DEPARTMENT OF ACCOUNTING AND FINANCE

Diversification, Financial Performance and the Destruction of Corporate Value? An Application of Fuzzy Set Analysis

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Declaration

This thesis is the result of the author's original research submitted as fulfilment of the degree of Doctor of Philosophy in accounting and finance at the University of Strathclyde. It has not been previously submitted for examination which has led to the award of a degree.

Signed: Ernest Francis **MABONESHO**

Date: August 2013.

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PhD is like a "***bitter pill"*** that can only be swallowed by sick persons after receiving some supports from caring persons. PhD requires a researcher to be patient, humble, and flexible throughout the process. And, it needs encouragements, guidance and supports from persons who care and willing to help, without them the PhD would have not been.

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Diversification, Financial Performance, and the Destruction of Corporate Value? An Application of Fuzzy Set Analysis

Abstract

FSA techniques appear to offer valuable complementary theoretical and empirical insights to conventional finance research methods in order to better understand the financial impact of corporate diversification strategies. FSA can provide a conceptual framework to integrate the often confusing and conflicting theoretical explanations and empirical results of past research. This thesis explores the potential usefulness of FSA in addressing finance research problems or paradoxes that are characterised by large numbers of inter-connected variables, complex causality and where different configurations lead to similar outcomes. Specifically fuzzy set analysis is used on cross-sectional data from firms listed in London stock exchange FTSE All-share index (2001-2010) in order to address a gap in the literature as to "***how corporate diversification necessarily and sufficiently leads to favourable financial performance"***.

The results of this research show that there is no simple answer to this question nor is there a simple theoretical explanation. It appears that a diversification strategy per se is neither a necessary nor a sufficient indicator of favourable or unfavourable financial performance. The FSA results showed multiple configurations of corporate diversifications and other firm attributes which are usually or more often than not sufficiently associated with favourable firm value, profitability, and risk-return performance. This indicates presence of complex causality, asymmetric causality, and equifinality in examining determinants of financial performance. The results are partially explained by elements of standalone theories but better explained by the construction of a series of hybrid theoretical frameworks.

The usefulness of FSA in helping understand and improve decision making processes that rely on complex financial or numeric information has been demonstrated, and it is hoped that this research acts as a "stepping stone" to legitimate a new set of analytical techniques for accounting and finance researchers to use. This would help corporate managers/CEOs, analysts, and investors in decision making processes.

Acronyms

ACTs	:	Agency cost theories. This includes ACTd which stands for agency cost theory of debt; and ACTe which stands to agency cost theory of equity.
CET	:	Coinsurance effect theory
DBA	:	Degree of business diversification as measured using segmental assets
DBS	:	Degree of business diversification as measured using segmental sales
DGA	:	Degree of geographic diversification as measured using segmental assets
DGS	:	Degree of geographic diversification as measured using segmental sales
FSA	:	Fuzzy set analysis
fsQCA	:	Fuzzy set qualitative comparative analysis software
HGHB	:	High geographic and business diversification.
HGLB	:	High geographic and not-high business diversification
ITS	:	Internalisation theory of synergy
LGHB	:	Not-high business and high geographic diversification
LGLB	:	Not-high geographic and business diversification
LSE-FASI-Firms	:	London Stock Exchange FTSE All-Share Index listed firms
POT	:	Pecking order theory
QMA	:	Quine-McCluskey Algorithm
RRP	:	Risk-return performance
TCT	:	Transaction cost theory

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Chapter 1 : OVERVIEW OF THE THESIS

1.1: INTRODUCTION

Diversification is an important strategic consideration for senior corporate managers as it is critical to the growth of their organisation and will have a major impact on their financial performance (Capar and Katobe, 2003, p.345). The merits of corporate diversification strategies have been questioned over time and have often been seen in a very negative light and recently Ammann et al., (2012, p.286) posed the question why "so many firms diversify or remain diversified if diversification destroys so much value?" Studies on corporate diversification-performance relationship reported conflicting empirical results as to how corporate diversification is associated with favourable (or negative) financial performance (Hall and Lee, 2010). The main theories used in empirical finance have also struggled to explain the merits and consequences of corporate diversification strategic choices.

Whether corporate diversification is beneficial to shareholders, debt holders or managers has been a topic of interest for many researchers (Barnes and Hardie-Brown, 2006; Wiersema and Bowen, 2011). These research studies have consistently provided inconsistent and inconclusive results (Riahi-Belkaoui, 1998; Denis et al., 2002). The corporate diversification-financial performance relationships have been found to be negative (Shaked, 1986; Collins, 1990; Berger and Ofek, 1995; Lins and Servaes, 1999), positive (Kogut, 1985; Grant, 1987; Daniels and Bracker., 1989; Morck and Yeung., 1991; 1992; 1997), and/or curvilinear relationships (Hitt et al., 1997; Riahi-Belkaoui, 1998; 1999; Chiang and Wang, 2011).

Campa and Kedia., (2002, p.1731) argue that "firms choose to diversify when the benefits of diversification outweigh the costs of diversification and stay *focused* when they do not". Despite the undeniable logic of this statement there remain a number of unanswered questions, such as how does diversification sufficiently enhance or destroy financial performance? Which attributes of corporate diversification are *necessary or sufficient* [1] to create favourable financial performance?

The idea for this thesis began with the observation that corporate diversification could either enhance or destroy firm value and a desire to better understand the statement that "diversification is bad for some firms and good for others" (Matsusaka and Nanda, 2002, p.176). The research into the impact of corporate diversification strategies is characterised by competing theories, inconsistent empirical findings and a collection of plausible, yet partial answers. Researchers noted that methodological and theoretical problems could be one source of these inconsistent results and conclusions (Sullivan, 1994, Hitt et al., 1997; Capar and Katobe; 2003; Hall and lee, 2010) given that the complex causality relationships associated with investigating corporate diversification strategies had exceeded the ability of traditional statistical methods to provide robust and reliable answers.

This thesis attempts to contribute to the research in this field by addressing the research question:

> ***How does corporate diversification necessarily and sufficiently lead to favourable financial performance?***

The answer to this question will be explored by examining configurations of geographic and business diversification strategies[2], corporate attributes (financing choice, asset structure, and firm size) and firm value, profitability, and risk-return performance in London stock exchange FTSE All-share index (hereafter LSE-FASI-Firms) firms. Specifically this thesis is proposing to apply a set-theoretic framework, fuzzy set analysis (FSA), and develop hybrid theories that could explain and empirically examine the complex relationships amongst corporate diversification strategies, corporate characteristics and financial performance outcomes. In

[1] Appendix 1 defines necessary and sufficient conditions/configurations, and most of the FSA terminologies are defined this appendix, therefore, I would request the readers to refer to appendix 1 for definitions where necessary

[2] Corporate diversification includes geographic and business diversification. Geographic (business) diversification is defined as a company's expansion beyond its home country (main business activities) across different geographic areas (line of business).

particular this thesis will seek to identify how (and whether) corporate diversification can be value-adding.

It was decided to apply fuzzy set analysis (FSA) in response to calls for new statistical methods to address the causal complexity of this research topic. FSA has been successfully applied to research problems that are characterised by complex configurations and complex causality relationships and was felt to offer a number of complementary insights to conventional finance research methods as well as having the potential to integrate the theoretical and empirical results of past research. It is argued that FSA could provide the bigger picture to frame, reposition and evaluate past theoretical and empirical findings. This thesis will attempt to demonstrate the value of FSA in addressing empirical sites with large numbers of inter-connected variables, complex causality and where different configurations lead to similar outcomes.

1.2: MOTIVATION OF THE RESEARCH

> *"Human understanding of causation and of events in general is fundamentally* ***holistic****. Parts are not viewed in isolation but in the context of the whole they form. To change one or more elements often changes how the whole is perceived or understood, which, in turn has an impact on the meaning of each individual part"* (Ragin, 1987, pp. 23-24).

As an assistant lecturer and researcher in accounting and finance, I have often wondered how examining external indicators of corporate financial performance can help to understand what is going on inside the corporate box. While reflecting on this question over a long period of time I felt understanding these financial indicators in a more holistic way could provide a better understanding of the inside of the box. This preference towards understanding problems as a series of inter-connected systems and relationships was critical in shaping the research design of my thesis.

Corporate financial performance is usually represented in financial statements as forms of accounting numbers. Many important decisions are informed by these numbers, for example, when investors make investment decisions or managers evaluate the effectiveness of past decisions. However, when viewed in isolation, accounting numbers can be difficult to incorporate into stakeholders' decision models. Incorporating these numbers into decision making processes requires a theoretical understanding of the cause-effect relationships of these different proxies of corporate performance, although in most case these theories are implicit, rather than explicit. For example, high levels of debt in the capital structure could be used as an indicator of low average cost of capital[3], leading to favourable profitability because of tax advantages. However, high leverage does not necessarily lead to favourable financial performance in firms that have high levels of intangible assets. In these cases high leverage can be interpreted negatively and associated with a high average cost of capital, with investors in debt capital requiring higher returns due to heighten risk concerns leading to lower profitability. In this context, viewing leverage in isolation from asset structure could lead to conflicting results due to different theoretical assumptions of acceptable levels of debt.

It is also naively assumed by many users of financial indicators that different measures of financial performance (firm value, profitability, risk-return) can be conflated and unproblematically substituted when evaluating performance or making decisions. These abstract numbers require different theories to translate them into judgements or evaluations of good / bad. It is the combination of the 'data' and the 'theory' that turns simple measures into predictions of future performance or effective evaluations of corporate performance. The importance of understanding the theories underpinning the selection of financial indicators (how well they represent an outcome of interest) and the causal relationships (that lead to an outcome of interest) is something that I believe is often overlooked and worthy of further investigation.

The theories (and practices) of corporate diversification-financial performance relationships have undergone major shifts over time. In the last decade it would appear that there is a value premium from corporate diversification (Campa and Kedia, 2002). However, this contradicts previous studies that argued that highly diversified-firms traded at discounts as compared to focused firms (Rumelt, 1982; Varadarajan and Ramanujam, 1987; Berger and Ofek, 1995; Servaes, 1996; Lins and Servaes, 1999; Barnes and Hardie-Brown, 2006). Diversified firms were deemed to

[3] Capital asset pricing model (CAPM) can be used to justify this.

have less market power in their markets (Montgomery, 1985) and higher agency costs and problems (Jensen, 1986; Li and Li, 1996), which hinders synergistic benefits from information-based assets across related businesses (Bettis and Hull, 1982), and prohibits knowledge transfer across segments (Nickel and Rodriguez, 2002; Fang et al., 2007). These factors suggest that diversified-firms would exhibit poorer financial performance when compared with focussed firms.

Prior research into corporate diversifications and their relationship with financial performance outcomes suggested that existing theories of representation and causation do not adequately explain the relationship between diversification strategies and financial performance. This suggests that a new approach that is able to embrace complex causality and represent a more holistic, systematic understanding of the situation of concern could complement the existing body of work as it is argued that the complex interaction of causal variables cannot be adequately modelled using net-effect models (Gujarati, 1988; McGahan and Porter, 2002; Diamantopoulos et al., 2008; Greckhamer et al., 2008; Richard et al., 2009; Crilly, 2011; Fiss, 2011; Purkayastha et al., 2011; Rodgers and Guiral, 2011). It is also argued that understanding corporate diversification-financial performance relationships is highly sensitive to the problems of multidimensional variable misrepresentation in net-effect models (Kimberly, 1976; Nunnally, 1978; Gooding and Wagner III, 1985; Sullivan, 1994; Rodgers and Guiral, 2011). Net-effect models, like linear regression, assume that independent variables are “freestanding”, and “operate in a relatively uniform and linear-additively” when impacting upon dependent variables (Ragin, 2000, p.332). It will be argued that in the case of corporate diversification-financial performance relationships these assumptions are not always true as it appears that certain causal factors only appear to impact on an outcome in the presence (or absence) of other factors (Ragin, 2008; Pajunen, 2008; Greckhamer et al., 2008; Rihoux and Ragin., 2009; Crilly, 2011; Fiss, 2011).

Generally net-effect models are considered to be the effective tools for predicting and determining significant relationships between causes and outcomes (Hair et al., 2006). However, structurally these models are relatively weak when testing for causality. Kandall and Stuart, (1961) as cited in Gujarati, (1988) asserted that

> "*a statistical relationship, however strong and however suggestive, can never establish causal connexion: our idea of causation must come from outside statistics, ultimately from some other theory*" (Gujarati, 1988, p.18).

Therefore, McGahan and Porter, (2002, p.850), made a call to "explore whole new approaches" for dealing with complex causality.

This structural weakness with net-effect modelling combined with a desire to develop a more holistic approach to understanding financial performance measure led to the second motivation for this study. This motivation was to explore and evaluate new methodologies that can adequately deal with complex causality in finance and accounting research (Gujarati, 1988; McGahan and Porter, 2002; Richard et al., 2009) and FSA appeared to be a suitable methodology for this task (Greckhamer et al., 2008; Crilly, 2011, Fiss, 2011).

Ragin, (2000; 2008) and Fiss, (2007; 2011), suggest that FSA is capable of handling complex causality and can complement net-effect models through examining the necessity and sufficiency of causes for an outcome of interest. FSA is claimed to be able to avoid the methodological problems of model misspecification (Diamantopoulos et al., 2008; Rodger and Guiral, 2011), concept misrepresentation, biased results, and misleading conclusions (Nunnally, 1978; Sullivan, 1994).

The received wisdom of research into corporate diversification-financial performance relationships is that "diversification is bad for some firms and good for others" (Matsusaka and Nanda, (2002, p.176), depending on other corporate attributes. Unfortunately, the research (when taken as a whole) does not provide us with reliable and robust findings as to what these attributes are. Theoretically, both business and geographic diversification strategies (or any combination) can enhance or destroy firm value depending on the presence (or absence) of a range of corporate attributes. I will argue that understanding how corporate diversification strategies can lead to favourable financial performance outcomes requires configurational model analysis ***in addition to*** net-effect models. FSA was selected as an appropriate research methodology as it has the ability to analyse complex configurations, applies macrovariables[4] to solve multidimensional concept misrepresentations (Ragin, 2000), allows for causal asymmetry and equifinality.

The impact of corporate diversification on financial performance in the firms listed in the London Stock Exchange has not been extensively examined (Barnes and Hardie-Brown, 2006). Therefore, this research selected LSE-FASI-Firms to understand how (and whether) corporate diversification strategies necessarily and sufficiently increased financial performance.

To summarise, this research will apply a configurational approach (FSA) and develop theoretical hybrids (Jacob, 2005; Thomson et al. 2012) in order to understand how diversification strategies interact with other firm attributes and financial performance indicators. In this thesis the term *hybridisation of theories* is used to refer to a combination of two or more theories that support one another in explaining results. The specific research objectives, related research questions and testable hypotheses will now be discussed in the sections that follow

1.3: RESEARCH OBJECTIVES, QUESTIONS AND HYPOTHESES

1.3.1: RESEARCH OBJECTIVES

The principal aim of this thesis is to understand how geographic and business diversification strategies interact with other corporate attributes to create configurations that could necessarily or sufficiently lead to favourable financial outcomes. In order to accomplish this aim, I identify two intermediate objectives.

The first objective is to provide evidence of the methodological advantages of using a FSA approach relative to more conventional net-effect methodologies. This required analysing the same dataset using traditional methods (cluster analysis, independent sample mean comparison, and linear regression analysis as in Singh et al., (2003) and using FSA. The results of these two different methodologies are able to be combined to identify the contributions, contradictions and complementary insights from both approaches in understanding corporate diversification-financial performance relationships. This two-phase research design allows the identification of the additional insights from FSA methods as compared to the traditional finance

[4] See section 1.5.2.2 for definition and illustration of macrovariable (see also appendix 1)

research methods as well as providing a degree of mutual robustness checking. Establishing an empirical baseline to demonstrate of the extent to which FSA techniques, such as set-theoretical frameworks, macrovariables and truth tables, can mitigate the relative weakness of net-effect methods (Nunnally, 1978; Ragin, 2000; Sullivan, 1994).

The second objective is to explore how different configurations of geographic and business diversification, asset structure, financing choices, and firm size are related to financial outcomes such as firm value, profitability, and risk-return performance. It was hoped that through the application of FSA, (Ragin, 2008; Fiss, 2011) and the hybridisation of theories it would be possible to identify robust and statistically significant case configurations that are associated with favourable firm values, profitability and risk-return performance and that are explainable using relevant theoretical reasoning.

This research project draws on the dominant theoretical approaches used in empirical finance research. These theories include, internalization theory of synergy (ITS) (Morck and Yeung., 1991; 1992; 1997; Malone and Rose, 2006), agency cost theories (ACTs) (Jensen & Meckling, 1976; Jensen, 1986; Stulz, 1990; Li and Li., 1996), transaction cost theory (TCT) (Williamson, 1988), coinsurance effect (CET) (Lewellen, 1971) and pecking order theory (POT) (Myers, 1984; Myers and Majluf, 1984).

1.3.2: KEY RESEARCH QUESTIONS AND HYPOTHESES

FSA is not a common method of analysis in an accounting and finance context. Therefore, this research uses conventional statistical tools such as cluster analysis, independent sample means comparison, and ordinary least square (OLS) analysis to provide an empirical baseline for comparing my results with previous researchers and provide support for FSA results. In this context, research questions were divided into two categories: key research questions and supporting research questions. The key research questions are concerned with the results from the application of FSA and the supporting questions are intended to demonstrate the suitability of and justify the application of FSA for the current research aims.

The main research question (*How corporate diversification necessarily and sufficiently leads to favourable financial performance?*) was broken down to be sub-divided into three key research questions to facilitate empirical testing and theoretic analysis. These three questions are listed below:

1. ***How does corporate diversification necessarily and sufficiently lead to favourable firm value?***
2. ***How does corporate diversification necessarily and sufficiently lead to profitability?***
3. ***How does corporate diversification necessarily and sufficiently lead to favourable risk-return performance?***

These three research questions were then developed to establish testable hypotheses based on FSA concepts and terminology. A short summary of the reasoning for each of the hypothesis is provided below.

a. ***A combination of high membership in geographic and not-high membership[5] in business diversification sets, high membership in internal fund and intangible asset sets is a necessary but insufficient indicator for achieving favourable firm value. Sufficient configurations will depend on a firm's memberships in other set attributes such as size and leverage[6].***

b. ***A combination of not-high membership business diversification and high membership in internal fund sets is a necessary but insufficient indicator of favourable profitability. Sufficient configurations will depend on a firm's membership in other attributes like asset structures, firm size, and geographic diversification.***

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[5] In this research, a case is classified as having high memberships in a particular set when it has higher than 0.5 fuzzy set value (see chapter 5) in the respective set otherwise it is classified as having not-high membership. Most of the terms used in this research are defined in appendix 1.

[6] The hypotheses were stated using theories that appear to identify necessary but not sufficient configuration because of the possible complex interaction among corporate attributes which can only be determined through truth table analysis. Therefore I was unable to hypothesize the sufficient configurations.

c. ***The combination of not-high membership geographic diversification and intangible asset sets is necessary but not sufficient for unfavourable firm value.***

d. ***A combination of not-high membership in a business diversification set, and high membership in internal fund (retained earnings) and firm size sets is a necessary but insufficient indicator of favourable risk-return performance. Other factors like asset structure and degree of geographic diversification are important for determining sufficient routes***

e. ***The absence of a high level of internally generated fund is a necessary but insufficient indicator of unfavourable business risk-return performance in diversified firms.***

Hypothesis a

This hypothesis is linked to key research question 1 and draws on the reasoning underpinning internalisation theory of synergy (ITS), and transaction cost theory (TCT). There would appear to be a large degree of commonality and hybridisation potential from these two theories (Williamson, 1988; Richard et al., 2009) in explaining the impact of geographic and business diversification on firm value. ITS explains that geographic diversification creates an internal market for firm-specific assets (intangibles) that allow investors to positively value firms that have a high level of geographic diversification and intangible assets (Morck and Yeung, 1991; 1992; 1997). However, due to the high transaction costs of financing intangibles through external funds (e.g., debt capital), TCT argues that a high level of internal fund is necessary to finance intangible assets as this reduces transaction costs and leads to lower average cost of capital.

In addition, not-high business diversified-firms allow synergistic benefits from information-based assets (Bettis and Hull, 1982), which facilitates easier knowledge transfer across the related segments (Nickel and Rodriguez, 2002: Fang et al., 2007). This allows not-high business diversified-firms to benefit from company’s specific assets. In this context, hybridisation of the two theories suggests that high geographic and not-high business diversification strategies (HGLB) require a configuration of a high level of intangible asset and internal funds as a necessary condition for favourable firm value. Therefore, **hypothesis a** will be used to test key question 1

Hypothesis b

Prior research argues that not-high business diversified-firms create more profit than high-business diversified firms, because not-high business diversified firms have relatively high market power (Montgomery, 1985), lower agency problems (Jensen, 1986), enjoy synergistic benefits from information-based assets across related business (Bettis and Hull, 1982), and easier knowledge transfer across the segments (Nickel and Rodriguez, 2002: Fang et al., 2007). These factors combine to allow firms to create favourable profits. However, the coinsurance effect (Lewellen, 1971), would suggest that not-high business diversified-firms may be associated with high transaction costs of accessing external debt capital because the expected risk of cash flow from related business is relatively high. This means a high level of internal funds may be necessary in combination with not-high business diversification to create favourable profitability. Therefore, **hypothesis b** tests the key question 2.

Hypothesis c

Question 1 and 2 should also identify configurations for unfavourable firm value and profitability respectively. Since firms are not established for creating unfavourable firm value and profitability, it might be difficult to provide a hypothesis for essential routes to unfavourable financial performance (Fiss, 2011). However, based on ITS, it would be expected that the absence of a high level of intangible assets and high level of geographic diversification is necessary before investors assign less value to firms. Therefore, **hypothesis c** will allow additional testing of research questions 1 and 2.

Hypothesis d

Prior research based on agency cost theories (ACTs) would suggest that any diversification (geographic or business) increases agency problems which could reduce firm profitability. However agency theory would also suggest that business risk-reduction performance depends on financing choices and firm size. It is argued that while high leverage reduces the agency problem of overinvestment on the one hand (Jensen, 1986; Li and Li, 1996), on the other hand high leverage increases agency problems of underinvestment (Jensen and Meckling, 1976; Hillier, et al., 2011). Therefore, it is not clear as to how corporate diversification and financing choice lead to favourable risk-return performance. However, recent evidence has shown that the diversification discount is higher in high leveraged firms than in high equity fund firms (Ammann et al., 2012).

In addition, a high level of internal funds is considered "as a buffer to external turbulence and as a reservoir for exploring available opportunities" (Deephouse and Wiseman, 2000, p. 468). It is also noted that the presence of internal funds enhances innovation and prevents firms future "downside risk" (Singh, 1986, p. 567), as well as providing discretionary decisions for future investments (Myers, 1977). In addition, firms with low or zero dividend payout are considered as having high positive investment opportunities (Jones and Danbolt, 2004; 2005), this implies that high level of internal funds can be used as a signal of positive investments and can be used to make less risky diversification in the best interest of shareholders and provide "indicators of a firm's health" (Deephouse and Wiseman, 2000, p.466).

