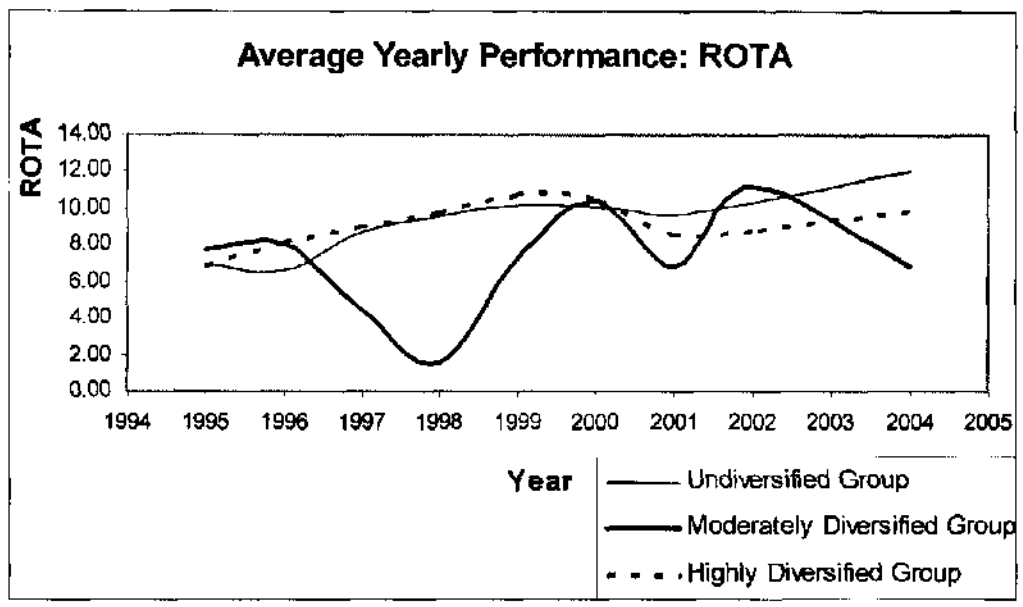
	Undiversified Group	*Highly Diversified Group*
Mean	9.634461538	8.873
Variance	3.367893465	2.068578889
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	1.032736152	
P(T<=t) one-tail	0.158098312	
t Critical one-tail	1.739606432	

Table 4.9.30: Test statistic –moderately diversified Vs highly diversified (ROTA) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Total Assets

	Moderately Diversified Group	*Highly Diversified Group*
Mean	7.623333333	8.873
Variance	9.950958025	2.068578889
Observations	10	10
Hypothesized Mean Difference	0	
df	13	
t Stat	-1.139856862	
P(T<=t) one-tail	0.137456367	
t Critical one-tail	1.770931704	

Figure 4.9.6: Average annual performance (ROTA) (Geographic) (without outliers)



The results remain the same based on ROCE. Table 4.9.31 through to table 4.9.33 show these results.

Table 4.9.31: Test statistic – undiversified Vs moderately diversified (ROCE) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances

Average Annual Return on Capital Employed

	Undiversified Group	*Moderately Diversified Group*
Mean	18.26030342	15.85211111
Variance	11.56296946	36.37943387
Observations	10	10
Hypothesized Mean Difference	0	
df	14	
t Stat	1.099844441	
P(T<=t) one-tail	0.144976495	
t Critical one-tail	1.76130925	

Table 4.9.32: Test statistic – undiversified Vs highly diversified (ROCE) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Undiversified Group	*Highly Diversified Group*
Mean	18.26030342	18.38047222
Variance	11.56296946	7.243753465
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	-0.087626441	
P(T<=t) one-tail	0.465598756	
t Critical one-tail	1.739606432	

Table 4.9.33: Test statistic –moderately diversified Vs highly diversified (ROCE) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Return on Capital Employed

	Moderately Diversified Group	*Highly Diversified Group*
Mean	15.85211111	18.38047222
Variance	36.37943387	7.243753465
Observations	10	10
Hypothesized Mean Difference	0	
df	12	
t Stat	-1.210543513	
P(T<=t) one-tail	0.124687257	
t Critical one-tail	1.782286745	