Previous researchers have documented that "related diversification is a necessary but not sufficient condition to achieve favourable risk-return performances" [7] (Bettis and Mahajan, 1985, p.793). Not-highly business diversified firms with high expenditure on intangible asset and lower level of debt capital had relatively better RRP performance (Bettis and Hall, 1982; Bettis and Mahajan, 1985). It was therefore argued that related diversification strategies enable efficient results through shared R&D and marketing costs, expertise, and business experience across related segments. This implies that internal funds are necessary in enabling not-high business diversified firms to enhance risk-return performance. It is also the case that relatively large firms are likely to achieve favourable RRP because; they are capable

[7] A condition or a configuration is considered necessary if it must be present for an outcome to occur, while a cause is defined as sufficient if, by itself, it can produce an outcome (see section 3.2.3.6 of this thesis for further discussion on these concepts).

of accumulating large amounts of internal funds and undertaking geographic diversification.

It was further found that not-high business diversified firms enhance RRP through geographic diversification (Kim et al., 1989; 1993). It was found that related-business environments across countries overcome sales volatility which can lead to higher returns and lower risks. This is because geographic diversification increases profits and reduces business-risks through operational flexibility that mitigates the negative impact of a specific country's interest rates, tax rates, labour costs, and raw material costs (Kim et al., 1989; 1993; Lee et al., 2006).

According to the literature above, it appears that a hybridisation of TCT, ITS, and ACTs could provide sufficient explanation and answers for the key research question 3. **The hypothesis d** is therefore used to explore empirical answers to key research question 3

Hypothesis e

Key research question 3 also was intended to explain configurations that would usually lead to unfavourable risk-return performance. However, since firms are not established for creating unfavourable financial performance, then it is hard to identify better theories that can explain configurations that lead to unfavourable risk-return performance. However, it would appear that most theories agree that the absence of a high level of internal fund leads to the inability of firms to flexibly undertake positive investments and increases risk of bankruptcy. This leads to unfavourable profitability and business risk-reduction. In addition, absence of high level of internal funds provides signal of an "unhealthy" firm (Deephouse and Wiseman, 2000, p.466). In this context, the hypothesis e is used to understand routes to unfavourable RRP.

1.3.3: SUPPORTING RESEARCH QUESTIONS

As noted above, the impact of corporate diversification on financial performance appears to depends on other firm attributes (Chkir and Cosset., 2001; Singh et al., 2003; Low and Chen., 2004)[8], such as asset structure (Morck and Yeung., 1991; 1992; 1997; Malone and Rose, 2006), financing choice (Li and Li 1996; Singh et al., 2003), and firm size (Morck and Yeung, 1997; Drugun, 2002; Qian, 2002; Qian et al., 2003; Canbäck et al., 2006; Geiger and Cashen., 2007). The potential impact of these factors has already been tested in the research literature with a range of different results. However, this does not mean that prior research methods cannot provide robust or significant answers to the key research questions or that it can be assumed that FSA will provide better answers. Therefore a series of supporting research questions specifically designed to test the contribution of FSA in resolving the previously identified weaknesses in conventional analysis techniques have been developed. These three supporting questions form an important part of this research design in order to provide support and act as stepping stones towards the application of FSA. I will now outline these three supporting research questions and related hypothesis.

Supporting research question 1

> ***Does a single measure of a multidimensional concept sufficiently represent the concept?***

Researchers have argued that the selection of one variable to represent a multidimensional concept can lead to biased and inconclusive results (Nunnally, 1978; Sullivan, 1994). For example, Sullivan, (1994), argued that corporate diversification is a multidimensional construct, and, unless an index which reflected these multiple dimensions of corporate diversification was used, researchers would end up with biased results and misleading conclusions. The question as to what variable or measure could sufficiently represent corporate diversification is unresolved (Sullivan, 1994) and this problem also exists in other studies (see for example Danbolt et al., 2011), but there is limited attempts to solve the problems of multidimensional concept misrepresentations. Therefore, this thesis will attempt to

[8] See table 2.4 in chapter 2 for further evidence and review of the literature

provide evidence of the extent of this variable misrepresentation problem and how this problem may be mitigated.

In order to provide more fine grained empirical answers to this question, I developed three questions that were directed to the three multidimensional concepts applied in the current research (see section 1.5).

1(i) ***Does choice of segmental assets or segments sales to measure corporate diversification lead to a firm to be classified as having different memberships in corporate diversification set?***

1(ii) ***Does choice of ROA or ROS to measure profitability lead to a firm to be classified as having different memberships in profitability set?***

1(iii) ***Does choice of assets or sales volume to measure firm size lead to a firm to be classified as having different memberships in firm size set?***

H0: ***The use of a single measure to represent a multidimensional concept is not a sufficient proxy of the multidimensional concept.***

H1: ***The use of a single measure to represent a multidimensional concept is a sufficient substitute for the multidimensional concept.***

Supporting research question 2

The first and the second key research questions were preceded by supporting research question 2 which was divided further into 3 questions.

2(i) ***Is there a diversification strategy that necessarily leads to favourable firm value and profitability?***

2(ii) ***Does degree of geographic and business diversification lead a firm to be classified in different memberships in firm value, profitability, financing choice, firm size, and asset structure sets?***

2(iii). ***Given geographic and business diversification strategies, what are the impacts of geographic and business diversification memberships on firm value and profitability sets?***

Supporting question 3

The third key research question is preceded by supporting research question 3 which was divided further into four questions.

3A. Is there a diversification strategy that is necessary for risk-return performance?

3B Do diversification strategies usually lead firms to possess different memberships in risk-reduction and risk-return performance sets?

3C Do firms with the same memberships in favourable risk-return performance have significant different memberships in other firm characteristics sets?

3D. Given firms' diversification strategies; what is the impacts of corporate diversification membership on risk-return performance set?

In order to provide empirical evidence on the key research questions 1, 2, and 3, I need to understand if diversification strategies per se are necessary attributes for favourable firm value, profitability, and risk-return performance. I also wanted to understand if diversification strategies usually lead to significant differences in financing choice, asset structure, and firm size. The supporting questions were also intended to examine whether the impact of business and geographic diversification on financial performance is different across different diversification strategies. Therefore, supporting questions consists of further sub-questions which can be used as stepping stones to the key research questions 1, 2 and 3. Empirical evidence of supporting questions 2 is presented in chapter 6 and chapter 7, and the empirical evidence of supporting question 3 is presented in chapter 8 of this thesis.

1.4: ASSUMPTIONS OF THE RESEARCH

Leedy and Ormrod, (2010) argued that research "assumptions are so basic that without them, the research problem itself could not exist" (p. 62). Research objectives and research questions are usually built on underlying research assumptions and these assumptions need to be theoretically and substantively true. This research is built on the fuzzy logic principle that "everything is a matter of degree" depending on the context (Kosko, 1994, p.18).

In order to provide answers to research questions, philosophical assumptions are important because they allow researchers to establish the boundaries of their research (Morgan and Smircich, 1980). Philosophical assumptions allow researchers to correctly select better methods for answering the research questions. While research philosophy and method are discussed in detail in chapter 4, this section provides a short summary of my prior assumptions as to how I conceptualise organisations and why the FSA is important for this research.

In this research, an organisation is considered to be analogous to a living organism (Boland, 1989; Hatch, 1997). Boland (1989) argued that like an organism, an organisation is an open system inhabiting, adapting, and evolving interactively with the environment in order to build up its intrinsic potential and to uphold the sense of organisational wellbeing. In addition, like living organisms, organisations have purposes to accomplish. For the profit oriented firm: profitability, value enhancements, and survival are their primary goals which have to be accomplished through proper use of their available resources.

Living organisms accomplish their goals through the collectiveness, interdependencies, and interconnectedness of their parts. However, some parts may appear more important for a particular activity and others appear secondary[9]. In the same way; favourable firm value, profitability, and risk-return performance are accomplished through collective functioning of a firm's "parts" of which some are core while others are supporting (Goertz and Mahoney, 2005; Fiss, 2011). Hatch, (1997) also argued that like a living organism, an organisation's survival depends on its fitness to operate in a range of different environments such as employees (human capital), investors (physical assets – source of finance), suppliers and customer relations (revenue).

In the sense of organic functioning, Hatch, (1997), noted that like living organisms, corporations compete for survival and are responsive to environments. Therefore, competitive advantage ensures corporate survival. In addition, parts of a living organism work as team in order to achieve certain outputs; therefore it is hard to examine the contribution of one part in isolation from other parts because they are connected in a particular way to bring hybridised results. The absence of a particular

[9] see Goertz and Mahoney, (2005, pp. 501-504) for more discussion of basic and secondary factors

part of the body impairs the performance of others and this is no different from the functioning of firm attributes.

Firm attributes: financing choice (debt and equity funds), asset structure (asset tangibility and specificity), firm size, and diversification strategies are like the "organs" of a firm. Their combinations provide various signals of financial performances and users of financial information utilise them in making decisions about financial performance. These signals are viewed as a configuration of the firm attributes that can be examined through a *fuzzy paradigm*[10]. Within this paradigm there are a number of important attributes that have the potential to contribute to addressing the research questions of this thesis.

The first attribute is *conjunctural causation* or complex causality as explained in Ragin, (1987; 2000). Conjunctural causation and complex causality are used interchangeably. Conjunctural or complex causality occurs when the variables that are seen "to be causally related in one configuration, may be unrelated or even inversely related in another" (Fiss, 2007, p.1181). This means that the relationship of causal and outcome variables goes beyond linearity or symmetry and can create binary interaction relationships involving synergistic effects, which leads to asymmetrical causality. According to Ragin, (2008), asymmetric causality argues that causes leading to an outcome of interest may be significantly different from those that ***do not*** lead to that same outcome of interest.

Financial performance causal conditions have been found to exhibit complex causality. For example the same factors exhibit differential effects on financial performances due to the presence or absence of other factors (Greckhamer et al., 2008; Fiss, 2011). In this research, I assumed that the presence or absence of geographic and business diversification strategies and other firm attributes (financing choice, asset structure, and firm size) exhibit conjuctural causality and could result in different configurations leading to favourable or unfavourable financial performance outcomes. This means that the impact of corporate diversification on financial performance should be viewed in combination with other corporate characteristics as

[10] The concept of fuzzy paradigm is discussed in chapter 4. The concept refers to research paradigm which is not purely found in objectivists' or subjectivists' camps.

noted in (Morck and Yeung, 1997; Capar and Kotabe, 2003; Lu and Beamish, 2004; Barnes and Hardie-Brown, 2006), and are more likely to be explained through the hybridisation of many theories rather than a single standalone theory.

The second attribute is the fuzzy assumption that causes of financial performance are similar in *kind* but different in *degrees* (Greckhamer et al., 2008; Fiss, 2011). Differences in degrees lead to different configurations that exhibit same outcomes. This is consistent with the concept of equifinality. Equifinality is defined as "the state of achieving a particular outcome (e.g., high performance) through different types of configurations" (Payne, 2006, p. 756). The idea behind equifinality is that different configurations which are created by either similar conditions or different conditions, can achieve the same results (Fiss, 2007; 2011). For examples Fiss, (2011), found that there are different configurations of a firm's structure, strategy, and environments that have different core and peripheral conditions but all lead to high profitability.

According to Fiss, core conditions are those which are considered important for an outcome to occur; they "indicate a strong causal relationship with the outcome of interest", while peripherals are conditions "for which the evidence for a causal relationship with an outcome is weaker" (Goertz and Mahoney, 2005, p.498; Fiss, 2011, pp.393-394). Based on this idea, this research assumed that different diversification strategies require combinations of different degrees of other firm characteristics to enhance financial performance.

Thirdly, I used the concept of *"higher-order constructs"* (macrovariables) (Ragin, 2000, pp.322) to deal with problems associated with multidimensional concepts. Based on previous research (Lijphart, 1971; 1975; Collier, 1993; Berg-Schlosser and De Meur, 1997), Ragin concluded that a "high-order construct" is a useful way of addressing the problem of too many variables measuring the same concept in social science research (p. 321). In this research field, there are many different variables used to represent multidimensional concepts. However, the same concepts are often measured and/or defined in very different ways, such as firm size, asset structure, financial choice and profitability.

For example the corporate diversification concept can be defined by segmental sales or segmental assets (Sullivan, 1994), firm size can be defined using assets or sales volumes (Gooding and Wagner III., 1985; Colak, 2010; Ammann et al., 2012), while firm profitability can be defined using return on assets (ROA) or return on sales (ROS) (Sullivan, 1994) (see also table 2.3 in chapter 2 for further references).

Anecdotal evidence shows that the application of one measure at the expense of other measures leads to an incomplete representation of a multidimensional concept which can result in misleading conclusions (Gooding and Wagner III, 1985; Sullivan, 1994) ,inconclusive results and led researchers to failure to "walk the walk" (Richard et al., 2009, p.723). In this context this research assumes that macrovariables more accurately represents multidimensional concepts (see section 1.5 below).

The *fourth* attribute of the ***fuzzy paradigm*** is that "everything is a matter of degree" depending on the context (Kosko, 1994, p.18). Basically, people make decisions in "greys" rather than in black and white environments (Kosko, 1994; Ragin, 1987; 2000; 2008). It has been noted that "Social phenomena rarely result from a single cause…but from combinations, interactions or conjunctural of causal factors" (Ragin, 2000, p.99). This implies that people make decisions by examining how causal factors are connected to and support one another for an outcome of interest. In this context, Ragin suggested that researchers have to think beyond simple linear models and avoid assuming that standalone causes are "either necessary or sufficient" for an outcome of interest (p. 89). This assumption requires the application of a configurational approach in order to examine the necessity and sufficiency of causes for an outcome as a complementary approach to linear relationship studies (Crilly, 2011; Fiss, 2011). In this context, the current research examines the ***necessity*** and ***sufficiency*** of causes for outcome of interests.

This research is not designed to criticise or dismiss prior research methods or findings. Rather it is intended to provide a new "eye" on how causal factors synergistically interact for an outcome of interest and provide a complementary method and theoretical framework for examining and explaining previously overlooked or apparently contradictory findings or theories.

1.5: FUZZY THEORETICAL FRAMEWORK: AN OVERVIEW.

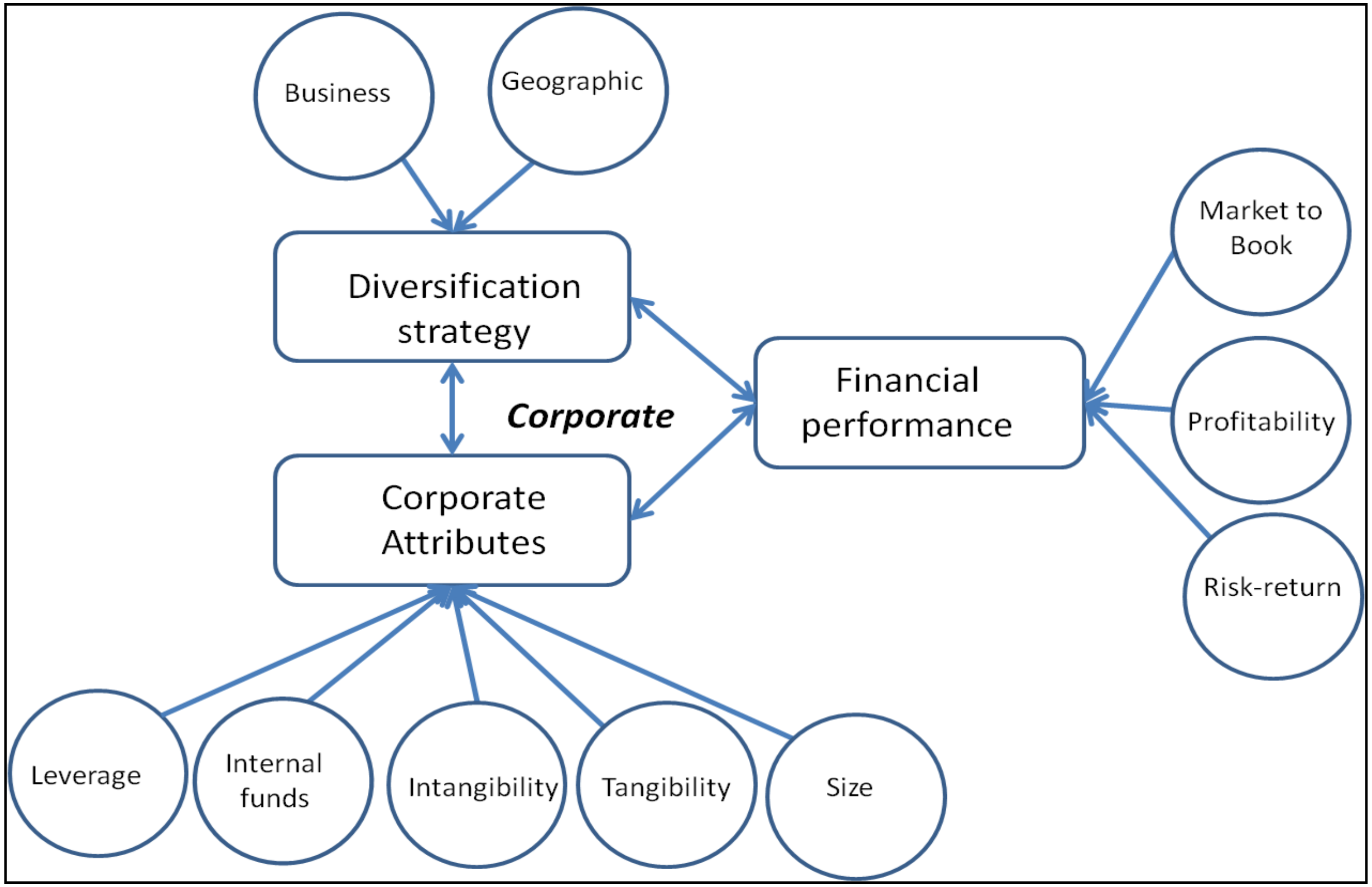
This section seeks to provide a concise introduction to the fuzzy theoretical framework, concepts and processes that are applied in this research. The framework adopted in this research is a set-theoretic framework which enables configurational analysis. Effectively a set theoretical framework allocates each case a membership value in a number of defined sets, then each case is configured by these different set values, which allows relationships amongst outcomes of interest and case configurations to be investigated. For example, we can identify cases with high membership values in the profitability set and examine their configuration of membership values in all of the other sets (such as geographic diversification, business diversification, leverage, size) in order to see if there are significant and recurring patterns or configurations.

Application of FSA involves a number of key stages. The first stage involves the researcher analysing the prior research literature to gain a thorough understanding of the theories and evidence related to the outcome of interest. The next stage is to design a set-theoretical framework of the research problem. This involves identifying the different sets that will be used to structure the case configurations and to identify theoretically informed relationships amongst the different sets. These sets should be defined using findings from prior research.

Figure 1.1 is the initial set-theoretical framework that will be used in this study. It identifies the main sets that are used to define all relevant configurations and inter-relationships amongst these sets. A detailed account of the derivation will be provided in chapter 2. Prior research would suggest firm characteristics ***hybridise*** with geographic and business diversification strategies in complex configurations such that it becomes difficult to pinpoint the contribution of one factor using net-effect methodologies (Russell and Thomson, 2009; Thomson et al., 2012). Therefore, this research adopts a configuration approach (Fiss, 2011) and figure 1.1 is a generic representation of attributes (sets) that are used to create case configurations that can be tested against different measures of financial performance.

Figure 1.1: The set-theoretical framework and definitions of sets

Figure 1.1 is the generic set-theoretic framework adopted in this research to explain how LSE-FASI-Firms necessarily or sufficiently achieve favourable financial performance through corporate diversification strategy. Corporations are viewed as being different because of possessing different memberships in their key attributes and diversification ***sets***. This leads corporations to have different configurations that enable firms to achieve favourable financial performance. The circles represent sets in which corporations find memberships,
Business = Memberships in business diversification set, and **Geographic** = Memberships in geographic diversification set. Business and geographic diversification are commonly determined using segmental assets ***or*** segmental sales as usually represented by entropy measures of diversification (see for example Palepu, 1985; Hitt et al., 1997; Qian et al., 2008, Chiao and Ho, 2012). Therefore this research uses segmental assets and sales to determine memberships of corporate diversification. A firm is classified as having high memberships in geographic or business diversification if it has a 3-4years average entropy measure higher than 0.6 in assets ***or*** sales attributes whichever the higher. Otherwise a firm is classified as having not-high memberships. Entropy of 0.6 is equivalent to a fuzzy set value of 0.5 (Section 5.3.1 of this thesis gives the details on calibration)
Leverage = Memberships of corporations in debt capital (leverage) set. Original measure of leverage was represented by percentage of total debts (leverage) on total assets. A firm is classified as having favourable memberships in leverage if a 3-4years average ratio of debt on total assets is above 25% otherwise it is classified as having not-high memberships
Internal fund = Retained earnings stand for cases' memberships in internal fund/retained earnings set. When 3-4years average ratio of retained earnings on total assets is above 18%, then cases' are classified as having high memberships. Otherwise a firm is classified as having not-high memberships. These benchmarks are equivalent to fuzzy set value above 0.5 (section 5.3.3 gives more details on this).
Intangibility and **Tangibility** = Stands for firm's memberships in asset structure sets. **Tangibility** is commonly measured as a percentage of total property, plant, and equipment (PPE) on total assets while **Intangibility** refers to percentage of total intangible assets on total assets (Morck and Yeung, 1991; Hitt et al., 1997; Rocca et al., 2009). A firm is classified as having high memberships in a tangibility ***set*** when its 3-4years average in PPE ratio on total asset is above 33%; it is classified as having high memberships in asset intangibility **set** when its 3-4years average ratio of intangible assets on total assets is higher than 20%, otherwise the firms are classified as having not-high memberships in the respective *sets.* These values are equivalent to fuzzy set value 0.5 (chapter 5 gives details on calibration).
Market to book (MTB) = Memberships in market value ***set***, value of the firm is usually defined as a ratio of market to book value of a firm (MTB) (Morck and Yeung, 1991; 1992; 1997; Denis et al., 2002). A firm is classified as having high memberships in MV when its 3-4years average MTB is higher than 1.5 (equivalent fuzzy set value 0.5), otherwise it is classified as having not high memberships (section 5.3.2 gives details on calibration).
Profitability (PROF) = Memberships in firm's profitability ***set***, **profitability** is here referred to as returns on assets (ROA) ***or*** returns on sales (ROS) as in (Sullivan, 1994: Riahi-Belkaoui, 1998; Delios and Beamish, 1999; Lee et al., 2006; Qian et al., 2008). A firm is classified as having high memberships in ***profitability*** if it has a 3-4years average ROA or ROS higher than 7% ***or*** 12% respectively; otherwise the firm is classified as not-high membership in profitability. These (ROA higher than 7% or ROS higher than 12%) are equivalent to fuzzy set value higher than 0.5 (section 5.3.2 gives details on calibration).
Risk-return (RRP) = firm's memberships in business risk-return ***set***. RRP was created as an ***intersection*** between business risk-reduction and profitability ***sets*** (see section 5.3.2 for details of these measures)


Business
Geographic
Diversification strategy
Market to Book
Financial performance
Profitability
Corporate
Corporate Attributes
Risk-return
Leverage
Internal funds
Intangibility
Tangibility
Size

These attributes were chosen due to their prior use in research into corporate diversification-financial performance relationships.