Figure 4.9.7: Average annual performance (ROCE) (Geographic) (without outliers)

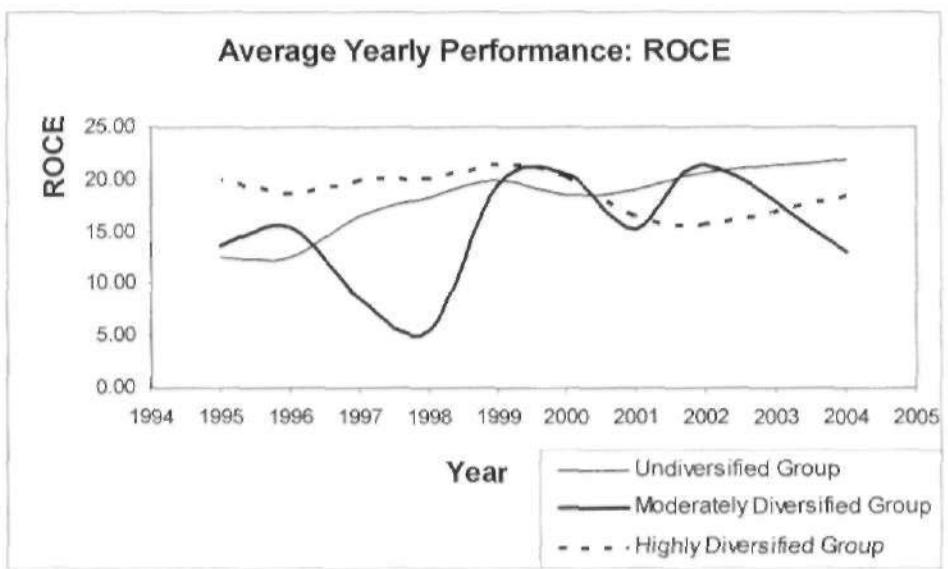


Table 4.9.34 through to table 4.9.36 show the results based on profit margin.

Table 4.9.34: Test statistic – undiversified Vs moderately diversified (PM) (Geographic) *(without outliers)*

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Moderately Diversified Group*
Mean	11.15138462	7.107333333
Variance	8.11493357	15.06587358
Observations	10	10
Hypothesized Mean Difference	0	
df	17	
t Stat	2.656148655	
P(T<=t) one-tail	0.008313378	
t Critical one-tail	1.739606432	

Table 4.9.35: Test statistic – undiversified Vs highly diversified (PM) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Undiversified Group	*Highly Diversified Group*
Mean	11.15138462	6.924
Variance	8.11493357	1.723487778
Observations	10	10
Hypothesized Mean Difference	0	
df	13	
t Stat	4.2619569	
P(T<=t) one-tail	0.000463196	
t Critical one-tail	1.770931704	

Table 4.9.36: Test statistic –moderately diversified Vs highly diversified (PM) (Geographic) (without outliers)

t-Test: Two-Sample Assuming Unequal Variances
Average Annual Profit Margin

	Moderately Diversified Group	*Highly Diversified Group*
Mean	7.107333333	6.924
Variance	15.06587358	1.723487778
Observations	10	10
Hypothesized Mean Difference	0	
df	11	
t Stat	0.141489544	
P(T<=t) one-tail	0.445020608	
t Critical one-tail	1.795883691	

The results are only different from initial ones in that they show no performance difference between moderately diversified and highly diversified firms.