FSA requires that the selection of the sets and possible causal configurations are logically and theoretically justifiable. The framework used in this thesis is a hybrid of different theories that have been used to provide partial explanations as to how corporate diversification strategies sufficiently and necessarily lead to favourable financial performance.

Once the sets have been established the next stage is to identify a suitable data source and select the cases that will form the empirical data for any subsequent analysis. In this case the sample chosen was London stock exchange FTSE All-share index (hereafter LSE-FASI-Firms) firms in the period 2001-2010.

The next stage involves deciding how to measure the extent to which each case belongs to each set. Fuzzy sets are defined as sets that permit partial memberships that range between 0 (full non-membership) and 1 (full membership) (Ragin, 2000). FSA is based on the configurations of degree of membership of individual sets and this involves the calibration of original variables into fuzzy set values (between 0 and 1).

Figure 1.2 (and also table 1.1) provides an example of different degrees of memberships of seven firms in the business diversification ***set***. As can be seen from figure 1.2 most firms score between 0 and 1 and therefore possess partial membership of this set. The next stage is then to establish relevant thresholds of set membership that will be used in the subsequent FSA. In this study it was decided to use three thresholds – high membership, low membership and neither high nor low membership (ambivalence).

Each set has its own statistically relevant thresholds (details of how these are derived are provided in chapter 5) which allows each case configuration to be described in terms of high/low/ambivalent membership of each set.

Figure 1.2. Illustration of fuzzy sets – business diversification set.

This figure is the Venn diagram (the set) that shows firm's memberships in high business diversified firms set. The circles in the set represent positions (memberships) of the respective firms in the set. Against every firm the fuzzy set value is indicated to show its memberships in the set, whilst those closer to the centre indicates higher memberships than those towards the edge of the set.

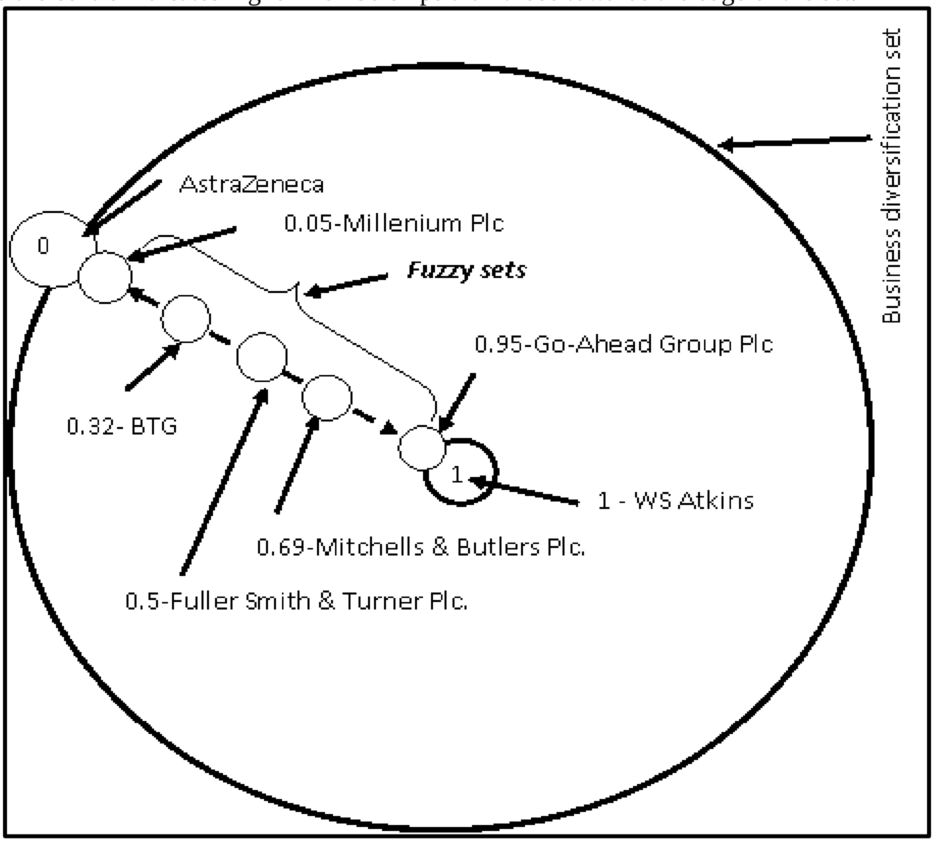


Table 1.1: Example of firms' memberships in business diversification

This table indicates degree of business diversification using entropy index as discussed later in section 5.3.2 and their corresponding set theoretic memberships as indicated by fuzzy sets. Details on how the values were calculated is indicated in chapter 5

Company Name	Business Diversification	Memberships	
	Entropy	**Fuzzy sets**	**Type**
WS ATKINS PLC	1.52	1.00	High
GO-AHEAD GROUP PLC	1.01	0.95	High
MITCHELLS & BUTLERS	0.72	0.69	High
FULLER SMITH & TURNER	0.59	0.50	Ambivalent
BTG PLC	0.46	0.32	Low
MILLENNIUM	0.21	0.05	Low
ASTRAZENECA PLC	0.00	0.00	Low

An important stage in FSA is determining how the membership of each set is measured. This is particularly important when a set is intended to represent a multiple dimensional concept or a concept that has previously been measured in a number of different ways. If it is determined that a set represents a multidimensional concept (determined from a theoretical analysis of the problem) then FSA recommends the use of macrovariables. A macrovariable is a variable developed through hybridisation of two or more variables which define the same concept, where the "dominant" variable is selected to represent the concept. The logic behind a ***macrovariable*** is that if highly correlated variables define the same concept are "jointly necessary or sufficient for an outcome" then these variables can be combined using fuzzy set logical operator ***"or"*** so that the variable with higher membership in a multidimensional variable set substitutes for the other variable and "reconceptualises" this *variable* as a "macrovariable" (Ragin , 2000, p.321). It is also possible to use the fuzzy set logical operator ***"and"*** so that the variable with lower membership in a multidimensional variable set substitutes for the other variable.

Macrovariables are often better understood by an example. In the prior research into corporate diversification-financial performance relationships geographic diversification has been measured by two different entropy measures. One index was based on the value of segmental assets and the other based on segmental sales. This would suggest that geographic diversification involves at least two measurable dimensions – sales and assets invested. However using a single measure of geographic diversification may on occasions misclassify individual cases.

Table 1.2 indicates how original variables that measured the extent of a firm's geographic diversification are firstly calibrated into fuzzy set values and then how the largest fuzzy set value is then selected as the macrovariable to represent each firm's geographic diversification. In this example each case is classified as highly diversified if either of its entropy measures are higher than 0.6 (fuzzy set value 0.5).

Table 1.2: Illustration of geographic diversification macrovariable development

This table demonstrates how macrovariables are developed. **Entropy:** stands for an entropy index which is an original measure of diversification as explained later in section 5.3.2. **Fuzzy sets**: represent calibrated entropy measures of diversification; this indicates degree of membership of a firm in the geographic diversification set.

COMPANY - 2006	Degree of Geographic Diversification					
	Segmental assets		Segmental sales		Segmental sales *or* assets (Macrovariable)	
	Entropy	Fuzzy set	Entropy	Fuzzy set	Entropy	Fuzzy set
AEGIS GROUP PLC	0.9	0.9	**0.92**	**0.92**	**0.92**	**0.92**
AGGREKO PLC	**1.35**	**1.0**	1.24	0.99	**1.35**	**1.0**
ANITE PLC	0.66	0.61	**1.16**	**0.99**	**1.16**	**0.99**
ARM HOLDINGS PLC	**0.73**	**0.73**	0.59	0.48	**0.73**	**0.73**
BLOOMSBURY	0.63	0.56	**0.76**	**0.77**	**0.76**	**0.77**
CSR PLC	0.3	0.1	**0.65**	**0.59**	**0.65**	**0.59**
DEBENHAMS PLC	0	**0.01**	0	**0.01**	**0.01**	**0.01**
DECHRA PHARMA	0.02	**0.01**	0.01	**0.01**	**0.01**	**0.01**

Table 1.2 shows that when geographic segmental sales are used to measure the degree of geographic diversification of Arm Holdings Plc, then Arm Holdings Plc's degree of geographic diversification becomes 0.48 (entropy 0.59) and therefore classified as not-highly diversified (discussion of entropy measure see section 5.3.2 of this thesis). However, when segmental assets are used, this firm will be classified as high geographic diversified (membership 0.73*).* In this case we determine Arm Holdings Plc's degree of geographic diversification by their segmental asset value and classify it as highly geographically diversified. Table 1.2 shows that the geographic diversification of Anite Plc , Bloomsbury Plc, and CSR Plc are determined by their segmental sales entropy index as indicated by the calibrated fuzzy set values.

Once it has been decided how to measure each set, how to calibrate variables to fuzzy set values and determine cross-over thresholds, the empirical sample data can be converted into fuzzy set values and labels and therefore ready for further analysis. Table 1.3 provides a summary of the sets (variables), macrovariables and thresholds that will be used in this research.

Table 1.3: List of variables and the three qualitative benchmarks

This table presents a list of all variables (sets) used in this research, OM refers to original variable measures, fs = fuzzy set values which defines membership of the cases/firms in different sets. Full = full membership, Non Full = full nonmembership, and Cross-over is a cross-over point that separates full and full nonmembership. *, expanded definitions of measures are found in table 4.4 chapter 4, and discussions on cut-offs see section 5.3.

Variables	Variable Measures*	Scale variables and Memberships					
		Full		Cross-over		Non Full	
		OM	fs	OM	fs	OM	fs
Market value (MTB)	MTB-market to book	2	0.95	1.5	0.5	1	0.05
Profitability (PROF)	ROA-return on assets	12%	**0.95**	7%	**0.5**	3%	**0.05**
	ROS-return on sales	20%		12%		4%	
Business Risk reduction (RISKR)	SDROA-std deviation	1	**0.95**	2.8	**0.5**	7	**0.05**
	SDROS-std deviation	0.6		1.7		5	
Geographic Diversification (DG)	DGA-segmental assets	1	**0.95**	0.6	**0.5**	0.2	**0.05**
	DGS-segmental sales	1		0.6		0.2	
Business Diversification (DB)	DBA-segmental assets	1	**0.95**	0.6	**0.5**	0.2	**0.05**
	DBS-segmental sales	1		0.6		0.2	
Financing Choices (FINC)	TDTA-leverage	38%	**0.95**	25%	**0.5**	10%	**0.05**
	RETA-retained earning	36%		18%		3%	
Firm size in £ (SIZE)	SIZEA=Total assets in billions	3.2	**0.95**	0.66	**0.5**	0.013	**0.05**
	SIZES = Total sales in billions £	2.5		0.56		0.026	
Asset Structures (ASTR)	INTA-Intangibility	38%	0.95	20%	0.5	2%	0.05
	TANG-Tangibility	50%	0.95	33%	0.5	10%	0.05

The next stage of FSA is to analyse the relationships between case configurations and different outcomes of interest which requires the construction of truth tables that produce a list of possible case configurations leading to an outcome (see tables 6.4, 7.5, and 8.5 for examples of the truth tables used in this research). A truth table lists all possible configurations of causal conditions associated with the outcome of interest (Ragin, 2000; 2008)[11]. The truth tables are produced using the underlying logic of the five research hypotheses (a-e) which are intended to answer the key research questions of this thesis. Based on the truth table outputs, consistencies and

[11] The concept of truth table is developed and discussed further in chapter 3 section 3.2.3.2 of this thesis.

coverage statistics are used to analyse the necessity and sufficiency of different configurations[12].

These configurations were tested for significance using Hays', (1981) formula as proposed in Ragin, (2000, p.111-114), as indicated below.

$$\boldsymbol{z} = \frac{(\boldsymbol{P} - \boldsymbol{\rho}) - \frac{\boldsymbol{1}}{\boldsymbol{2N}}}{\sqrt{\frac{\boldsymbol{\rho q}}{\boldsymbol{N}}}}$$

Where: z = statistic test of the difference between the observed proportion and the population (benchmark) proportion, P = observed proportion; ρ = benchmark proportion (e.g., 0.65), N = number of cases displaying the outcome or causal condition depending on whether we are testing necessary or sufficient condition respectively and q = 1- ρ.

This formula is used to examine if a certain observed proportion is significantly greater than the established benchmarks (Ragin, 2000).

The final stage of FSA is to subject configurations that appear to be significant to further robustness checks. These include triangulation with other statistical testing and sensitivity analysis particularly in relation to cross-over thresholds.

The FSA process should then produce a series of statically robust configurations associated with different outcomes of interest that can be further investigated and interpreted with reference to theoretical analysis and observations of practice. This should then enable the researcher to produce answers to the different research questions.

1.6: SUMMARY AND PLAN OF THE THESIS

1.6.1: SUMMARY OF THE THESIS

This chapter introduced the whole picture of the thesis. It began with identification of the motivations, objectives, research questions and assumptions of the research. Furthermore, this chapter discussed the theoretical framework adopted for the research and described the key concepts of the research. Chapter 1 also provides a summary of the research philosophy and methods and the general plan of the thesis.

[12] See section 3.3.3.5 of this thesis for discussion on consistency and coverage concepts (see also appendix 1 for definition of the terms.

Chapter 2 presents analytical literature in two main sections. The first section is on the history and trends of corporate diversification, it shows how and why diversification strategies have been changing since the 1950s to 2010. This helps to identify and appreciate some of the driving factors for corporate diversification. The second section is about corporate diversification and financial performance relationship. This provides theoretical and empirical evidence on the impact of corporate diversification on financial performance. Section two identifies underpinning theories and variables for this research, and explains how the theories and the variables are likely to hybridise. The analytical literature led to another chapter which is a descriptive literature.

Chapter 3 is intended to provide information on FSA and to justify its suitability of the research question and is presented in three main sections. Section one is intended to explain fuzzy sets. This demonstrates and discusses different common features of fuzzy sets. Section two, discusses common terms on FSA: equifinality and complex causality, core and supporting conditions, consistency and coverage, and necessary and sufficient conditions. Finally, theoretical and empirical evidence on why and how FSA is applied on financial performance studies is discussed.

Chapter 4 is about research philosophy and methods; this chapter discusses ontological, epistemological and methodological stances of the thesis. Furthermore the chapter discusses the issues on the research method (FSA), its benefits, and its limitations. Issues covered in the research method include the time frame used (a ten-year cross sectional period (2001-2010)) and highlight the calibration processes used in this research.

Chapter 5 discusses how the variables for this research were chosen and developed. Criteria for calibrating the original measures to fuzzy set values are presented, discussed, and justified. This chapter is basically a part of the methodological chapter, however I have separated it from chapter 4 in order to clearly show how fuzzy sets are developed and used. Furthermore, the chapter discusses how and why macrovariables are developed and used in this research. Chapter 5 also presents and discusses the empirical findings of supporting research question 1. Finally the chapter ends by identifying specific contributions of the chapter to knowledge.

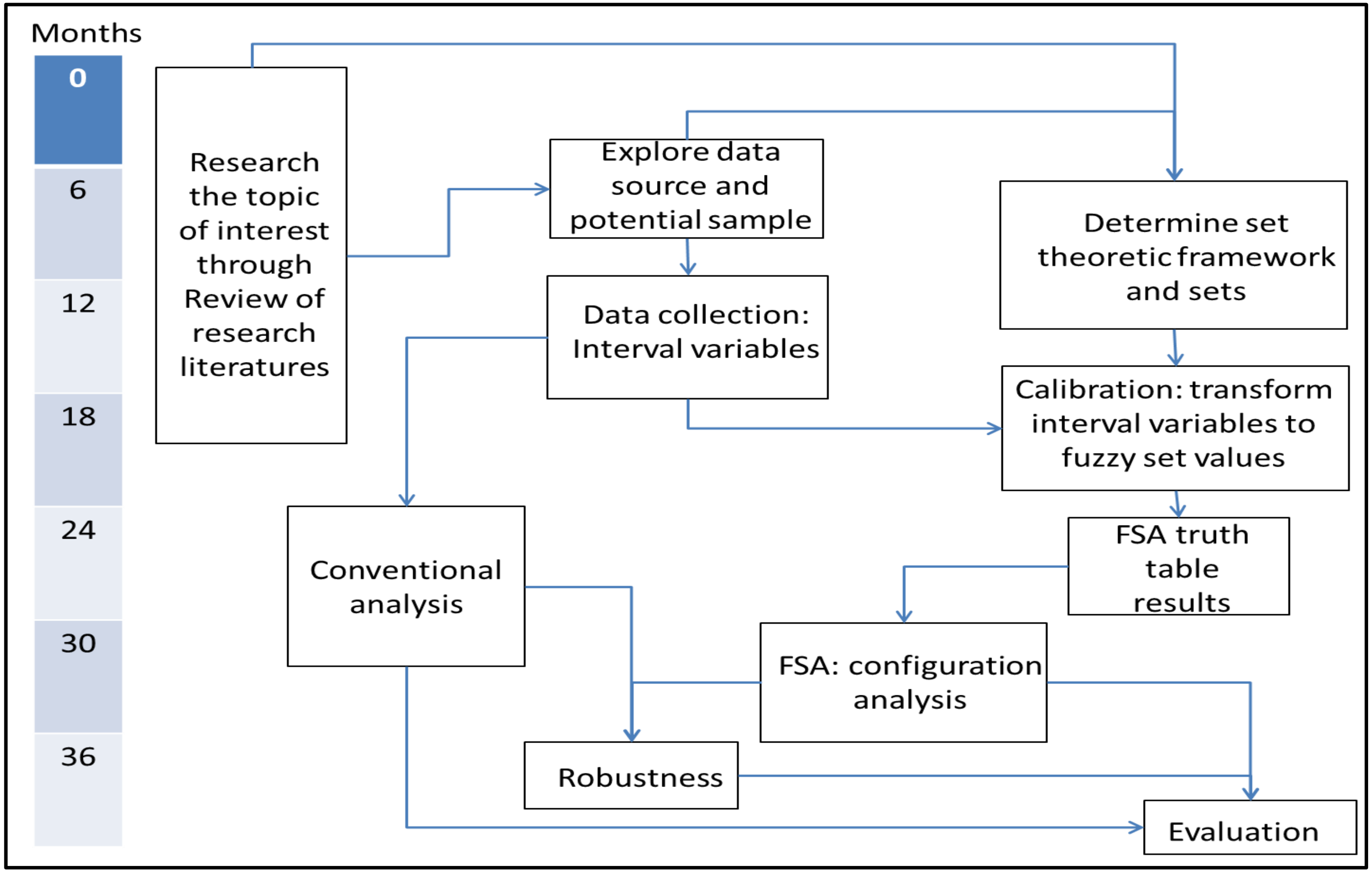
Empirical findings of my FSA approach are presented in chapter 6, 7 and 8. Chapter 6 presents results of the key research questions 1, chapter 7 present results of key question 2, while chapter 8 presents, analyses, and discusses the empirical findings of the key research question 3. These empirical chapters started with presentations and discussions of supporting questions before presentations of truth tables results. Truth tables are mainly used to identify consistent configurations to favourable financial performance.

Finally, chapter 9 is the concluding chapter and addresses the “so what?” question of this thesis. It looks at the contribution of the thesis to knowledge, limitations of the study and suggestions for future developments of FSA.

1.6.2: PLAN OF THE THESIS.

Every project needs a comprehensive plan. Figure 1.3 indicates the plan of the 36 months (PhD programme). The time scale and activities are all indicated in the flow diagram with arrows indicating the next dominant activity. It should be noted that this plan was just to show the main activities in a particular period of time (within 6 months) across the 36 months not including writing up stage. .

Figure 1.3: General plan of the thesis



Chapter 2 : RESEARCH INTO CORPORATE DIVERSIFICATION STRATEGIES AND FINANCIAL PERFORMANCE: AN ANALYTICAL REVIEW

2.1: INTRODUCTION

The aim of chapter 2 is to provide an analytical review on previous studies that addressed the question "*how geographic and business diversification enhance or destroy financial performance".* While these studies are useful in identifying types of corporate diversification strategy and other corporate attributes that predict financial performance, they were unable to identify necessary or sufficient configurations of corporate attributes that enhance or destroy financial performance (Fiss, 2011). Furthermore, these studies did not provide a clear definitive distinction of financial performance concepts (like firm value and profitability) which appear to be theoretically similar but in practice are different[13]. In addition, although the studies assume that corporate attributes and the theories used to explain the question above work on a standalone basis, their results imply that the variables are interdependent and the theories need to hybridise to adequately explaining the question above. In these contexts, the studies showed partial and fragmented answers that lack theoretical construct and robust conclusions.

It appears that the potential methodological problems that led to lack of robust conclusions include: failure to consider heterogeneities that exist amongst firms. Researchers have used different variables and theories without considering the extent of firms' heterogeneity in their attributes and how these attributes synergistically influence the results. Synergistically here means the contribution of one firm attribute on financial performance is influenced by other attributes in other words corporate attributes do depend on one other when it comes to determination of financial performance. I argue that capturing heterogeneity amongst firms and understanding how the corporate attributes support one another is important to understand and perhaps to integrate the partial, fragmented, and inconclusive results of previous studies.

[13] See for example the correlations amongst proxies of financial performance in table 4.11 and table 5.2 which appear to be not highly correlated indicating that they are practically not similar.

Therefore, the review of the previous studies intends to understand how firms' heterogeneity in terms of corporate diversification strategies, other attributes, and the theories that were applied by previous researchers hybridise to adequately explain the research question above, This helps to conceptualise configurations for providing answers and reduce the possibility of partial and fragmented answers. In particular, the aim of this chapter is to theoretically and empirically identify possible configurations of corporate diversification strategies and other attributes which would be used as necessary or sufficient indicators of favourable firm value (MTB), profitability, and risk-return performance (RRP).

Chapter 2 is divided into two main parts; in the first part, the literature is reviewed in the light of historical trends of corporate diversification strategies. This attempts to understand how and why diversification strategies have been changing in the period 1950s to 2010. This literature helps to identify the motivating factors for corporate diversification strategies across this period. In Part two, the literature is reviewed based on corporate diversification strategies and financial performance relationship studies. This review revealed theoretical and empirical evidences that show existence of configurations and hybridisation of theories which appear to explain how corporate diversification strategies enhance or destroy MTB, profitability, and RRP.

2.2: CORPORATE DIVERSIFICATION STRATEGIES TREND (1950'S TO 2010)

The idea of diversification for enhancing and protecting wealth has a long history. In the 4th century Rabbi Isaac Abar Aha applied the rule that one's wealth should be divided into thirds; a third in land, a third in merchandise, and a third in cash (Demiguel et al., 2009, p.1915). This rule was intended to provide guidance to ensure growth while protecting current wealth from future failures. It is therefore important to look at the history of diversification from as far back as the 4th century. However, because of the lack of studies that considered diversification before the 1950s, this section focuses only on the period 1950 to 2010.

2.2.1: CORPORATE DIVERSIFICATION STRATEGIES (1950S-1970S)

Before the 1950s most companies worldwide operated in single and dominant businesses (Lee and Cooperman, 1989; Utton, 2001; Simmonds, 2009). Thereafter and during the early 1960s, companies started growing organically in related businesses or by merger and acquisition (M&A) of related businesses (horizontal or vertical acquisitions) (Utton, 2001; Simmonds, 2009). Simmonds cited some very famous examples of horizontal acquisition including; Ford and General Motors and Imperial Chemical Industries (ICI). It was also reported that mergers in the UK firms for a period of twenty years (1945-1965) were much more in related or core businesses (Utton, 2001).

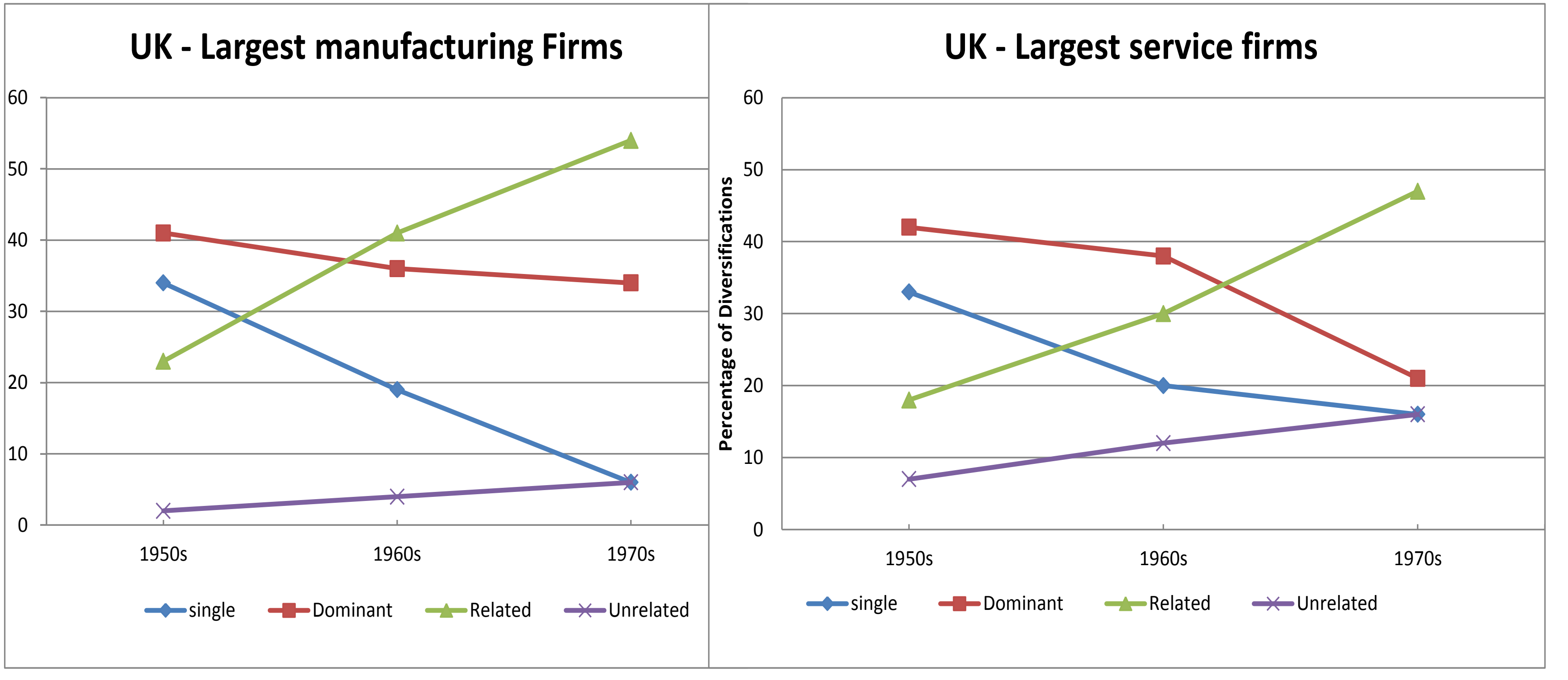
Figure 2.1 shows diversification trends in the UK's largest manufacturing and services firms as reported in Simmonds, (2009). It shows that manufacturing and services firms in the UK had similar diversification trends across the 1950s to the 1970s, and it appears that single and dominant firms were declining while related and unrelated diversification were increasing, related diversification at a higher rate than unrelated diversifications

It also appears that the diversification trends observed in the UK's largest firms were no different from diversification trends observed in other European and USA firms as clearly indicated in table 2.1. Simmonds, (2009), collected evidence from different studies on corporate diversification strategies in four major European economies (UK, France, Germany, and Italy) and in the USA on non-financial companies and found that the diversification trend across the countries was not different (table 2.1).

Table 2.1 shows the diversification trends of the largest non-financial companies in the USA and Europe over twenty years (1950 to 1970).

Figure 2.1: Diversification trends in the UK's largest firms – 1950s – 1970s

Figure 2.1 shows diversification trends in UK non-financial firms between 1950s and 1970s. Single means single businesses where one segment represents 95% or more of total sales or assets. Dominant means one segment represents more than 70% but less than 95% of sales or assets. Related means related businesses where more than 70% but less than 95% of total revenues or assets are from the firm's principle business and the other business segments are related to the principle business. Unrelated means unrelated business where the largest segment represents less than 70% of total revenue or assets and the other business are not related.



Source: Table 1 and table 2 in (Simmonds, 2009, p.11-12)

Table 2.1: Diversification of non-financial USA and Europe firms 1950s-1970s

This table shows the diversification trends of USA and European non-financial firms from the 1950s to 1970s

S = percentage of single business firms whose SR is 0.95 or higher

D = percentage of dominant business firms with SR between 0.95 and 0.7. Other segments are not related

R = percentage of related diversified business firms with SR between 0.95 and 0.7. Other segments are related that is related ratio greater than 0.7.

UR = percentage of unrelated business firms with SR less than 0.7 and related ratio less than 0.7 (Rumelt, 1974, p.31, figure 1.6)

Country	Percentages of diversification (based on specialisation ratio –SR)							
	1949/1950				1969/1970			
	S	D	R	UR	S	D	R	UR
USA	35	35	27	3	6	29	45	19
UK	34	41	23	2	6	34	54	6
France	42	21	33	4	16	32	42	10
Germany	35	26	32	7	22	22	38	18
Italy	30	24	43	3	10	33	52	5

Source: Simmonds (2009, p38, table 3)

The diversification trend presented on figure 2.1 and table 2.1 shows that firms were shifting from single and dominant activities to related and unrelated diversification. For example in the UK single and dominant firms declined from 34% (1950) to 6% (1970) and 41% (1950) to 34% (1970) respectively, while diversification in related and unrelated businesses increased from 23% and 2% in 1950 to 54% and 6% in 1970 respectively, other European and USA firms followed the same trend shifting from focussed to diversified businesses. .

2.2.2: IMPLICATION OF DIVERSIFICATION TRENDS OF THE 1950S - 1970S

The diversification trend for the period of 1950s-1970s, aimed at enhancing financial performance through economies of scope and scale achieved by leveraging firm-specific assets (Penrose, 1959) and managerial economics (Mueller, 1969). In the 1960s and 1970s firm wanted growth from related businesses in order to accumulate uncompetitive profits through monopolistic advantages (Channon, 1973; Dyas and Thanheiser., 1976; Lee and Cooperman., 1989; Matsusaka, 1993; Utton, 2001; Denis et al., 2002; Franko, 2004; Simmonds, 2009). Related diversification during this time therefore led firms to accumulate large amounts of internal funds and keeping less debt in their capital structures (Lee and Cooperman, 1989).

Lee and Cooperman, (1989), argued that during the early 1950s companies created-high levels of internal funds from monopolistic behaviour. These excessive internal funds encouraged managers and shareholders to seek investment opportunities. Although most firms diversified in related businesses, some firms started investing in unrelated businesses in the late 1960s (ibid). Investments in unrelated businesses were further encouraged by anti-monopoly regulations in the late 1960s (Simmonds, 2009). In addition, the post-World War II activities that allowed firms to obtain more profits from different businesses, led companies to engage more in unrelated businesses in the late 1960s and during the 1970s and 1980s (Matsusaka, 1993).

It appears therefore that the diversification trends discussed above were driven by the presence of high levels of internal funds created from post-World War II activities. Based on an agency theory perspective (Jensen, 1986; Stulz, 1990), it might be questionable as to whether the diversification observed between the 1960's and 1970s was beneficial to shareholders as slack resources were often blamed for causing the overinvestment problems that destroy shareholders' value (Jensen, 1993).

Matsusaka, (1993), examined the stock market response to acquisition announcements during and immediately after the wave of mergers in the 1960s by using data covering the 1960s and 1970s. He found that the shareholders of the acquiring firms benefited from acquisitions. Matsusaka showed that share prices of unrelated acquisition in U.S. companies were higher than those of companies with related acquisitions.

It appears that unrelated diversification during the 1960s and 1970s was financed through internally generated funds and was associated with better performance of stocks/shares. In this context, it is not always true that high level of internal funds leads to agency problem of overinvestment as suggested in Jensen, (1986; 1993) and in Li and Li, (1996). Indeed, it is argued that high level of internally generated funds allow flexibility of firms to undertake positive investments (Myers, 1977), and prohibits shareholders embrace asset substitutability and underinvestment problems

(Jensen and Meckling, 1976; Hillier et al., 2011). In addition, high level of internal funds can be associated with signals for positive investment opportunities (Jones and Danbolt, 2005). Jones and Danbolt noted that firms that do pay less or do not pay dividend are associated with positive investment opportunities.

2.2.3: CORPORATE DIVERSIFICATION STRATEGIES (1970S-2000S)

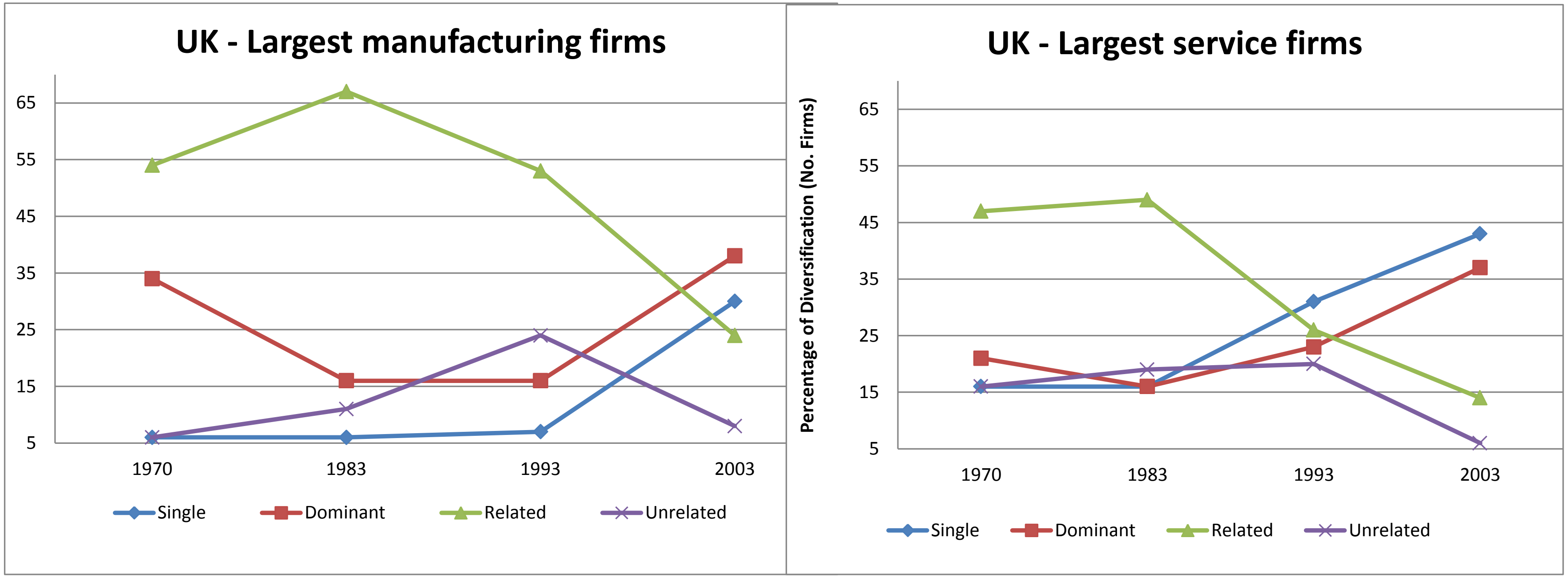
Due to the pressure of anti-monopolistic regulations firms were forced to diversify in unrelated businesses during the 1970s. However, during the late 1980s and early 1990s, firms realised that unrelated diversification destroys shareholders value (Lee and Cooperman, 1989; Kaplan and Weisbach, 1992; Jensen, 1993; Denis et al., 2002; Franko, 2004). This led to firms selling unrelated segments in order to reduce losses from diversification (Kaplan and Weisbach, 1992; Whitley, 1994).

Kaplan and Weisbach, (1992), evaluated the extent to which divestitures in the 1980s represent successful or failed acquisition. They used a large sample of acquisitions that occurred between 1971 and 1982. They found that acquisition failures were higher for conglomerates than for related acquisitions. In addition, Whitley, (1994), noted that unrelated diversification limits the scope of synergies because unrelated diversified firms are typically run on a standalone basis which hinders synergistic benefits from scope economies.

Based on an internalisation theory of synergy (ITS), it is argued that unrelated business diversification does not fully enjoy the benefits of firm-specific assets (Denis et al., 2002) because, unrelated diversifications hinder knowledge transfer within firms and limits economies of scope. In this context, unrelated diversifications were far from enabling scope economics that are associated with synergistic gains from managerial economics (Mueller, 1969; Roll, 1986; Porter, 1987; Shelton, 1988; Kaplan and Weisbach, 1992; Denis et al., 2002). Figure 2.2 shows diversification trends of the largest UK manufacturing and service firms from 1970 to 2003.

Figure 2.2: Diversification trend in the UK largest firms (1970s – 2000)

This figure shows diversification trends in UK non-financial firms between 1970s and 2000 Single means single businesses where one segment represents 95% or more of total sales or assets. Dominant means one segment represents more than 70% but less than 95% of sales or assets. Related means related businesses where more than 70% and less than 95% of total revenues or assets are from the firm's principle business and the other business segments are related to the principle business. Unrelated means unrelated business where the largest segment represents less than 70% of total revenue or assets and the other business are not related.



Source: Table 1 and table 2 in Simmonds, (2009, p.394).

Mueller (1969) noted that engaging in unrelated diversifications is irrational business practise because it limits scope synergy gains and managerial economics that can be otherwise realised through related diversification. Mueller noted that acquisitions after post-World War II was motivated by the desire for growth rather than profitability and therefore acquirers were over burdened by purchase prices (Roll, 1986). Roll used hubris theory to explain why managers of acquiring firms were interested in growth rather than profit maximizations and why most of the bidder firms offered competitive prices for acquisition without considering the impact of the acquisition on financial performance. As such, winners of the bids ended up paying higher prices and acquirers were therefore unable to achieve the expected returns from their new investments.

In addition to Mueler, (1969) and Roll, (1986), it is argued that business diversification in the 1980s was basically influenced by managers' self-interest to increase personal benefits such as increasing remuneration, hedging of employment risk (Amihud and Lev, 1981; Aggarwal and Samwick, 2003), and empire building (Porter, 1987). During this period losses from unrelated diversifications were seen to be attributed to failures of managers to meet shareholders interest through diversification. As such it was argued that individual investors could achieve the best portfolio of their investments (Aggarwal and Samwick, 2003). In addition, the failure of diversification during the 1980s can be associated with internal funds which were usually linked to agency problems of overinvestment. These led to unrelated diversification during the 1980s destroying firm value (Jensen, 1993). Indeed, Jensen, (1993) reported that in the 1980's General Motors (GM), IBM, and Kodak made massive unproductive investment of internal funds (free cash flows) which destroyed firms' value. This implies that the availability of internal funds led managers to opt for overinvestment rather than using the excess funds to pay dividends. It is argued that because of selfish interests, managers prefer re-investment of retained earnings even in value destroying investments rather than paying out dividends (Stulz, 1990).

As indicated in figure 2.2, it shows that diversification in the UK's largest firms during the period 1970s to 2000s have passed through two important trends, that is the rise and fall of diversifications. However, the research considered business diversification only and ignored geographic diversification which appears to have increased since 2000s as a result of cross-border acquisition (Danbolt and Maciver, 2012).

2.2.4: BUSINESS RE-FOCUSING AND GEOGRAPHIC DIVERSIFICATION

The rise and fall of unrelated diversification presented in figure 2.2, can be understood in the light of managers' self-interest inhibiting favourable financial performance and inability of unrelated business to create scope economics. Franko, (2004), showed that there was a huge shift of companies worldwide in almost every industry from unrelated business diversification to related and single business diversification in the late 1980s through to 2000s. This shift has been associated with the inability of conglomerates to create returns to investors and the rise of institutional investors/shareholders' demand on corporate "performance and clarity", and led managers to consider geographic diversification as replacement for business diversification (p. 41).

Franko, (2004) investigated why the death of diversification happened during the 1980s onwards. He used data from firms across 17 industries in four geographic regions: the USA, Europe, Japan, and the rest of world. He confirmed that the shift from high diversification to not-high business diversification was significantly higher in almost all the regions across the 17 industries. He noted that not-high business diversification generated higher returns to shareholders than unrelated ones.

This research concentrates on firms listed in the London stock exchange FTSE All share index (LSE-FASI-Firms) as their history of diversification is not significantly different from other US, UK and European firms. The trend of LSE-FASI-Firms' diversification is examined from 2001 to 2010 and includes both business and geographic diversification as explained in the next section.

2.2.5: DIVERSIFICATION TRENDS OF LSE-FASI-FIRMS (2001-2010)

In the paper entitled "The Death of Diversification: The Focusing of the World's Industrial Firms, 1980-2000" Franko, (2004) noted that managers were pressurised by professional investors into undertaking business refocusing in order to enhance profitability and firm value. However, Franko observed that "it is not obvious that because some focus is good then more focus is necessarily better" (p. 49). Therefore, consistent with previous researchers like Hitt et al., (1997), Chkir and Cosset., (2001), and Singh et al., (2003), Franko noted that a combination of business and geographic diversification was important to understand the impact of diversification on financial performance.

This implies that to understand whether business diversification increases or destroys financial performance, business diversification must be jointly considered with geographic diversification (Hitt et al., 1997). This research looks at both these diversification types.

In order to understand LSE-FASI-Firms' geographic and business diversification trends, I classified firms into four diversification strategies (sets) as in Singh et al., (2003): High geographic and high business diversified firms (HGHB), high geographic and not-high business diversified firms (HGLB), not-high geographic and high business diversified firms (LGHB), and not-high geographic and business diversified firms (LGLB). These diversification strategies represent configurations of firms' memberships in both geographic and business diversification sets as will be discussed in chapter 4.

Table 2.2 indicates the benchmarks on diversification levels across different studies. These benchmarks are used to determine levels of geographic and business diversifications for creating the four diversification strategies. These strategies are used to examine diversification trends in the LSE-FASI-Firms in this research. The table shows types and measures of diversification as applied by previous researchers and how these were applied to this research[14].

According to Rumelt, (1974), a specialisation ratio (SR) of 0.95 or higher defines a single business while SR between 0.7 and 0.95 defines dominant business where the other segments are not related but defined as related diversification where other segments are related to the core business. The SR of less that 0.7 is classified as unrelated diversification which is similar to a diversification level higher than 0.3

[14] Further discussion on how diversification sets were developed is found in section 5.2 of this thesis.

(Hitt et al., 1997). Hitt and others showed that diversification level of 30% defined benchmarks for high and not-high diversified firms. Similarly, Riahi-Belkaoui, (1998) concluded that geographic diversification level between 14% and 47% denotes moderate diversification.

In order to be consistent, this research argues that when a firm has two segments whose segmental sales or segmental assets are 30% and 70% of total sales or assets are classified as not-high diversified firms as indicated in table 2.2

Table 2.2: Diversification membership benchmarks

This table indicates diversification types and measures as applied by previous researchers and as used in this research.

SR = Specialisation ratio is calculated as a percentage of sales/assets of the large segment on total segmental sales/assets

D = Degree of diversifications calculated as percentage of geographic and business segmental assets and segmental on total sales/assets.

E = Entropy measure calculated using $D = \sum_i \left[Pi\ X \ln \frac{1}{Pi}\right]$ as defined in chapter 5, and

fs = Fuzzy set values as in chapter 5.

	Diversification type	**Diversification measures**			
Author	Diversifications	Specialisation ratio (SR)	Diversification level (D)	Entropy[15] (E)	Fuzzy set (fs)
Rumelt, 1974;1982	Single	SR ≥ 0.95	D ≤ 5%	E ≤ 0.2	fs ≤ 0.05
	Dominant	SR ≥ 0.70	D ≤ 30%	E = 0.6	fs = 0.50
	Related	SR ≥ 0.70	D ≤ 30%	E = 0.6	fs = 0.50
	Unrelated	SR < 0.70	D > 30%	E > 0.6	fs > 0.50
Hitt et al., 1997	Not high		D ≤ 30%	E ≤ 0.6	fs ≤ 0.50
	High		D > 30%	E > 0.6	fs > 0.50
Riahi-Belkaoui, 1998	Moderate		14% < D < 47%	E = 0.6	fs = 0.50
Current research	Not high			E ≤ 0.6	fs ≤ 0.50
Current research	High			E > 0.6	fs > 0.50

Based on the four diversification strategies developed from table 2.2, figure 2.3 was constructed to show percentages of firms in every diversification strategy across the ten year period. Figure 2.3 shows that the percentage of LGLB firms is generally declining over time, while on the other side HGHB firms are increasing. It appears also that HGLG firms are more than the other two diversification strategies (see also table 4.13).

[15]Chiao and Ho, (2012)

I also examined the numbers of segments across the period of ten years (2001-2010) to see if changes in segmental reporting had a significant impact on determining level of diversification[16], and I found no evidence. I also found that the percentage of geographic diversification is higher than that of business diversification. On average, more than 56% of firms have three or more geographic segments while firms with three or more business segments are less than 50% of the sample. This indicates that geographic diversification is more favoured than business diversification (see table 4.6).