Figure 4.9.8: Average annual performance (PM) (Geographic) (without outliers)

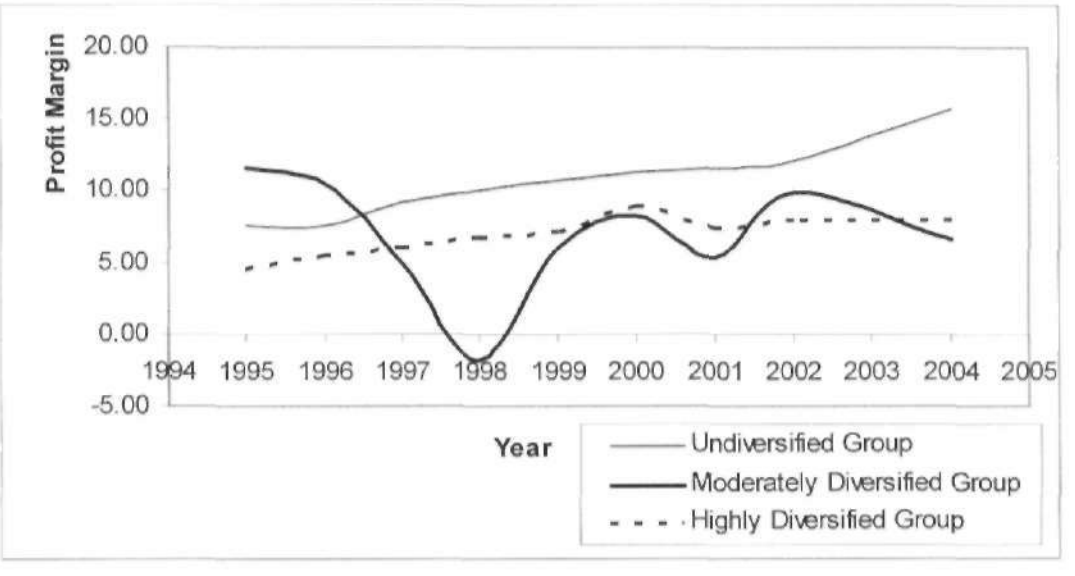


Table 4.9.37 through to table 4.9.40 show the results of variability and risk per unit of return of each performance variable.

Table 4.9.37: Variability and risk per unit of return on ROE (Geographic) (without outliers)

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	13	14.06	3.12	22.17
Moderately Diversified Group	3	10.21	8.76	85.77
Highly Diversified Group	2	14.66	3.12	21.25

Table 4.9.38: Variability and risk per unit of return on ROTA (Geographic) (without outliers)

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	13	9.63	1.84	19.05
Moderately Diversified Group	3	7.62	3.15	41.38
Highly Diversified Group	2	8.87	1.44	16.21

Table 4.9.39: Variability and risk per unit of return on ROCE (Geographic) (without outliers)

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	13	18.26	3.40	18.62
Moderately Diversified Group	3	15.85	6.03	38.05
Highly Diversified Group	2	18.38	2.69	14.64

Table 4.9.40: Variability and risk per unit of return on PM (Geographic) (without outliers)

	Number of Firms in Group	AROE	SD	CV
Undiversified Group	13	11.15	2.85	25.55
Moderately Diversified Group	3	7.11	3.88	54.61
Highly Diversified Group	2	6.92	1.31	18.96

The results are similar and in the same direction as those obtained in the initial analyses.

4.10 Summary

This chapter presented the results of the analyses. Key findings were that the extent of product diversification is negatively linearly related to performance when performance is measured based on ROTA and PM. However, no significant relationship exists between the extent of diversification and performance when performance is measured based on ROE and ROCE. With respect to geographic spread, the extent of diversification and performance are not linearly related based on all four performance measures.

In terms of product diversification, undiversified firms were found to outperform both moderately and highly diversified firms. No performance difference exists between moderately and highly diversified firms. In addition, undiversified firms were found to be superior to moderately and highly diversified firms both in terms of the variability and the risk per unit of return of the performance measures.

In terms of geographic diversification, no performance difference exists across the three groups when performance was compared based on ROE and ROCE. Undiversified firms outperform moderately diversified firms based on ROTA and PM. They also outperform highly diversified firms based on PM. Highly diversified firms outperform moderately diversified firms based on ROTA and PM. Highly diversified firms showed the best variability and risk per unit of return on all performance measures. However,

the variability and risk return profile of undiversified firms were found to be better than those of moderately diversified firms.

To test the robustness of these results, the data set was screened for outliers and reanalysed using the same methodology. In terms of product diversification, results on the nature of the relationship between diversity and performance remained the same. The results are in general, similar and the same direction except that the latter results suggest that both undiversified and moderately diversified firms outperform highly diversified firms in terms of ROE and ROCE. The latter results suggest that moderately diversified firms have better risk profile than undiversified firms.