I also found that there are more business focused firms than geographic focused firms, however business focused firms are declining at a higher rate (see figure 4.3 in chapter 4). This trend shows that there is economic rent from geographic diversification as suggested by previous research discussed later.

Furthermore, figure 2.3 indicates that diversification of LSE-FASI-Firms is increasing in both geographic and business diversification dimensions, while focused-firms are declining. Specifically, figure 2.3 shows that HGHB firms increased from about 33% in 2001 to around 39% in 2010 (an increase of 18%) while LGLB firms decreased from around 31% in 2001 to 20% in 2010 (a decrease of 35%). Furthermore, figure 2.3 shows that HGLB firms are more that LGHB firms across the ten year period. This implies that geographic diversification is more favoured than business diversification.

[16] See section 4.3.1.2 in chapter 4

Figure 2.3: Diversifications trend – LSE-FASI-Firms based on memberships

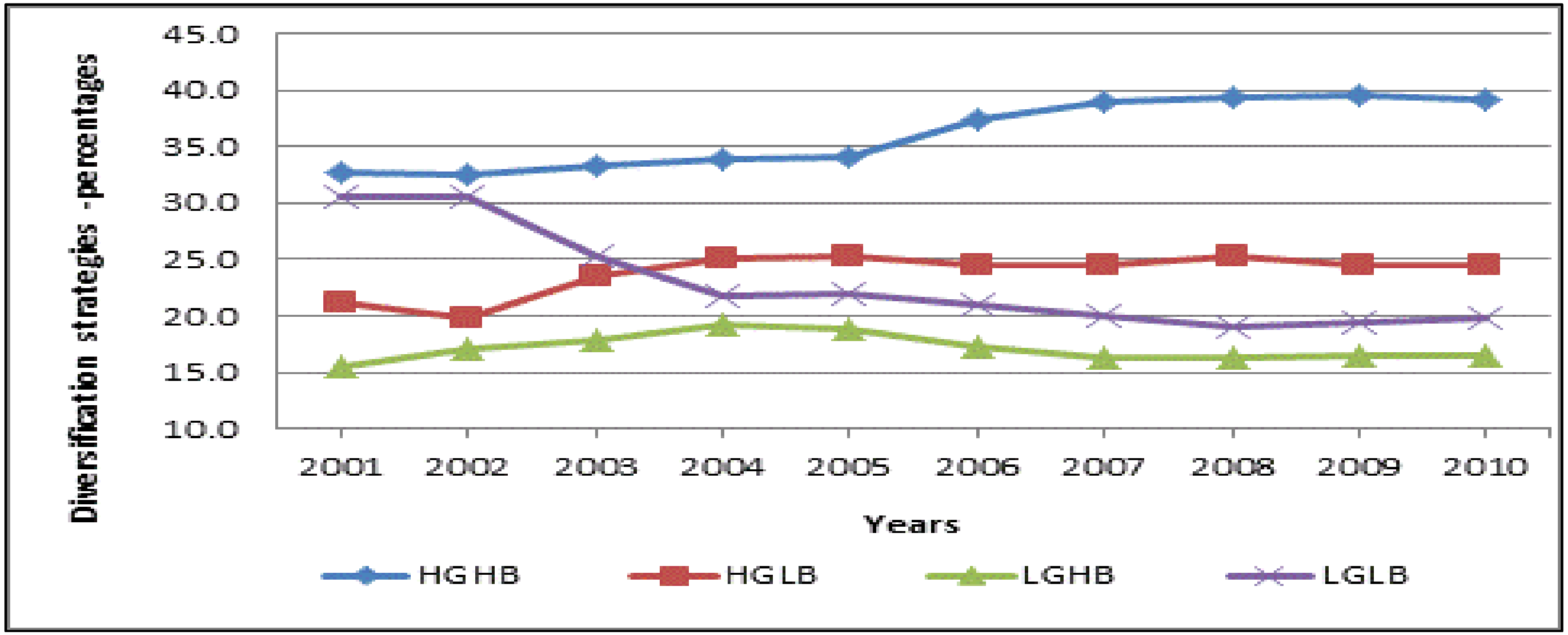
This figure shows the number of firms listed in the London Stock Exchange FTSE All Share Index (defined in this research as LSE-FASI-Firms) for the last ten years (2001-2010). The figure shows firms that appear to have geographic and business segmental information disclosed in the respective year. The table also shows four diversifications strategies as defined below. Table

HGHB = Percentage of firms with high membership in both geographic and business diversification whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to fuzzy set value (fs) higher than 0.5.

HGLB = Percentage of firms whose entropy measures are above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB= Percentage of firms with non-high memberships (entropy measure equal or less than 0.6 (fs ≤ 0.5) in either geographic segmental assets ***or*** segmental sales and high memberships in business diversification that is business segmental assets ***or*** segmental sales entropy measure higher than 0.6 (fs > 0.5)

LGLB= Percentage of firms with low memberships in both geographic and business diversification, that is entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales



2.2.6: SUMMARY OF DIVERSIFICATION TREND HISTORY

To summarise, the diversification trends discussed above indicate that firms listed in the U.S and other European countries have no significant differences to diversification trends compared to LSE-FASI-Firms. This means, diversification of LSE-FASI-Firms is reasonably representative. It appears also that firms are changing diversification strategies over time. The question is *why* are they doing so? The easy answer to this question is that “firms choose to diversify when the benefits of diversification outweigh the costs of diversifications and stay focused when they do not” (Campa and Kedia., 2002, p.1731), therefore once the firms have realised trade premiums from a certain diversification strategy they do not hesitate to take such action. The next section analytically reviews the studies on corporate diversification strategies and financial performance. The review starts with examination of common variables used in corporate diversification strategies and financial performance studies as control variables, so that to understand how these variables link to diversification studies.

2.3: COMMON VARIABLES USED IN DIVERSIFICATION STUDIES

2.3.1: INTRODUCTION

Researchers from both academia and practice agree that corporate diversification strategies involves both geographic and business diversification, and that geographic and business diversification have both standalone and synergetic impacts on firm value and profitability as highlighted in chapter 1. The standalone impacts (net effect) have been extensively examined with no agreed conclusions. For example table 2.3 shows some of the reviewed studies, and it appears that 100% of the studies presented in this table used net effect type of analysis. Whilst, the synergistic effect on the other hand has been ignored (Singh et al., 2003; Low and Chen, 2004). However, it has been noted that a standalone geographic or business diversification has no significant impact on financial performance, but requires to be combined with other corporate attributes (Morck and Yeung, 1991; 1992; 1997; Bodnar et al., 1999; Martin and Sayrak, 2003; Lu and Beamish., 2004; Barnes and Hardie-Brown, 2006). Table 2.3 indicates the common explanatory variables that have been used in examining corporate diversification strategies-financial performance relationships.

Table 2.3: Studies on corporate diversification strategies and financial performance

This table summarises some of the findings discussed in this research. The table is divided into two parts; the first part is the literature that mainly applied internalisation theory of synergy and transaction cost theory to examine corporate diversification strategies and financial performance and the second part summarises the studies that used agency theory and internalisation theory. The table also identifies explanatory and independent variables that were used, and the results of study are also indicated. Words in the brackets (explanatory variable column) indicate the applied measure of a respective variable.

1. Geographic diversification, intangibility, and financial performance – Internalisation and Transaction cost theory			
Authors & Issue examined	Independent and other explanatory Variables	Dependent variables	Results
Morck and Yeung, (1991), examines whether investors attach value on geographic diversifications and intangibles – Internalisation theory of synergy	Degree of multinational (number of segments), Intangibles(R&D & Adv. Exp/total tangible assets), leverage (debt/tangibles), Firm size (log. Sales),	Tobin's Q	Geographic diversification enhances the scope for using the firm's intangible assets but standalone geographic diversification has no impact on firm value. Intangible assets are necessary
Morck and Yeung, (1992), examines whether investors attach value to geographic diversifications and intangibles – Internalisation theory of synergy	Geographic diversifications(announcements of foreign acquisition), Intangibles (R&D&Adv.Exp), Firm size (log.assets), Insider equity holdings (dummies) Stock financing (dummies)	Stock price, abnormal return	Presence of intangible assets significantly leads to positive stock price reaction to announcements. Absence of such assets leads to at best, zero abnormal returns upon announcing overseas acquisitions.
Morck and Yeung, (1997), examine whether investors attach value to intangibles, firms size, geographic and business diversifications. Internalisation theory	Geographic and business diversifications (number of segments) Intangibles (R&D and adv. exp.), Size (total sales), Leverage (debt/tangible assets)	Tobin's q ratios	In firms with high degree of intangibles, geographic, business, firm size, and growth generally adds value
Delios and Beamish, (1999), examined the impact of geographic and product diversification on the performance of Japanese firms	Geographic diversification (Country count) Business diversification (entropy measure) Leverage (debt/total assets) Size Intangibles (technological and marketing)	ROS, ROA &ROE	The possession of proprietary assets and high business diversifications leads to superior profitability geographic-diversified firm rather than geographic diversification per se
Lins and Servaes, (1999), examined the impact of diversification on firm value	Diversification (no. of segments) Ownership measures Leverage (total debt/total assets) Size (total assets) Profitability (ROS)	Excess market value	Differences in corporate governance leads to different impact of diversification on firm value
Riahi-Belkaoui, (1999), examined the effect of internationalization on firm value	DG (foreign sales/total sales and foreign assets/total assets) Size (net total assets)	Market value of equity	There is an inverted U-shaped relationship
Denis et al.,(2002), evaluated the	DG (fraction of foreign sales)	Excess value	Both geographic and business diversification leads to

consequences of global and business diversifications on excess value	DB (number of segments) Leverage (LTD/Total Assets) Profitability (ROS) Intangibles (R&D and Advertisement spending) Tangible (CAPX/sales) Size (Market value of firm)		firm value discount The sample shows that there was relatively low spending on intangibles. This means the level of intangible assets was relatively lower as compared to tangible assets. It appears also that leverage levels is low in multinational firms.
Qian, (2002), examined the individual and joint impact of geographic and business diversification on profitability performance in small and medium-sized firms.	Product diversification (Entropy index) Geographic diversification (Foreign sales to total sales) Firm size (Log of assets) Firm age (number of years) Intangibles (R&D and Advertisement spending) Debt (total debt/total assets)	Profitability - ROS	Curvilinear relationship (inverted U-shape) exists between combined geographic and business diversification and profitability. Presence of high research and development expenditure and debt level significantly contribute to high profitability.
Capar and Katobe, (2003), examined the relationship between geographic diversification and financial performances in the service industry.	Geographic diversification (ID) (foreign sales to total sales (FSTS). Firm size (No. of employees). Industry effect (dummies)	ROS	There a U-shaped curvilinear relationship between ID and performance in service firms
Lu and Beamish, (2004) examined the impact of geographic diversification in Japanese firms	Diversification (number of segments) Size (net sales) Intangibility (R&D/sales; advertising/sales) Leverage (debt/equity)	ROA and Tobin's Q	There is S-Shape relationships between geographic and form performances. And that firms that invest more on intangibles achieve greater profitability
Jones and Danbolt, (2005), examined the stock market reaction to business and geographic diversification announcements	Size (market capitation) Price-earnings ratio Dividend yield	Market adjusted-returns	The stock market reaction was more favourable in relatively not-large firms and in firms that do not pay dividends than in firms that do pay dividends
Matraves and Rodriguez, (2005), examined the relationship between geographic and business diversification and profitability in leading German and UK Firms.	Diversification (Entropy) Size (production level) Industry growth (market share)	ROA	There is a curvilinear relationship between geographic and profitability in the UK, while the curvilinear relationship in Germany is between business and geographic diversifications. Furthermore, business and geographic diversification appear to be complementary in German firms but substitutable in the UK firms
Barnes and Hardie-Brown, (2006), evaluate the impact of geographic and industrial diversifications on firm value – theory: diversification increases opportunities and flexibilities and agency costs	Geographic and Business –number of segments(dummies 1 for presence 0 for absence), Intangibles (R&D/sales), Tangibles (CAXP/sales), Leverage (total debt/total equity) Firm size (total assets), profitability (ROS)	Market to Book value (MTB) and Adjusted Value Measure (AVM	MTB is positively and negatively related to geographic and business diversification respectively. Geographic diversification leads to AVM discount of 14%, and there is no systematic industrial value impact
Malone and Rose, (2006), based on ITS and TCT they examined whether	M&A (dummy –I if an acquiring or acquired firm is diversified over two or more businesses)	MTB	Firms with a high level of intangible assets enjoy abnormal returns of 6.84% above firms without

Intangible Assets and Firm Diversification have an impact on returns	High MTB –(dummy 1 if is above median) Growth – (dummy 1 if sales growth for five years is above median) Type of financing (dummy)	Prior returns (dummy 1 is above median)	intangibles. In support of transaction costs, they found that firms that engage in foreign direct investments and business diversification also generate an average abnormal event period return of -2.36%.
Qian et al., (2008), examined the effect of geographic diversification on profitability of the largest US firms over the period of five years (1996-2000).	Geographic diversification (Entropy index) Business diversification (entropy index) Firm size; Age Leverage; Risk Intangibility (R&D)	Profitability (ROA and ROS)	Geographic diversification has curvilinear relations with firm profitability
Hall and Lee, (2010), examined impact of both business and geographic diversification on performance in US, Japanese, and EEC firms	DG (proportion of overseas revenue) DB (Herfindahl index) Intangibles (R&D/Total Sales Leverage (Total Debt/ Equity) SIZE (Sales). all variables calculated as simple average 4-years	ROA and Tobin's Q	Business diversification is negatively related to ROA. While geographic diversification is positively associated to Tobin's Q.
Munz-Bullon and Sanchez-Bueno, (2011), examined the impact of joint effect of geographic and business diversification on financial performance of Spanish SME firms	Geographic diversification (Dummies) Business diversification (Dummies) Firm size Intangibility (R&D and advertising exp Leverage liquidity	Profitability ROA and ROS	The evidence shows that there is a negative relationship between geographic diversification and profitability and the combination of business and geographic diversification does not usually lead to favourable financial performance.
2. Business Diversification, leverage and financial performance – Agency cost and internalisation theory			
Lins and Servaes, (2002), examined the impact of diversification on profitability of firms in emerging markets	Diversification (dummies – 1 if two or more segments) Firm size (total assets) Profitability (ROS) Growth (CEXP/total sales)	Excess profitability	Diversified firms have lower profitability than focused firms. Focused firms appeared to have relatively high level of tangible assets and leverage.
Graham et al.,(2002), examined if corporate diversification strategies destroys value.	There were no specific variables that were controlled	Excess value	They find that half of the diversification discount was explained by adding an already discounted segment.
Aggarwal and Samwick, (2003), examined why managers diversify their firms	Diversification (number of segments) Managers' incentives Size (Sales) Leverage (debt/assets) Intangibles (R&D, and Advertisement spending) Tangibility (CAEXP/sales)	Tobin,s Q	Diversification and managerial incentives are positively related, thus diversification is beneficial to managers rather than shareholders
Singh et al., (2003) considered an agency theory to examine how leverage offsets value loss from diversifications. They investigated the impact of geographic	Business diversification (Entropy index) Geographic diversification (Foreign sales/total sale) Growth (5-yrs sales growth) Firm size (3 yrs sales)	Leverage (Total Debt/total assets)	Product diversification does not appear to create debt capacity, and therefore would not offset the value loss from diversification.

and business diversification on corporate leverage.	Intangibles (intangibles/assets) Profitability (ROA&ROE)		
Miller, D. J. (2006), examined the relationship between diversification and firm value.	Corporate diversification strategiess- Entropy. Technologically diversity –log of patent stock Intangibles - ROS Leverage Dividend Capital intensity	Log of market value	There is a positive relationship between related diversification and firm performance (market measure).
Park and Jang, (2011), examined the impact of related and unrelated diversification on firm profitability measures and business risk (profitability risk) in US restaurants	Diversification (entropy measure)	Profitability and profitability risk	Related diversification destroys firm profitability while unrelated diversification enhances firm profitability
Ammann et al., (2012) Examine whether conglomerates lead to firm value discount – Agency cost of debt perspectives	Diversification (segmental sales), size (assets), growth (3yrs sales growth, Intangibility (R&D/sales), Tangibility (CAPX/sales), Leverage (Debt/assets)	Excess value (book value of debt)	Discount is higher in high levered than firm with high equity funds - managers in levered firms reduce business-risk at the expense equityholders. Why do many firms diversify?

The previous studies in table 2.3 have shown that the relationship between corporate diversification strategies and financial performance been extensively examined through standalone explanatory variables and theories. These theories include: internalization theory of synergy (Caves, 1996; Morck and Yeung, 1991; 1992; 1997), transaction cost theory (Errunza and Senbet, 1981; 1984; Williamson, 1988; Harry and Mutti, 1991), and agency cost theories (Amihud and Lev, 1981; Jensen, 1986; 1993; Li and Li, 1996; Aggarwal and Samwick, 2003), and the common variables include: financing choices (leverage and internal funds), asset structures (asset inatngibility and tangibility), and firm size. However, analysis of the variables and the theories and the empirics demonstrates the presence of partial, fragmented, and conflicting results. It appears that the theories and the variables used in previous research are more hybridisable than conflicting, and theoretically they appear to be highly interactive and interdependent.

Specifically, previous research has recognised the contribution of different firm attributes (level of leverage, internal fund, firm size, and asset intangibility and tangibility) as important variables to understand impact of geographic and business diversification on firm value and profitability (Lins and Servaes, 2002; Aggarwal and Samwick, 2003; Singh et al., 2003; Miller, 2006; Ammann et al., 2012). However, these studies assumed that these attributes have individual contributions into profitability or firm value rather than synergistic contributions. However, it appears that those attributes may hybridise and provide synergic-effect in corporate diversification-financial performance relationships.

The subsections that follow review and analyse the studies in table 2.3 in order to identify and explain how the firm's attributes that appear to hybridise can be used to create configurations for favourable MTB and profitability. The literature is reviewed based on ITS, TCT, and ACTs. These theories were commonly used in corporate diversification strategies and financial performance literature.

2.3.2: ASSET STRUCTURE, DIVERSIFICATION, AND FINANCIAL PERFORMANCE

Asset structure comprises: asset tangibility (tangible assets) and asset intangibility (intangible assets). Intangible assets are usually derived from human assets, and they include company specific assets like human capital assets, patents, brands, goodwill, marketing abilities, and research and development (Rugman, 1977; Morck and Yeung, 1991: Malone and Rose, 2006). These assets have no physical forms; they are firm specific in nature; they have less value to external markets; and they have limited use across business lines. These assets are difficult to measure in accounting terms (Malone and Rose, 2006) because they are non-monetary in nature; and they have many definitions (De Vita et al., 2010; 2011). International Accounting Standards (IAS) 38, defines an intangible asset as "an identifiable non-monetary asset without physical substance" IASCF, 2008, p. (1867).

Based on ITS and on the qualities of intangible assets, it appears that firms can benefit more from intangible assets by creating of internal markets for the intangible assets through high geographic diversification strategy and adopting not-high business diversification strategy. This increases economies of scale and scope for enhancing shareholders' value.

Based on ITS, Morck and Yeung, (1992, p.45), noted that "geographic diversification is viewed by investors as value adding in the presence of intangible assets". However, arguing from TCT, it appears that high level of intangible assets needs to be financed through internally generated funds rather than external funds. This is because, intangibles are less collateralised therefore they attract high cost of accessing external funds such as debt. This implies that in order to determine the impact of intangible assets and geographic diversification on financial performance, the level of leverage or internal funds must be considered. In this context, although it has been theoretically and empirical verified that geographic diversification is positively related to firm value in firms with high level of intangible assets[17], the combination of intangible assets and geographic diversification strategy can be a necessary but not a sufficient indicator of favourable firm value.

It appears that the relationship between geographic diversification and intangible asset and firm value is more than linear relationships because the levels of these attributes and levels of internal funds or leverage hybridises to create complex

[17] See table 2.3 for a list of studies that confirms this result.

causality that can lead to synergistic-effects on firm value as discussed in later sections.

Tangibility refers to assets that have physical form. They are commonly defined as a percentage of the total of tangible assets: plant, property, and equipment (PPE) on book value of total asset (Campello and Giambona, 2010). These assets are important for external financing choice and diversification decisions. Arguing from TCT perspectives, Williamson, (1988), noted that the liquidation value of tangible assets depends on the availability of alternative uses (see also Gompers, 1995). It is believed that tangible assets have high resale value which is important to debt capital investors to recover their investments in case of financial distress. Therefore theoretically, tangible assets enable firms to enhance borrowing capacity and access cheap debt that would lead to high profitability (Williamson, 1988; Shleifer and Vishny, 1992; Rajan and Zingales, 1995; Campello and Giambona, 2010.

These tangible assets allow debt capital investors to repossess their investments in case of firms' bankruptcy (Rajan and Zingales, 1995). In this context, researchers have consistently found positive relationships between asset tangibility and leverage (Gompers, 1995; Rajan and Zingales, 1995; Singh et al., 2003; Campello and Giambona, 2010).

Based on TCT, I argue that high levels of asset tangibility allow firms to finance growth such as diversification using relatively cheap debt. This leads to a lower cost of capital and finally higher levels of profitability (Cheng, 2008). In addition, high levels of tangible assets provide opportunities to equityholders to opt for liquidations or takeovers when the firm is not creating value. This option is costly to managers (Campello and Giambona, 2010). Therefore, managers of firms with a high level of tangible assets are willing to make less risky diversifications in favour of their human capital (Houston et al., 2001; Aggarwal and Samwick, 2003; Miller, 2006; Laeven and Levine, 2007; Andreou et al., 2010). Furthermore, in principle tangible assets are relatively less mobile or they have costly mobility, therefore they are not favourable for high geographically diversified firms.

The key argument of TCT is that tangible assets increase profitability via cheap debt financing and reduced bankruptcy costs (Rajan and Zingales, 1995; Colombo, 2001; Dessi and Robertson, 2003). Based on these theoretical arguments, it appears that firms that have high levels of tangible assets and leverage can benefit more through business diversification than geographic diversification. As noted above, the relationship explained here implies variable interdependencies which indicate complex causality.

To summarise, the discussion in this section has shown that while asset intangibility and tangibility can combine with geographic and business diversification to enhance firm value, leverage and internal funds play a big synergistic role on the asset structures when it comes to creation of favourable financial performance.

2.3.3: FINANCING CHOICES, DIVERSIFICATION, AND FINANCIAL PERFORMANCE

Financing choice is the firm's decision on choosing sources of finance for financing growth. Due to the high cost associated with seasoned equity offerings (SEO) (Loughran and Ritter., 1997), this research assumes that SEO is not a common financing choice for growth in established firms like LSE-FASI-Firms and therefore is not included. This means that debt and retained earnings are used as important financing choices to finance growth strategy like diversification.

Bases on agency theories (ACTs), users of financial information have diverse views about the role of leverage and internal funds on corporate diversification strategies and financial performance. Jensen and Meckling, (1976), identified two types of conflict of interest associated with financing choices which exists among three key stakeholders (managers, shareholders, and debtholders) of public firms.