The results in terms geographic diversity are generally the same except that the latter results show no performance difference between undiversified and moderately diversified firms in terms of ROTA. Also, the results show no performance difference between moderately diversified and highly diversified firms based on profit margin. The differences in the results as a result of screening out the outliers do no in general change the overall direction of the findings.

Chapter five: conclusion and recommendation

5.1 Introduction

This Chapter pulls together the results obtained in previous research works in the areas of diversification and performance with those obtained in this study. It does so by highlighting areas of agreements and disagreements between the results obtained and those of previous works.

Based on the analysis of the findings of this and those of previous works, practical recommendations are drawn and directions for future research are suggested.

5.2 *Conclusions*

The aim of the study was to asses the impact of both product and geographic diversification on the performance of construction firms. The first objective was to investigate the areas into which construction firms diversify. A review of the literature revealed that construction firms diversify into both related and unrelated businesses for different reasons. Some of these firms adopt the diversification strategy only as a short term survival strategy while others adopt it as a long-term growth strategy. Other reasons include the use of more positive cash flow and the avoidance of construction cycles and particular clients and markets. It was found that much like in the Korean and Singaporean construction industries, construction firms in the UK diversify mostly into construction related businesses. These businesses typically include property, housing and construction materials. The review of literature as evidenced by the areas into which construction firms diversify reveal that the direction of diversification is into construction related business. A look at the business segments in the annual reports of the construction firms in this study confirmed this.

The second objective was to investigate the extent of diversification (both product and geographic) by construction firms. This study used the specialisation ratio to measure the extent of firm's diversification. The firms were then grouped into undiversified (focused), moderately diversified and highly diversified based on Rumelt's (1974) classification scheme. In terms of product diversification, it was found that 39.1% (9 firms) of the firms studied are focused (undiversified), 43.5% (10 firms) are moderately diversified and 17.4% (4 firms) are highly diversified. In terms of geographic diversification, 14 (67%) are undiversified, 5 (24%) are moderately diversified and 2 (9%) are highly diversified. The implications of these results is that majority of the

firms studied are more in favour of focusing rather than diversifying, both geographically and product wise. Although none of the literature reviewed studied the extent of diversification in the UK construction industry, the results obtained are in line with the findings of a similar study (Hua and Pheng, 1998) in the Asian construction industry.

The third objective sought to investigate the nature of the relationship between the extent of diversification (product and geographic) and performance of the firm. Meeting this objective required the test of the following null hypotheses.

Null hypothesis (H1o): There is no negative linear relationship between a firm's average level of geographic diversity and its average performance.

Null hypothesis (H2o): There is no negative linear relationship between a firm's average level of geographic diversity and its average performance.

The measures of performance employed are return on equity (ROE), return on total assets (ROTA), return on capital employed (ROCE) and profit margin (PM). H1o is rejected based on ROTA and PM and accepted based on ROE and ROCE. The implication of the result is that the nature of the diversification-performance relationship follows the linear model when performance is measured based on ROTA and PM. The nature of the relationship when performance is measured based ROE and ROCE is less clear. What is clear is that it does not go by the linear model. The findings based on ROTA and PM partly agree with the position of the industrial organisation literature only with respect to the linearity of the relationship. However, while the position of the industrial organisation literature points to a positive relationship, the findings in this research suggest a negative one. This disagreement might be due to the peculiar nature of the construction industry.

With respect to the nature of the relationship between the extent of geographic spread and performance, the null hypothesis H2o was accepted based on all four performance measures.

The final objective of the research was to analyse the relative group-wise performance of undiversified, moderately diversified and highly diversified firms in terms of both

product and geographic diversification. Based on product diversification, the following null hypotheses were tested.

H3o: There is no performance difference between undiversified firms and moderately and highly diversified firms.

H4o: There is no performance difference between moderately diversified firms and highly diversified firms.