Equityholders would like to use diversification strategies to increase corporate profitability and enhance firm value. Equityholders as owners of the business may undertake risky diversification at the expense of debtholders when level of debt is relatively high in the capital structure with expectation of getting higher returns (Harris and Raviv, 1991; Hillier, et al, 2011), this is because losses and benefits from risky diversification leaves them better-off than debtholders.

Debtholders consider diversifications as *insurance* for their investments (Lewellen, 1971). Debtholders want to receive interest and their principal repayments when they are due. Therefore, less risky diversification is favoured by debtholders. Whereas, managers consider corporate diversification strategies as means to increase remunerations and reduce employment-risks (Amihud and Lev, 1981; Roll, 1986; Amit and Wernerfelt, 1990; Aggarwal and Samwick, 2003; Laeven and Levine, 2007; Andreou et al., 2010), and undertake diversifications that would lead to high pay and safe employment regardless of profit created.

Conflicts between equityholders and debtholders arise because "debt contract gives equityholders an incentive to invest sub-optimally" (Harris and Raviv, 1991, p.301). Debt contracts provide fixed returns to debtholders, as a result, much of the benefit created by debtholders' money drops into the hands of equityholders. This implies debtholders receive the same returns regardless of the level of profit created by their funds. In this context, equityholders are likely to pursue selfish investments such as diversification at the expense of debtholders when level of debt is higher. Indeed, Hillier et al., (2011), identified three types of selfish investment strategies that are likely to happen in firms that have high levels of debt and where threat of bankruptcy is high: choosing higher risky investments, opting for underinvestments, and "milking the property" through paying out high dividends (p. 462). This is consistent with Jensen and Meckling, (1976) who noted that asset substitutability problems are likely to occur in firms with higher levels of debt than equity capital.

Therefore, based on an agency cost theory of debt (ACTd), one can hypothesise that diversified firms that have high leverage are associated with unfavourable financial performance compared to those with relatively high level of equityholders' funds. This is contrary to TCT which shows that a configuration of high level of asset tangibility and leverage may lead to lower cost of capital and favourable profitability. However, this doesn't guarantee high profitability because according to ACTd, high leverage may lead to equityholders' biased investments when bankruptcy threat is high (Hillier et al, 2011).

As discussed in section 2.3.2 above, it appears that levels of leverage, internal funds, firm size, asset intangibility and tangibility have to be considered together as a configuration rather than individually in order to explain their impact on financial performance such as profitability. Basically, this is not a simple linear relationship but a complex relationship that may not be revealed through linear models.

2.3.4: Firm size, diversification, and financial performance

Firm size is commonly defined in relation to total assets and net sales (Sullivan, 1994) or number of employees. In the UK, sections 465 of the Companies Act 2006 as amended in 2008 define a SME for the purpose of accounting requirements. According to this a medium-sized company has a turnover of not more than £25.9 million and asset not more than £12.9 million and not more than 250[18]. This implies that a firm is defined as large if has net assets above £12.9million or net sales higher than £25.9million as explained later in section 5.3.3. However, it can be argued that although these thresholds for large firms have been precisely and objectively determined, they appear not appropriate as the concept of largeness generally remain fuzzy because some firms are much larger than the benchmarks.

Firm size has been found to be an important determinant of financial performance in diversified firms (Morck and Yeung, 1997; Chkir and Cosset, 2001; Drugun, 2002; Qian, 2002; Qian et al., 2003; Jones et al., 2004; Jones and Danbolt, 2005; Canbäck et al., 2006; Geiger and Cashen., 2007). The size of firm can offer an advantage in accessing financial and non-financial resources, efficient organisational routines, and managers' capabilities and competences important for making diversification decisions (Lavie, 2006; Bercovitz and Mitchell, 2007; Yore, 2007). For example, evidence has shown that large firms are likely to have better employees who are capable of bringing about better performance to the firm (Amihud and Lev, 1981), have greater influence on financial performance (Chang and Thomas, 1989), and diversification choices (Yore, 2007)

Yore, (2007), argued that since firms are not equal in terms of size and since large firms have relatively more resources, then size matters when it comes to the value impact of corporate diversification strategies. It appears that very large firms are

[18] http://www.legislation.gov.uk/ukpga/2006/46/section/465. Visited on 20th August 2012

capable of creating large amounts of internal funds and therefore less reliant on capital markets to finance their growth strategies like diversification.

However ceteris paribus, theoretically large firms are expected to have high levels of agency problems and are not considered efficient in utilising corporate resources especially when levels of internal funds are high. This leads to diversification value-discounts in large firms but diversification value-premium in not-large firms (Stulz, 1990; Stein, 1997; Shin and Stulz, 1998; Scharfstein and Stein, 2000; Rajan et al., 2000; Jones et al., 2004; Jones and Danbolt, 2005; Canbäck et al., 2006; Munoz-Bullon and Sanchez-Bueno, 2011). Indeed, Jones et al., (2004) and Jones and Danbolt, (2005) found that firm size was negatively related to abnormal returns from the UK listed firms during 1991-1996.

Based on agency theory, Stulz (1990) showed that managers of large firms often prefer to reinvest the firm's profits rather than paying them to investors as dividends even when reinvestment appear to destroy value. In contrary, relatively not-very large firms was found to benefit more through not paying dividends (Jones and Danbolt, 2005), and managers of not-large firms made better allocation of scarce resources and better choice of projects which add value than managers of large firms (Stein, 1997, Canbäck et al., 2006).

It appears that both very large and not-very large firms can lead to favourable MTB and/or profitability depending on financing choices. The literature has shown that diversified firms that are relatively not-very large require high levels of internal funds to enhance financial performance. In contrast, high leverage appears to ehance financial performance in relatively very large and diversified firms. This implies that financing choices and firm size interacts to synergistically influence financial performance in the diversified firms. This is not a simple linear relationship and demonstrates the possibility of equifinality in the corporate diversification-financial performance relationship as discussed in section 1.4.2.

2.3.5: SUMMARY

To summarise, table 2.3 and the reviewed studies show that the relationship between corporate diversification and firm value/profitability have been examined using the different firm attributes: leverage, internal funds, firm size, and asset intangibility and tangibility as important variables to understand the relationship. Furthermore, these studies used three main theories: internalisation theory (ITS), transaction cost theory (TCT), and agency cost theories (ACTs) to explain how these attributes are linked with geographic or business diversification and firm value or profitability.

Although, it appears that the variables and the theories used were considered to be independent, the analysis has indicated that these variables are highly interactive and interdependent such that they make the relationship between geographic and business diversification strategies and firm value and profitability to appear complex. This implies the relationship could be explained through hybridisation of ITS, TCT, and ACTs rather than standalone theories.

The failure to consider this complex relationship is likely to lead to partial, fragmented, and conflicting results on the main research question of this thesis. In the next section the prior studies are analytically reviewed to identify and discuss the possible source of partial, fragmented, and conflicting results. Also the review is used to identify and discuss the possible configurations of the variables and hybridisation of theories for sufficient explanations on how geographic and business diversifications lead to favourable financial performance.

2.4: ITS, TCT, AND ACTS IN CORPORATE DIVERSIFICATION STUDIES.

2.4.1: INTRODUCTION

ITS states that firms can increase their value through the creation of internal markets for their intangible assets that stem from "superior production skills, patents, marketing abilities, managerial skills, or consumer goodwill" (Morck and Yeung, 1991, p.165). Morck and Yeung added that intangible assets are like public goods in that their value increases in direct proportion to geographic diversification. In addition, ITS can be used to explain that since intangible assets are less likely to be efficient in multiple line of businesses (Bettis and Hall, 1982), then firms with high level of intangible assets are likely to benefit from not-high business diversification.

On the other hand TCT contends that firms that have high levels of intangible assets would be motivated to expand geographically and use equityholders' funds to finance their growth opportunities and their intangible assets to reduce transaction costs (Malone and Rose, 2006). Basically, TCT states that firms exist because of possessing unique advantages that allow them to trade at relatively lower costs.

Agency costs are costs incurred by firms due to a conflict of interest among firms' stakeholders (Harris and Raviv, 1991). The conflict of interest arises due to separation of control and ownership of capital invested in the business. In principle there are two types of owners of physical capital in corporations: debt capital (debtholders) and equity capital (equityholders) owners. These physical capitals are controlled by managers (the agents). Managers may have different interests to those of capital owners. And, in order to align managers' and owners' interest requires some costs which are commonly referred to as agency costs.

ACTs contends that managers diversify their firm for a number of reasons. Firstly to use the excess resources instead of distributing them to shareholders (Jensen, 1986; Stulz, 1990); secondly, managers (investors in human capital) diversify their firms to reduce idiosyncratic risk and to increase their remuneration, prestige, and power (Amihud and Lev, 1981; Aggarwal and Samwick, 2003); thirdly, firms are diversified in order to exchange low-risk investments for high risk investments that have higher expected returns (asset substitution), especially when debt capital is relatively higher than equity capital (Jensen and Meckling, 1976; Hillier et al., 2011).

As indicated in this section, ITS, TCT, and ACTs have been used in corporate diversification strategies and financial performance studies. The next sections analytically review these studies across three different proxies of financial performance: firm value, profitability and risk-return performance.

2.4.2: AN ANALYTICAL REVIEW ON DIVERSIFICATION STRATEGIES AND FIRM VALUE

Based on the qualities of intangible assets discussed in section 2.3.2, ITS has been used to argue that geographic diversification strategy enhances firms value (MTB) because it enables efficient use of intangible assets (Caves, 1971 1996; Morck and Yeung, 1991; 1992; 1997). In addition, TCT indicates that because of the qualities of intangible assets (see section 2.3.2), they appear expensive to finance using external funds (Williamson, 1988), but high level of intangible assets gives firms unique competitive advantage over other firms (Malone and Rose, 2006) and these assets can be deployed in wide geographic markets (Caves; 1971; Morck and Yeung., 1991; 1992; 1997) with limited marginal costs. This implies that internal funds are important to finance intangible assets when it comes to creating favourable MTB. In this context, researchers have consistently found that geographic diversified firms with high levels of intangible assets and internal funds are favourably valued by the market.

Indeed, Jones et al., (2004) and Jones and Danbolt, (2005), noted that firms with a high level of future investment opportunities like research and development, lower dividend payout ratio, and geographic diversification have high abnormal returns. This implies that firms with high level of intangible assets, internal funds, and geographic diversification would create favourable MTB.

Morck and Yeung, (1991; 1992: 1997), examined the impact of geographic diversifications on MTB. They found that research and development and advertising spending all enhance the MTB of the multinational firms. Specifically, Morck and Yeung, (1991), in their paper entitled “Why Investors Value Multinationality”, examined the value of geographic diversification to investors. They found that geographic diversified firms that had high levels of information-based asset (intangibles) had relatively high value. This interpretation was that geographic diversification creates efficient internal markets for intangible assets, and therefore it is positively valued by investors. They conclude that intangible assets are necessary for creating value for high geographic diversified firms. In addition, they noted that standalone geographic diversification has no impact on MTB.

The descriptive statistics of the sample from Morck and Yeung, (1991) indicate that on average 28% of assets were financed by leverage. This means on average the assets in the sample were highly financed by equityholders' funds rather than debtholders' funds[19]. Based on the TCT and agency cost theory of debt (ACTd), I argue that the financing choice adopted in the sample firms used in Morck and Yeung, (1991), reduced the cost of capital (Myers and Majluf, 1984) and underinvestment problems (Jensen and Meckling, 1976). In this context, it appears that lower level of leverage was an important cause of the observed results.

Similarly, Morck and Yeung, (1992), examined whether investors attach value to geographic diversification and intangible. They found that firms with a high level of intangible assets had significant positive stock price movements following overseas acquisition announcements while firms with low level intangibles experienced "at best zero abnormal returns" (p.41). They also concluded that a combination of geographic diversification and intangible assets is *necessary* but *not sufficient* for improving value.

Furthermore, Morck and Yeung, (1997), wanted to understand why investors sometimes value size and diversification. They found that the presence of high level of intangible assets, business diversification, and large firm size lead to favourable MTB in high geographic diversified firms. This means geographic diversification per se is not considered as "an unbooked intangible asset" as claimed in Riahi-Belkaoui, (1999, p.195), unless geographic diversification is viewed in combination with other firm attributes. This is consistent with the arguments that human beings understand complex things in "holistic rather than individual parts" because when the "parts" are joined in different fashions they lead to different outcomes (Ragin, 1987, pp.23-24).

Denis et al., (2002), examined the consequences of geographic and business diversification on excess value. They found that excess values are negatively related to geographic diversification, business diversification, and to the combination of both geographic and business diversification. They argued that firm value is not driven by diversification per se but "driven by common firm-specific factors" (p.1969). The

[19] Shareholders' funds includes internal fund which is common when it comes to financing firm's growth strategy (Myers, 1997)

descriptive statistics shown in the Denis et al sample proved that most of the multinational firms involved in the analysis had relatively low levels of R&D and advertising expenditure (median around 0% of sales) as compared to capital expenditure[20]. It appears also that the firms in their analysis had relatively high levels of tangible assets and low level of leverage, i.e. leverage ranges between 11% and 19% of total assets. According to transaction cost theory, these firms would have benefited more from use of high leverage rather than equityholders' funds. This result supports that in the absence of high level of intangible assets, geographic diversified firms are not favourably valued by the market. This is evidence that there is synergistic effect between geographic and intangible assets that has been overlooked in previous research.

Barnes and Hardie-Brown, (2006), evaluated the impact of geographic and business diversification on firm value as measured by market to book value (MTB) and adjusted value measure (AVM)[21]. They found that MTB is positively and negatively related to geographic and business diversifications respectively. However, when AVM was used, the result showed that geographic diversification leads to value loss. This implies that different measures of financial performance may lead to different results (see also Hall and Lee, 2010).

Hall and Lee, (2010) examined the impact of both business and geographic diversification on firm value and profitability (Tobin's Q and ROA) in US, Japanese, and EC firms. They found that the impact of corporate diversification strategies depends on performance measures. More specifically, they found that business diversification is negatively related to return on assets (ROA) but that there is no significant relationship between business diversification and Tobin's Q. Also geographic diversification had a significant positive relationship with Tobin's Q but no significant relationship with ROA. They concluded that a non-linear relationship

[20] See table II in Denis et al., (2002, p.1960)

[21] Barnes and Hardie-Brown, (2006) defines AVM=$\frac{\ln(MVE+BVL)}{IVTA}$. Where AVM is the Adjusted Value Measure, MVE is the Market Value of Equity, BVL is the Book Value of Total Liabilities, and IVTA is the Imputed Value of Total Assets which is expressed as: IVTA = S × M where S is the Annual reported Sales and M is the Industry Multiplier for FTSE industry. The Industry Multiplier (M) is expressed as: M = Median x ($\frac{MVE+BVL}{S}$). Where median is the median of the observation.

between geographic and business diversification and financial performance usually depends on types and measures of diversification and financial performance. The descriptive statistics in the sample used by Hall and Lee showed that debt to equity ratio was 0.30 which indicates that on average the firms in the sample had a relatively high level of equityholders' funds rather than debtholders funds. In addition, R&D intensity seem to be high[22]. This implies that the firms involved in the sample had high level of intangibles, and these intangibles were more financed by equityholders funds than debtholders' funds.

2.4.2.1: CRITICAL REVIEW AND SET-THEORETIC FRAMEWORK FOR FAVOURABLE MTB

The analytical reviews in section 2.3 and in section 2.4 above have highlighted three important points for this research.

First, it appears that none of the standalone ITS, TCT, or ACTs is sufficient to explain the impact of corporate diversification strategies on firm value. These theories appear to hybridise in order to provide adequate explanations of how corporate diversification strategies lead to favourable MTB.

Secondly, these studies have shown that different explanatory variables used to determine the relationship between corporate diversification strategies and firm value appear to be interdependent and interacts in such a way that it is hard to pinpoint the impact of one variable on MTB because they seem to hybridise (Thomson et al., 2012) and exhibit complex causality (Fiss, 2011), rather than simple linear relationship.

Thirdly, these studies indicated that corporate diversification strategies-financial performance relationships are complex and cannot adequately be examined using net effect models like linear regression (Diamantopoulos et al., 2008; Crilly, 2011; Fiss, 2011; Purkayastha et al., 2011; Rodger and Guiral, 2011; Wiersema and Bowen, 2011).

[22] See table 1 in Hall and Lee, (2010, p.113)

Specifically, these studies have indicated that based on ITS, high level of intangible asset may cause firms to expand geographically, but also high geographically diversified firms can be motivated to increase level of their intangible assets in order to benefit from internalising the markets of the intangible assets. This suggests that based on ITS firms with different levels of geographic diversification and intangible assets could experience high level MTB (see for example Morck and Yeung, 1991; 1992; 1997). This relationship appears to be not a linear relationship but a ***set-theoretic*** or a configurational relationship and it can be examined through set-theoretic framework.

In addition, although ITS has been used to explain geographic diversification–firm value relationship (see table 2.3). I ague that this relationship cannot sufficiently be explained by ITS per se because of possible complex causality. Based on ACTd and TCT, I argue that high level of intangible assets require to be financed by internal funds so that to avoid the possibility of high agency cost of underinvestments as suggested in prior research such as Meckling and Jensen, (1976) and Hillier et al., (2011), and to avoid high transaction cost of accessing external finance which could lead to high cost of capital (Williamson, 1988). In this context, it can be argued that firms that have high level of internal funds and asset intangibility can benefit more from geographic diversification than firms with high level of leverage and intangible asset. In this context, it is a configuration of geographic diversification, level of asset intangibility and internal funds that investors do assign positive value to firms rather than standalone impact of these attributes.

This idea of configuration has been implied in previous research results but not explicitly stated. For example previous research has concluded that high level of geographic diversification per se is not positively valued by investors but the presence of high level intangible assets (Morck and Yeung., 1991; 1992; 1997; Lins and Servaes, 1999; Lu and Beamish, 2004; Jones and Danbolt, 2005; Malone and Rose, 2006) and high level of retained earnings (Jones and Danbolt, 2005) lead investors to assign the positive value to the firms. These studies implicitly suggest that firms with high memberships in geographic diversification, intangible asset, and internal fund sets could create a necessary configuration for favourable MTB[23]. However as noted in previous research, other firm characteristics such as levels of business diversification and firm size may influence the ralationship (Morck and Yeung, 1997; Jones and Danbolt, 2005), such that this configuration can be ***necessary but not sufficient*** for favourable MTB. The sufficiency will depend on other characterists as per ***hypothesis a*** of this thesis.

Based on this review, I argue that hybridisation of ITS and TCT is necessary to explain the above complex causality, and they can be used to develop a generic set-theoretic framework to explain configurations for favourable MTB. Figure 2.4 is the generic set-theoretic framework that reflects the hybridisation of internalisation and transaction cost theories. Figure 2.4 is therefore used to provide theoretical and empirical evidence on key research question 1 which seeks to explain:

> ***How does corporate diversification necessarily and sufficiently lead to favourable firm value?***

The filled circles in figure 2.4 indicate that firms require to possess high membership in the respective attributes in order to achieve favourable MTB, and the circles with a cross indicate that firms require to possess not-high memberships, while the unfilled circles show ambivalent situations where it is not theoretically clear how the attributes will influence the results, therefore, it is the empirical evidence that would indicate the impact of these attributes on MTB. Therefore figure 2.4 is basically developed to reflect ***necessary*** but ***not sufficient*** configurations for favourable MTB[24]

Generally, figure 2.4 shows that a configuration of high membership in geographic and not-high membership in business diversification sets, high membership in internal funds, and intangible asset sets is necessary for achieving favourable MTB. This is consistent with hypothesis “a”. Theoretically, high geographic and not-high business diversification enables firms to benefit from economies of scale and scope, intelligence and experience gathering, product improvements, operational stability

[23] See figure 1.2 in chapter 1 for a possible theoretical and conceptual framework for identification of configurations that lead to favourable financial performance.

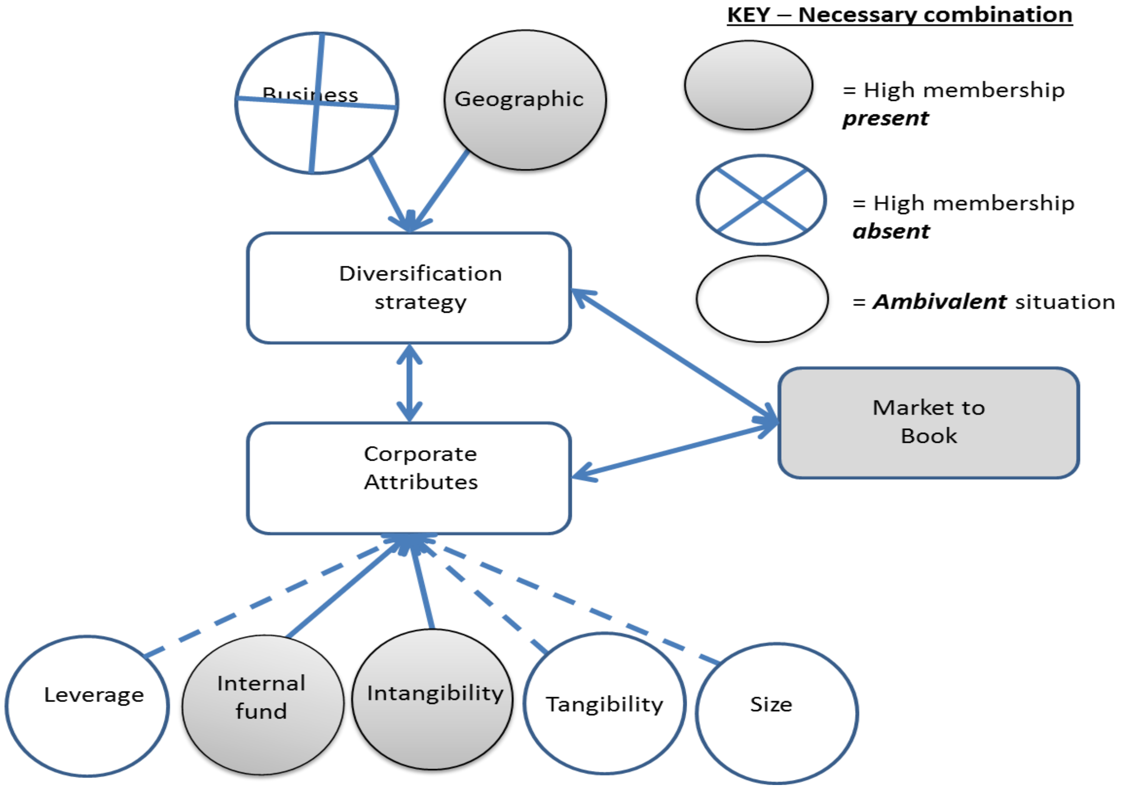
[24] The concepts of necessary and sufficient are well described later in section 3.3.3.6 of this thesis.

and international production costs flexibility (Kim et al , 1993), tax advantages (Harry Grubert and Mutti 1991), and reduces business risks caused by differences in demand and supply of products across geographic locations (Kim et al., 1989; 1993; Lee at al., 2006). These enable geographically diversified firms to enjoy flexibilities on relative operation costs/benefits and other institutional differences as per the "winner-picking" model of investment decisions (Stein, 1997).