The null hypothesis H3o was rejected. The research findings revealed that while there is no significant difference between the undiversified group and the two other groups when performance is measured in terms of ROE and ROCE, undiversified firms outperform both other groups when performance is measured in terms of ROTA and PM. However, based on all four performance measures, H4o was accepted. The difference in performance between the moderately diversified group and the highly diversified group was not statistically significant. The implication of these findings is that diversification does not help the performance of UK construction firms. These findings agree with the findings of Ofori and Chan (2000) who found that Singaporean contractors have benefited and grown by focusing on construction and not by diversifying. In addition, the results support the findings of Hillebrandt (1996) who found that diversification by UK contractors has not been successful and went on to suggest that perhaps contractors are simply not good in other businesses. However, the findings disagree with the findings of Choi and Russel (2005) who found that the evidence in favour of focusing was not convincing for the USA construction industry.

This research effort further assessed the performance of each diversification group by analysing the variability and risk per unit of return of each of the performance measures. The results revealed that undiversified firms perform better than both moderately and highly diversified firms both in terms of variability and risk. The moderately diversified group was found to outperform the highly diversified group. What is interesting about this finding is that it does not support the generally accepted notion that diversification reduces risk. However, since UK construction firms are found to diversify mainly into construction related businesses (e.g. housing and property) which Hillebrandt (1996) explained are mainly investment goods that are as irregular and as cyclical as construction itself, the results are perhaps in the expected direction. The implication of

the findings is that diversifying into such areas that are as risky as the current business will only lead to increased risk. This is perhaps a subject of further research.

With regards to geographic diversification, performance difference across the groups was analysed by testing the following hypotheses:

H5o: There is no performance difference between geographically undiversified firms and geographically moderately and highly diversified firms.

H6o: There is no performance difference between the geographically moderately diversified firms and geographically highly diversified firms.

Both hypotheses were accepted when performance was compared based on ROE and ROCE. However, they were rejected when performance was compared based on ROTA and PM. The results indicate that undiversified firms outperform moderately diversified firms based on ROTA and PM and undiversified firms outperform highly diversified firms based on PM. Highly diversified firms outperform moderately diversified firms based on ROTA and PM. These results do not show as consistent a pattern as the results for product diversification.

The results for variability and risk per unit of return are also somewhat mixed. Highly diversified firms were found to outperform both moderately diversified and undiversified firms. This finding is in the expected direction since by spreading their businesses geographically, firms are expected to lower their risk-return profile (Qian, 1997). However, undiversified firms were found to exhibit lower variability and lower risk than moderately diversified firms. This finding is somewhat mixed as it does not seem to agree with the notion that internationalisation improves the risk-return profile of a firm.

To test the robustness of the findings of this research, the data set was screened for outliers and reanalysed using the same methodology. The results were generally similar and in the same direction. The only difference that affects the conclusion reached is that moderately diversified firms were found to have better variability and risk return profile than undiversified firms. Otherwise, the conclusion remains the same.

5.3 *Recommendations*

Based on the findings of this research effort, the following recommendations are put forward:

- The findings of this work suggest that diversification does not aid the performance of construction firms. It is therefore recommended that construction firms do not diversify if their aim for doing so is to achieve increased performance.
- Again, if the aim for diversifying is to reduce risk, it is recommended that construction firms do not diversify highly into construction related businesses. Rather, they should do so geographically.

5.4 Directions for Further Research

The following areas are identified as suitable for further research:

- In order to establish more solid understanding on the nature of the diversification-performance relationship, it is important to conduct a similar research with a larger sample than the one used in this study, and possibly carry out international comparisons on the diversification-performance subject.
- A key area that needs to be addressed in further research is difference in performance between related and unrelated diversifiers. This will throw more light on whether or not construction firms should seek related diversification.
- Further research effort should be tailored towards detailed investigation of why undiversified construction firms generally outperform diversified ones.
- Another area that needs further attention is the nature of the diversification-performance relationship. Further research efforts should be tailored towards building models that seek to explain the nature of this relationship.
- Further research effort should be tailored into detailed investigation of why the risk return profile of undiversified firms is lower than that of diversified firms.

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