Although figure 2.4 shows configurations *necessary* to achieve favourable MTB, they cannot guarantee a *sufficient* configuration for favourable MTB because high geographic diversification increases organisation complexity, agency problems, and information asymmetry. These lead to high coordination costs between corporate headquarters and divisional managers across different geographic locations (Harris et al., 1982), reduced efficiency because of cross-subsidization of less profitable segments (Denis et al., 2002), and increases managers' interest in selfish benefits that stem from diversification (Rajan et al., 2000). In short, geographic diversification may also lead to unfavourable MTB.

Figure 2.4: Set-theoretic framework linking diversification and MTB

This figure is a ***generic*** set-theoretic framework adopted to examine ***necessary configurations*** that lead to favourable MTB. The dots represent firms' memberships in different attributes that include: Geographic and business diversification sets, internal fund and leverage sets, intangibility and tangibility sets, and firm size set. The filled dots represent the presence of above 0.5 memberships in the respective set and dots with a cross indicate presence of firms' membership of 0.5 or less in the respective set. The unfilled dots represent ambivalent situation that is the impact of presence of high or not-high membership in the ***necessary configuration*** is not theoretically clearly determined. The continuous arrows indicate that the condition is theoretically assumed present. While dotted arrows indicate the presence of a condition is not theoretically determined but the attribute is important in the configuration



From the theoretical arguments above, one can get confused with regards to the direction of the geographic diversification-performance relationship. Indeed, empirical evidence showed negative relationships (Shaked, 1986), positive relationships (Grant, 1987; Daniels and Bracker., 1989), or curvilinear relationships (Hitt et al., 1997; Riahi-Belkaoui, 1998; 1999; Qian et al., 2008; Chiang and Wang, 2011). Therefore, the set-theoretic framework developed above is important to determine essential configurations for favourable MTB, and figure 2.4 is particularly used to tested ***hypothesis a*** as stated below

> ***A combination of high membership in geographic and not-high membership in business diversification sets, high membership in internal fund and intangible asset sets is a necessary but insufficient indicator for achieving favourable firm value. Sufficient configurations will depend on a firm's memberships in other set attributes such as size and leverage.***

2.4.3: AN ANALYTICAL REVIEW ON DIVERSIFICATION STRATEGIES AND PROFITABILITY

The studies presented on table 2.3 also show that ITS, TCT, and ACTs are not limited to explaining the geographic diversification and firm value relationship in firms with high level of intangible assets, but it extends to other proxies of financial performance such as profitability. There is evidence that geographic and business diversification have different impacts on different proxies of financial performance (Barnes and Hardie-Brown, 2006; Hall and Lee, 2010), depending on levels of other firm attributes like leverage and firm size (Delios and Beamish, 1999; Capar and Katobe, 2003; Lu and Beamish, 2004; Mtraves and Rodriguez, 2005; Barnes and Hardie-Brown, 2006; Malone and Rose, 2006; Hall and Lee, 2010; and Munz-Bullon and Sanchez-Bueno, 2011).

Delios and Beamish, (1999), examined the impact of geographic and business diversification on the profitability of Japanese firms. They found that possession of proprietary (intangible) assets leads to superior profitability in firms that combine high geographic and not-high business strategies. A close examination of Delios and Beamish's sample indicated that on average, debt capital was 29% of total assets.

This means that on average these firms had relatively less debtholders' funds as compared to equityholders' funds. According to TCT, lower leverage implies lower transaction costs of financing the intangibles (Williamson, 1988), that would lead to superior profits.

Matraves and Rodriguez, (2005) examined the relationship between geographic and business diversification and profitability in leading German and UK firms. They also found that firms with high R&D expenditure and geographic diversification experienced higher profitability than other firms. In addition, they noted that the impact of business and geographic diversification on a firm's profitability was linked to the firm's specific characteristics. However, they were unable to pinpoint the specific characteristics that influenced the results and they didn't present the descriptive statistics of their sample. They also found that business and geographic diversification were complementary and substitutable in Germany and in UK firms respectively.

Lu and Beamish, (2004), examined the impact of geographic diversification in Japanese firms, and they found that firms that invest more in intangible assets achieve greater profitability. The descriptive statistics of the sample used in Lu and Beamish, showed that most of the firms included in the sample were highly diversified in terms of business lines and the level of leverage was more than three times of equity funds. In addition most firms were large[25]. Therefore, it might be that the results were influenced by a combination of high leverage, business diversification and firm size because according to coinsurance effect and TCT, this combination leads to a lower cost of capital which leads to favourable profitability (Lewellen, 1971, Williamson, 1988 see also section 2.3.3 of this thesis).

Capar and Katobe, (2003), examined the relationship between geographic diversification and profitability of firms in service industry. Firms in service industries usually have a high level of intangible assets. They demonstrated a curvilinear (U-shape) relationship between geographic diversification and profitability. In addition, they also demonstrated a negative relationship between

[25] See table 1 in Lu and Beamish, (2004, p.603)

profitability and firm size, and a positive relationship between firm size and geographic diversification. This means that when firm size and diversification levels increase, a firm's profitability declines. Therefore, the ability of intangible assets to create profit declines as firm size increases. This provides evidence that the combination of geographic and intangible assets is necessary but not sufficient for high profitability as firm size has a significant influence on the results.

Malone and Rose, (2006), wanted to understand why firms engage in mergers and acquisitions (M&A) and foreign direct investments (FDI). Based on ITS and TCT and a sample of 703 US domiciled firms, they used cross-sectional multivariate regression and event study analysis. They controlled for variables like firm size and type of financing. They found that firms with internalisation advantages [26] experienced 6.84% abnormal returns higher than firms without internalization advantages. This is consistent with Jones et al., (2004, p.437), who found that the market reacts more "favourably to investments that create future investment opportunities"[27] and in relatively not large firms. Furthermore, Malone and Rose showed that non-debt source of finance was an important factor to explain ability of intangible assets to create abnormal returns consistent with transaction cost theory (Williamson, 1988).

Munz-Bullon and Sanchez-Bueno, (2011), also examined the impact of the joint effect of geographic and business diversification on the financial performance of Spanish SMEs. They found a significant negative relationship between geographic diversification and profitability. In addition, they noted that the combination of business and geographic diversification does not lead to favourable financial performance. They argued that the results might be influenced by limited resources and lack of experience in new business lines and markets of not-large firms. This implies that not-high business diversification is important for enhancing profitability in not-very large firms.

[26] A firm was considered to possess internalisation advantage when it has a high level of intangible assets.

[27] According to Jones and Danbolt, (2005), expenditures on intangible assets and low level of dividend yield is a signal of favourable future investment opportunities.

Based on agency cost theory as summarised section 2.4.1, researchers argue that business diversification destroys financial performance because of high agency costs (Jensen, 1986; Li and Li, 1996; Aggarwal and Samwick, 2003). It is noted that diversified firms can enhance financial performance by reducing agency problems through financing choices. For example high leverage was found necessary for diversified firms to create favourable financial performance because it reduces slack resources in hands of managers that would otherwise attract underinvestments (Li and Li, 1996).

Based on the transaction cost theory of Williamson, (1988), I argue that high leverage would destroy profitability in firms that have a high level of intangible assets (less collateralised assets) because of the high transaction costs of accessing debt capital. In addition, it has been argued that high leverage leads to underinvestment problems (Jensen and Meckling, 1976; Harris and Raviv, 1991; Hillier, et al., 2011). Indeed, Ammann et al., (2012) wanted to know how conglomerates lead to value-discounts. They found that diversification value-discount is high in firms with high leverage, and there were no diversification value-discounts in high equity-firms. Based on this finding, they concluded that there are conflicts of interest between shareholders and debtholders as regards to risk taking behaviours when level of leverage is relatively high. Furthermore, the results have shown that in the presence of high levels of equity funds, managers' interests align with those of shareholders, so there were no diversification value-discounts in high equity financed firms.

Aggarwal and Samwick, (2003) applied agency theory to examine why managers diversify their firms. They argued that there are two theoretical reasons that motivate managers to diversify their firms: hedging idiosyncratic risks and to gain personal benefits like prestige and high remuneration. After controlling other firm specific factors, they concluded that managers diversify their firms to enhance their personal benefits. Close examination of descriptive statistics showed that the average percentage of intangible asset expenditure on firm's capital was relatively high at about 71%. This may imply managers are acting in their own interests when pursuing business diversification and spending on intangible asset. If this is true, then a combination of high business diversification and intangible assets would lead to high agency problems which would destroy profits.

The results in Aggarwal and Samwick, (2003) supported the work of Roll, (1986), which showed that since managers have a high appetite for growth rather than profit and firm value maximisation, they undertake mergers and acquisitions in unrelated businesses to hedge their employment risk and to increase personal perquisites; Roll showed evidence that unrelated takeovers were basically influenced by managers' self-interest to increase personal benefits. This means, unrelated diversification leads to value discounts because of overinvestment problems (Mueller, 1969; Jensen, 1993; Li and Li, 1996). In order to reduce overinvestment problems, (Li and Li, 1996), suggested that high level of debt capital could be used to reduce problems and enhance profitability.

Lins and Servaes, (2002), examined whether diversification is beneficial to firms in emerging markets. They found that high business diversified firms are less profitable than not-high diversified firms in emerging markets. The descriptive statistics reported by Lins and Servaes showed that on average the firms had leverage of about 31% and 34% in not-high and high diversified firms respectively. In addition, high diversified firms had lower levels of capital expenditure (16% of sales) than those of not-high diversified firms (20% of sales). Based on these observations, and in connection to TCT, it appears that the better performance of not-high diversified firms might be attributed to a combination of high leverage and high levels of tangible assets (capital expenditure) as this combination allows firms to benefit from lower cost of debt capital (Williamson, 1988). Furthermore, in principle not-high business diversified firms have relatively lower agency problems than high business diversified firms.

Although, in most cases it appears that not-high business diversified firms enhance firm profitability, other researchers have found that not-high business diversification destroys firm profitability (Park and Jang, 2011). Park and Jang used 308 US firms in the restaurant sector to examine the impact of related and unrelated diversifications[28] on firm profitability measures and business risk across 28 years (1980-2008). They found that related diversifications destroy firm profitability while unrelated diversification enhances firm profitability.

Colak, (2009) used a large sample of firms to examine the argument that diversification leads to value discount while not-high diversification leads to value premium. He found no evidence of high diversification value-discount or not-high diversification value-premium.

To summarise, studies have shown that high business diversification leads to poorer profitability than not-high business diversification because *firstly,* high business diversification increases corporate complexity (Aggarwal and Samwick, 2003; Scott et al., 2007) and agency problems (Jensen, 1986; Li and Li., 1996) when compared to not-high business diversification. Firms that operate in diverse businesses are complex and therefore require relatively higher operating costs that lead to unfavourable profitability (Amihud and Lev, 1981; Goldberg and Heflin, 1995).

Secondly, diverse businesses hinder synergistic benefits from scope economics (Kaplan and Weisbach, 1992; Denis et al., 2002). Unrelated businesses do not allow easy knowledge transfer and resource sharing across segments as compared to not-high business diversified firms (Nickel and Rodriguez, 2002). Not-high business diversification leads to cost savings that result from sharing of resources like production areas, common equipment, intangible resources like brand and reputation, production technology, marketing capability, and managerial skills that could not be enjoyed in unrelated businesses. In this context, it is not surprising that high business diversification leads to unfavourable financial performance as compared to not-high business diversification (Bettis and Hall, 1982, Barnes and Hardie-Brown, 2006)

Thirdly, it appears that high-business diversified firms have relatively lower market power as compared to not-high business diversified firms (Montgomery, 1985). Diverse businesses means less specialisation in particular business lines that lead to

[28] In the current research, related and unrelated diversifications are referred to not-high and high diversifications as indicated in defined in chapter 1.

less market power for the different business lines as compared to specialised firms. In these cases, profitability of the diversified business segments is relatively lower compared to not-high business diversified firms.

2.4.3.1: CRITICAL REVIEW AND SET-THEORETIC FRAMEWORK FOR FAVOURABLE PROFITABILITY

The research has indicated partial, fragmented, and conflicting results from the standalone ITS, TCT, and ACTs that were used to explain contributions of the standalone of geographic and business diversification strategies and firm attributes (leverage, internal funds, firm size, asset intangibility and tangibility) on profitability. However, these theories seem to support one another in explaining the relationship.

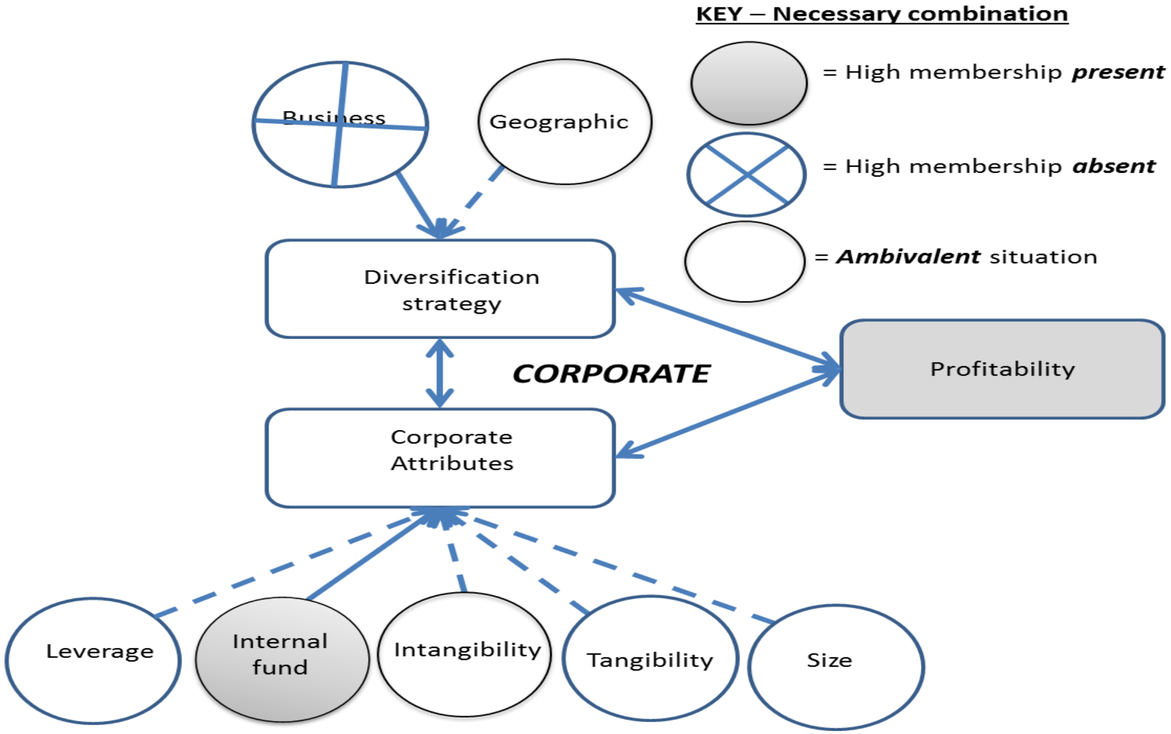
It appears also that the relationship is complex and that the direction of the relationship is not clear. However, recent researchers have found an inverted U-relationship between corporate diversification strategies and financial performance (Chiang and Wang, 2011) which suggests that corporate diversification strategies are "bad for some firms and good for others" (Matsusaka and Nanda, 2002, p.176), depending on the levels of presence of other firm characteristics (Morck and Yeung, 1997: Lu and Beamish, 2004; Barnes and Hardie-Brown, G., 2006).

However, researchers generally agree that high level of business diversification destroys while not-high diversification enhances profitability (Rumelt, 1982; Varadarajan and Ramanujam, 1987; Lins and Servaes, 1999; Lins and Servaes, H., 2002). However, based on ACTs and TCT, it appears that not-high business diversification per se does not guarantee favourable profitability, because level of leverage and internal funds appear to have synergistic-effects on the results.

It appears that the presence of a relatively high level of equityholders' funds would necessarily but not sufficiently enable not-high business diversified firms to create high profitability. This leads to the development of figure 2.5 which is one of the set-theoretic frameworks for this research. It shows that a combination of not-high business diversification and internally generated funds is necessary but not sufficient for high profitability.

Figure 2.5: Set-theoretic framework linking diversification and profitability

This figure is a ***generic*** set-theoretic framework adopted to examine the ***necessary configurations*** that lead to favourable profitability. The dots represent firms' memberships in different attributes that include: Geographic and business diversification sets, internal fund and leverage sets, intangibility and tangibility sets, and firm size set. The filled dots represent the presence of over 0.5 memberships in the respective set and dots with a cross indicate the presence of firms' membership of 0.5 or less in the respective set. The unfilled dots represent ambivalent situations where the impact of the presence of high or not-high membership in the ***necessary configuration*** is not theoretically clear. The continuous arrows indicate that the condition is theoretically assumed present. While dotted arrows indicate the presence of a condition that is not theoretically determined but it is important in the configuration



This is consistent with the literature which shows that not-high business diversified firms have less agency problems, and the presence of a high degree of internal funds reduces transaction costs of obtaining external funds in not-high diversified firms. In addition, internal funds reduce shareholders' appetite for undertaking underinvestment which leads to favourable financial results. In this context, the combination mentioned above appears essential to the configurations that lead to favourable profitability.

The set-theoretic framework developed in figure 2.5 is used to examine the key question 2 that seeks to understand:

How does corporate diversification necessarily and sufficiently lead to favourable profitability?

As explained in chapter 1, the hypothesis associated to research question 2 is stated here below.

Hypothesis b

> ***A combination of not-high membership in business diversification and high membership in internal fund sets is a necessary but insufficient indicator of favourable profitability. Sufficient configurations will depend on a firm's membership in other attributes like asset structures, firm size, and geographic diversification.***

The filled circles on figure 2.5 indicate that firms require to possess high membership in respective attributes in order to achieve favourable profitability, and the circles with a cross indicate that firms require to possess not-high memberships, while the unfilled circles show ambivalent situations where it is not theoretically clear how the attributes will influence the results, and therefore it is the empirical evidence that would indicate the influence of these attributes on profitability. Therefore figure 2.5 is developed to reflect ***necessary*** but ***not sufficient*** configurations leading to favourable profitability

2.5: CORPORATE DIVERSIFICATION STRATEGIES AND RRP

2.5.1: INTRODUCTION

Although it was argued that "the objective of diversification is to produce the best portfolio-the one with the most favourable **combination** of risk and expected return" (Lintner, 1965, p. 589), the question as to how corporate diversification strategies lead to the favourable balance of risk-reduction and return performance (RRP) has remained a topic of interest and there is no clear answer to this question (Bowman, 1980; Bettis and Hall, 1982; Bettis and Mahajan, 1985; Fiegenbaum and Thomas, 1988; Kim et al., 1993; Nickel and Rodriguez, 2002; Andersen et al., 2007; Olibe et al., 2008). Favourable risk-return performance (here after RRP) is here defined as above average performance in both firm's business risk-reduction and returns, assuming there is a negative relationship between firm's business risk and return (Nickel and Rodriguez, 2002). Consistent with previous reseachers, in this research business risk is defined as volatility of firm's profitability and measured by standard deviation of profitability measures (return on assets and return on sales) (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Fiegenbaum and Thomas, 1988; Kim et al., 1993; Nickel and Rodriguez, 2002; Andersen et al., 2007). Therefore, risk-reduction is when the standard deviation of the profitability measures are relatively lower. In the same way, I defined return as firms' profitability as measured by return on assets (ROA) or return on sales (ROS). Further discussion on these measures see section 5.3.1 of this thesis.

The capital asset pricing model and finance theory usually proposes positive relationships between firm's business risk and return, implying that investors who expect higher return have to accept high business risks (French et al., 1987; Fletcher, 2000; Ghysels et al., 2005) that is risk-return trade-off is considered as "the fundamental law of finance" (Ghysels et al., 2005, p. 510). In other words it is believed that there is no ***free lunch*** for investors seeking higher returns or lower risks. However, Bowman, (1980), challenged this conventional wisdom of absence of "*free lunch*" for high return or low risk investment seekers by showing that diversification strategies can lead to a favourable balance of RRP (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Fiegenbaum and Thomas, 1988; Kim et al., 1993; Nickel and Rodriguez, 2002; Andersen et al., 2007).

Bowman, (1980) argued that some firms can simultaneously increase profitability and reduce business risks. However, Bowman didn't specify the type of firms that can benefit from high returns and low business risks. This negative risk-return relationship is commonly known as Bowman's risk-return paradox. This paradox attracted researchers from many disciplines to apply different theories in order to provide explanations on risk-return relationships. To date, the evidence show partial, fragmented, and conflicting conclusions as to whether corporate diversification strategies bring a favourable balance of risk-reductions and returns to shareholders (Houston et al., 2001; Aggarwal and Samwick, 2003; Laeven and Levine, 2007; Andreou et al., 2010) [29]

Generally, there are mainly two schools of thought that explain the relationship between corporate diversification strategies and RRP. Firstly, there are those who believe that diversification reduces business risk at the expense of returns or increase returns at the expense of business risks. These researchers usually agree that there is a trade-off between business risks and returns as such firms cannot achieve a favourable balance between business risk-reduction and return (Amihud and Lev, 1981; French et al., 1987; Amit and Wernerfelt, 1990; Fletcher, 2000; Ghysels et al., 2005). Secondly, there are those who argue that firms are capable of attaining favourable balance of RRP through corporate diversification strategies (Bowman, 1980; Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1993).

This section presents an analytical review of studies on corporate diversification strategies and RRP. This review identifies configurations that can lead to favourable RRP that has been overlooked by previous researchers. Table 2.4 summarises some of the key literature for this research since 1980.

[29] See Nickel and Rodriguez, (2002) for a list of researchers with different results on risk-return relationship (see also table 2.4)

Table 2.4: Studies on diversification and risk-return performance (RRP)

Authors and topic.	Other Variables	Variables of Interest	Results
Bowman, (1980), examined risk-return relationship.	Different industries – no other variables	Risk – Variance of ROE Return - ROE	Negative relationship between risk and return across industries
Bettis and Hall, (1982), examined Bowman risk-return paradox based on **diversification** as a factor for favourable RRP	Business Diversification - Specialisation ratio (Rumelt, 1974 - categorization). No other variables considered	Return - ROA Risk – SDROA	Related diversifications enjoy superior RRP than unrelated product diversifications (i.e., positive relationships in unrelated diversified firms and negative relationships in related diversified firms
Bettis and Mahajan,(1985), examined theRisk/Return performance of related and unrelated business diversified firms based on **diversification theory**	Diversifications – Specialisation ratio (SR) (Rumelt, 1974; 1981) Industry indicators Firm indicators: debt/equity Fixed asset/total assets; average sales growth; payout-ratio; R&D and Advertising intensity, total assets turnover,	Return -ROA Risk - SDROA	On average related firm perform better than unrelated diversified firms. However unrelated firms do not necessarily create favourable RRP. (Positive relationship in unrelated diversified firms. Negative relationship in related diversified firms
Singh, (1986), applied **behavioural theory** to examine the relationship beteween firm performance and risk taking bahaviour	Size – log of total sales Environmental turbulence – Questionnaires Mass output orientation of technology – subjective Slack: Absorbed and Unabsorbed	Performance: ROA and ROE Risk: Questionnaires, debt level and R&D level	There is a negative relationship between risk and firm profitability
Figenbaum and Thomas, (1986), examined whether the risk-return paradox is stable across time.	Market risk – Beta Risk and return stability across period	Risk – Variance of ROE Return - ROE	The paradox is not stable across different periods (negative in 1970s and positive in 1960s), and does not exist when risk is measured using market-based measures.
Chang and Thomas, (1989), examined the impact of **diversification** of RRP	Size – log. of mean assets Diversification – dummy (related and unrelated categorisation - SR	Risk - variance of ROA 5yrs Return – Mean of ROA	Diversification strategies have no impact on RRP. Market and business structures impact on RRP. There is curvilinear risk-return relationship Firm size leads to better risk-return profiles
Fiegenbaum, (1990), interested in applying **prospect theory** to examine exisistency of Bownman paradox	Target levels	Return – average ROA Risk – Variance of ROA	The risk-return relationship: In firms with above target performance – is positive In firms with below target performance – is negative They concluded that the characteristics of the firms environment, strategy, and implementation processes are necessary in influencing risk-return relationship.
Bromiley, (1991b), based on **prospect**	Expectations: Means of earning forecast	Risk: Variance of ROA,	There is negative relationship between risk and

theory, He examined how past performance and other factors influence risk taking and vice versa.	Aspirations: past ROA time 1.05 (p.46) Slack: Available, Potential, and Recoverable	ROS, and ROE Return: ROA, ROS, and ROE	return
Cool et al., (1898), to gain insight on multiple determinants of RRP on business level	Market power – Market share Size – Total assets Efficiency – (Human capital) - intangibles	Risk – SDROA and SDROS Return – Average ROA and ROS	There is a positive relationship between risk and return. There is a negative relationship between risk and market power. They conclude that other firm attributes are important in risk-return relationships
Kim et al., (1993), examined the impact of geographic **diversification** on RRP	Diversification levels (three) were used as independent variables	Return – ROA Risk-std dev of ROA	They found that geographic diversification can both increase profitability and reduce business in not-high diversified firms than in high business diversified firms.
Gooding et al., (I 996), applied **prospect theory** to examine risk-return relationship	Target level (points of references)	Risk – SDROE Return - ROE	There is a curvilinear relationship between risk and returns – supported prospect theory.
Qian and Li, (1998), examined the impact of geographic scale and geographic scope on risk performance of large firms (**Diversification theory)**	Geographic scale - Ratio of foreign sales to total sales Geographic scope – geographic segments Geographic diversification – entropy measure	Risk – SDROA	The combination of high geographic scale and medium geographic scope outperformed other combinations.
Deephouse and Wiseman, (2000), examined the risk-return relationship using multiple theories including **agency theory** and **behavioural theory.**	Leverage – Debt /Equity Governance - proportion of outside to total members of board of directors Bankruptcy proximity - Al Altman's Z	Risk – Deviation of earning per share (EPS) Return – average ROA	The relationship is different across different periods They conclude that multiple frameworks provide better explanations of risk-return relations. .
Nickel and Rodriguez, (2002), reviewed the literature on Risk-return relationship in order to understand the rationale of the paradox across different theories	Review of the literature: Applied prospect theory Diversification theory Market power	Different measures of return: ROA, ROS, ROE, ROI risk: Variance of return	Many researchers provide evidence of the negative relationship between risk and return. However, in general the relationship is mixed. Different theories lead to different results.
Aggarwal and Samwick, (2003), based on agency theory examine why managers diversify their firms.	Diversifications – number of segments Tobin's Q Size – log of assets; Leverage – debt/total assets R&D/capital; Advertising/capital	Risk – SD of returns CEO – pay performance	Diversification decisions are driven by the private benefits managers receive from greater diversification (that is managers risk reduction and private benefits)
Andersen et al., (2007), examined Bowman' Paradox.	Diversification – number of segments	Return – ROA Risk – SD of ROA	Negative risk–return relationships in different industry

2.5.2: RISK-RETURN TRADE-OFF STUDIES

Although geographic and business diversification have been associated with both benefits and costs (Olibe et al., 2008), research studies that employ ACTs and TCT have consistently found positive relationships between risk and returns in high geographic or business diversified firms (Amihud and Lev, 1981; Amit and Wernerfelt, 1990; Reeb et al., 1998; Deephouse and Wiseman, 2000; Aggarwal and Samwick, 2003; Olibe et al., 2008). This research suggests that there is always a trade-off between risk and return performance that is associated with agency problems. Indeed, Amihud and Lev, (1981), noted that manager's decisions about diversification usually relies on risk and return trade-offs that favour their own interest.

Basically, it is argued that due to separation of firm’s ownership and control; managers, equityholders, and debtholders have different perceptions and motives towards risk taking behaviour (Nickel and Rodriguez, 2002), and the differences in motivations to risk taking are associated with the capital structure of firms. When the level of debt capital is relatively higher than that of equityholders then managers and equityholders are likely to adopt a high risk growth strategy such as diversification in unrelated business lines with the expectation of getting higher returns (Jensen and Meckling, 1976).

ACTd contends that less risky investments usually give less or no return to equityholders and more returns to debtholders when debt is relatively high in the capital structure. In this case, equityholders of firms that have high leverage would opt for high risk investment (e.g., unrelated diversification). Risky investments make shareholders relatively better-off than debtholders (Jensen and Meckling, 1976; Hillier et al., 2011). This implies that on average firms with a high level of leverage engage more in risky diversification with expectation of better returns. Therefore according to the ACTd a combination of high diversification and leverage is expected to lead to risk-return trade-off.

Amit and Wernerfelt, (1990), identified three motives of corporate diversification strategies for business risk reduction: agency motives, cash flow motives, and rate of return motives. According to Amit and Wernerfelt, investors of human capital (managers), face two major risks in their investments: losing employment and receiving low payments (see also Amihud and Lev, 1981). Managers are likely to lose their employability when their firms go bankrupt (Amihud and Lev, 1981 Deephouse and Wiseman, 2000). This implies that if business diversification reduces employment risk, then managers could be willing to diversify their firms provided that the benefits from risk-reduction outweigh the costs for their expected income. In addition, Amit and Wernerfelt, (1990), argued that "if risk-averse managers are compensated on the basis of their firm's earnings" then they could opt for diversifications that lead to stable returns regardless of costs shouldered onto equityholders (p.522). Amit and Wernerfelt, described this as agency motives because the motive is associated with the conflict of interest between managers and equityholders. This motive suggests the existence of a positive risk-return relationship. This implies that business risk reduction can be achieved at the expense of equityholders' interest which is consistent with the idea that diversification is more beneficial to managers than equityholders (Amihud and Lev, 1981; Aggarwal and Samwick, 2003).

The second motive of diversification is the cash flow motive where managers diversify their firms in order to increase stability of cash flows. Stable cash flows enable firms to acquire external financing (debt capital) at lower costs which enhances profitability (Amit and Wernerfelt, 1990), and reduces cost of capital. Amit and Wernerfelt proposed a negative relationship between business risk reduction and level of cash flows, for which they found no support, implying that diversification per se has no significant impact on RRP.

In principle, human assets are less diversifiable than other assets (Deephouse and Wiseman, 2000) as they can only be invested in one firm at one time and perhaps in one certain skill that is required by the firm. Therefore, managers suffer relatively higher loss than other investors when their firms are bankrupt (ibid). In this context, managers would like to avoid bankruptcy through avoidance of risky diversification

(Ross, 1977; Ammann et al., 2012). Since high leverage is a good indicator of bankruptcy risks then it would be expected that managers of high leveraged firms avoid risky diversifications to reduce the chances of bankruptcy. In addition, high leverage disciplines managers in utilising slack resources that otherwise would be selfishly used by managers in loss making diversifications (Harris and Raviv, 1991).

The third motive according to Amit and Wenerfelt is based on transaction costs perspectives, which explains that firms undertake business diversification to help investors reduce costs of diversifications such as brokerage and time related costs

Furthermore, Nickel and Rodriguez, (2002, p.13), noted that firms usually engage in unrelated diversification by "buying businesses in the market". However, as most of the purchased assets are overpriced, then unrelated diversification leads to favourable risk-reduction while pulling down firm's returns (ibid). In this context, ceteris paribus, unrelated business diversification can reduce business risk at the expense of return.

2.5.3: THE FAVOURABLE BALANCE OF RRP

Researchers have found that firms can simultaneously gain high profits and reduce business risks through better choice of diversification strategies (Bowman, 1980; Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993). The presence or absence of certain attributes appears to make firms achieve favourable RRP (Bettis and Mahajan, 1985; Chang and Thomas, 1989; Kim et al., 1993), and this includes the choice of diversification strategy.

Business diversification has been frequently used to explain risk-return relationships (see table 2.4). It is argued that business relatedness has a better chance of enhancing RRP as compared to unrelated business diversified firms (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Chang and Thomas, 1989; Kim et al., 1993). In theory, high business (unrelated) diversification leads to very low covariance of returns across the firm's segments. Low covariance implies relatively lower levels of risk. However, unrelated business segments hinder synergistic results that would otherwise be realised from shared resources across related segments (Bettis and Hall, 1982; Chang and Thomas, 1989). The absence of synergistic-effects from unrelated business leads high business diversified firms to suffer from lower returns (Bettis and Hall, 1982; Bettis and Mahajan, 1985). This implies that high business diversification is capable of reducing business risks but, it leads to lower returns (profitability).

Furthermore, not-high business diversification implies that business segments of the firm are cross-related. This allows easier knowledge and experience sharing among employees and resource sharing across segments. In addition, not-high business diversification enables managers to understand and overcome the risks of the business because of accumulated knowledge, skill, and experience in a related business. These reduce the chances of business failure and possible future risks. In this context researchers have found high returns and lower business risk come from synergistic results of related businesses (Mueller, 1969; Shelton, 1988; Kaplan and Weisbach., 1992; Whitley, 1994).

Although, not-high business diversification was found necessary for favourable RRP, it has been noted that geographic diversification is also important for enhancing RRP (Bettis and Mahajan, 1985; Kim et al., 1993). It is argued that firms can enhance RRP through geographic diversification (Rugman, 1976; Kim et al., 1993; Kand et al., 2012). Geographic diversification reduces political risks, inflation, and currency risks. Furthermore, Kim et al., (1993), noted that geographic diversified firms have three unique advantages for reducing business risks and enhancing returns as compared to not-high geographic diversified firms. These include: access to global markets that reduces the effect of home competitors, wider choices on labour and material costs, production costs, tax advantages and other interest rates as these can be shifted amongst countries with added advantages operating in multiple countries can reduce demand and supply inequalities because different countries have unequal seasonal demands. In these cases high geographic diversification enhances the RRP relative to not-high geographic diversification.

Specifically, favourable RRP has been found to exist in not-high business diversified firms and high geographic diversified firms. However, other firm attributes like financing choice, asset structure, and firm size have been found to bring synergistic support to the relationships as discussed below.

Based on the work of Rumelt, (1974) and Bowman, (1980); Bettis and Hall, (1982) sought to understand the types of business diversification strategies (related-constrained, related-linked, or unrelated firms)[30] that lead to both risk and return advantages. They argued that not-high diversified firms might lead to favourable RRP through possession of information-based assets like research and development and marketing resulting from accumulated competencies and expertise around core businesses. This brought substantial synergies among related segments that led to low business risks and high returns.

To test this, Bettis and Hall, (1982), analysed data from 80 U.S firms for 5 years (1973-1977) previously used by Rumelt, (1974). They found that on average not-high business diversified firms displayed high returns and lower risks than high diversified firms. This result was further confirmed by regression analysis which shows that the relationship between ROA and standard deviation of ROA (risk) in not-high business diversified firms was generally negative, while the relationship was positive in high business diversified firms. They further noted that business diversification strategies per se were not sufficient to lead firms to achieve favourable RRP but the interaction of business and geographic diversification played a big role.

Bettis and Mahajan, (1985), used the same accounting measures and samples as in Bettis and Hall, (1982), to examine the rationale of Bowman, (1980)'s risk-return paradox. They grouped firms into four clusters based on risk-return similarities. Cluster 1 included firms with lower returns-high risk, cluster 2 include lower risk-lower return, cluster 3 higher return-lower risk, and cluster 4 is lower risk-moderate returns. These clusters were analysed based on their diversification strategies, industry, individual firm characteristics, innovation, and product differentiation indicators. The results of their cluster analysis indicated that cluster 3 was found to be dominated by firms with not-high level of business diversification, higher levels of research and development and advertisement expenditures, and lower levels of debt capital.

[30] The terms related (constrained and linked) and unrelated diversification in Bettis and Hall, (1982), are referred to this thesis as not-high and high business diversification strategies respectively.

Bettis and Hall (1985) observations indicated that a combination of high degrees of information-based assets, low debt, and not-high business diversification was important for favourable RRP. Based on TCT the conclusion was drawn that not-high business diversification enable the accumulation of competences and expertise around the core activities which allows synergetic-effect among business segments and internalisation of firm-specific assets (intangibles) that resulted in a favourable balance of RRP.

It was also concluded that business "related diversification is a ***necessary*** but ***not sufficient*** condition to achieve favourable RRPs" (Bettis and Mahajan , 1985, p.793). Therefore, future researchers should consider synergistic-effect studies in order to understand the effect of business and geographic diversification and other corporate attributes.

Kim et al., (1989), examined the impact of geographic and business diversification on profitability and profit stability (business risk), using 62 US firms. Firms were grouped into four major groups based on business and global market diversification strategies. They measured profitability and risk using ROA and standard deviation of ROA respectively. They generally found a trade-off between profit growth and stability in most of groups. However, a cluster of related business and high global market diversifiers was found to have the most favourable RRP. This implies that not-high business and high geographic diversified firms enjoy more favourable RRP than other groups.

Kim et al., (1993), further examined the role played by geographic diversification in enhancing risk and return performance. They used 152 large US multinational firms categorised as unrelated diversifiers (diversification across different business), global market diversifiers (diversified across different markets), and global related diversifiers (worldwide diversification across related business segments). In order to address their curiosity on Bowman's, (1980) risk-return paradox, they created four further clusters using return-risk differences. Group 1 is Low risk-high return, group 2 is high risk-medium return; group 3 represented by medium risk-medium return, and group 4 is low risk-low return. They measured risk and return as in Bettis and Hall, (1982), Bettis and Mahajan, (1985), and Kim et al., (1989).

The results from Kim et al., (1993)' cluster analysis showed that group 1 (low risk-high return cluster) was highly and significantly diversified in terms of geographic locations. While cluster 4 (low risk-low return) was highly and significantly diversified in terms of businesses. This implied that both high geographic and business diversification helps to reduce business risks. However, business diversification leads to lower returns but, geographic diversification leads to favourable balance of RRP.

In addition, Lee et al., (2006), found that a high degree of geographic diversification reduces risk and enhances profitability more than not-high geographic diversified firms. They concluded that multinational firms increase profits and reduce business-risks through operational flexibility that mitigates the negative impact of a specific country's interest rates, tax rates, labour costs, and raw material costs.

Furthermore, Lubatkin and Chatterjee (1994), examined how managers are capable of using diversification advantages to stabilise cash flows and reduce risks. They argued that firms that have high level of geographic diversification and information-based assets would manage to achieve favourable balance of RRP because in addition to the geographic diversification advantages stated in Kim et al., (1993), geographic diversification provides internal markets in firm specific assets as discussed in Morck and Yeung, (1991; 1992) which is likely to increase returns that can lead to favourable RRP in not-high business diversification (Bettis and Mahajan, 1985).

Based on the above studies, I argue that firms can achieve favourable RRP through corporate diversification strategies. What matters is to understand to what degree geographic and business diversification hybridise with other attributes to give unique advantages to firms (Miller and Pras, 1980; Bettis and Mahajan, 1985; Chang and Thomas, 1989; Kim et al., 1989; 1993; Lubatkin and Chatterjee, 1994).

To summarise, the studies reviewed in this section have shown that: first, it is possible to simultaneously achieve low risk and high returns through diversification which challenges the idea that *there is no free lunch* for high return seekers, secondly, it appears that a combination of not-high business, high level of internal funds and firm size is usually a necessary but not sufficient indicator of favourable RRP. Thirdly, the review has shown that there is a complex relationship amongst corporate diversification strategies and other firm characteristics for enhancing RRP. This relationship requires a set-theoretic framework to understand how corporate diversification strategies lead to favourable RRP.

2.5.4: Critical review and set-theoretic framework for favourable RRP

The review of the literature in this section has shown the expected partial, fragmented and conflicting results on the key research question 3. However, the cluster analysis was able to highlight the combinations of firm characteristic that appear necessary but not sufficient for achieving favourable RRP. Therefore the results of cluster analysis presented above were used to develop the set theoretic framework used to provide theoretical and empirical answers to the research question 3.

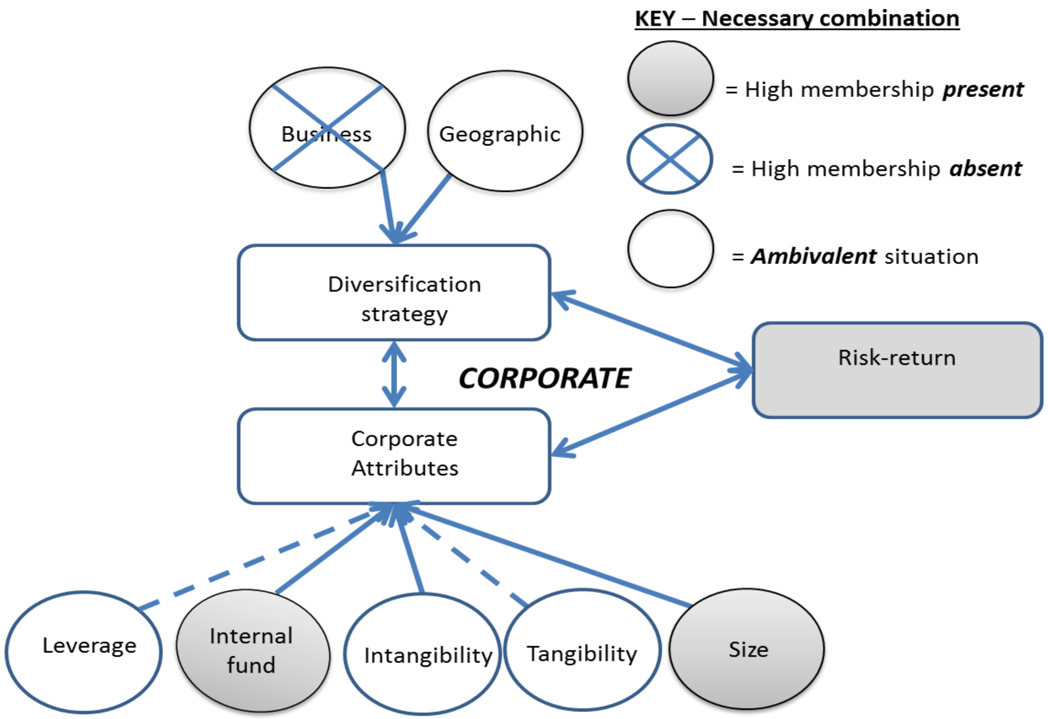
Based on the summary above, a set-theoretic framework has been constructed, and it is used to explore configuration to be used as a sufficient indicator of favourable RRP. Figure 2.6 is the set-theoretic framework that links levels of geographic and business diversification strategies, leverage, internal funds, firm size, and asset intangibility and tangibility in LSE-FASI-firms. These attributes are considered as *sets* as discussed in chapter 1, and they are used to explore answers to the key question 3 of this thesis which intends to explain:

> ***How does corporate diversification necessarily and sufficiently lead to favourable RRP?***

The dots in figure 2.6 represent memberships of firms in different sets. The filled dots indicate that firms require high memberships in the respective set to create favourable RRP, while dots with a cross indicate that firms require not-high memberships in the respective set to achieve favourable RRP. Unfilled dots represent ambivalent situations where there is currently no theory to indicate that the presence of high or not-high membership in the respective sets impacts on RRP.

Figure 2.6: Set-theoretic framework linking diversification and RRP

This figure is a set-theoretic framework adopted to examine configurations that lead to favourable RRP (RRP). The dots represent firms' memberships in different attributes that include: geographic and business diversification sets, internally generated fund (internal) set, leverage set, intangibility set, tangibility set, and firm size set. The filled dots represent the presence of above 0.5 memberships in the respective set and dots with a cross represent firms' memberships of 0.5 or less in the respective sets. The unfilled dots represent ambivalent situations where a firm's membership (high or not-high) doesn't matter when it comes to identification of the configuration that leads to favourable RRP.



The figure therefore shows that a configuration of not-high memberships in business diversification, high memberships in internal fund, and firm size sets is a necessary but not sufficient condition for favourable RRP. The ***hypothesis d*** is stated as follows:

Hypothesis d

> ***A combination of not-high membership in a business diversification set, and high membership in internal fund (retained earnings) and firm size sets is a necessary but insufficient indicator of favourable risk-return performance. Other factors like asset structure and degree of geographic diversification are important for determining sufficient routes***

2.6: SUMMARY AND CONCLUDING REMARKS

2.6.1: SUMMARY OF THE CHAPTER

This chapter aimed at reviewing and analysing research into corporate diversification strategies and firm value (MTB), profitability, and risk-return performance (RRP). This literature has been reviewed using the ***fuzzy paradigm*** introduced in chapter 1 and discussed later in section 4.1 of this thesis[31]. This paradigm helped to identify set-theoretic frameworks that link geographic and business diversification and other firm characteristics to favourable MTB, profitability, and RRP. The literature was divided into two main parts.

The first part discussed corporate diversification strategies trends in firms listed in the US and European stock markets and including firms listed in UK stock market (in this thesis referred to as LSE-FASI-firms). It shows that there were similar diversification trends. The diversification history also showed that corporate diversification strategies were motivated by the need to create favourable MTB and profitability.

Part two was concerned with analytical review into corporate diversification strategies and financial performance studies. This part was intended to critically examine why past research into corporate diversification strategies-financial

[31] The concept of fuzzy paradigm in this thesis is generally refers to a research paradigm which is not purely found in objectivists' or subjectivists' camps.

performance relationships is largely fragmented and inconclusive. This part was organised into three sections. The first section was intended to identify the common variables and theories that previous researchers employed to examine corporate diversification strategies-performance relationships; and to determine possible hybridisation among the variables and theories previously used on a standalone basis. The review has identified that geographic and business diversification strategies, leverage, internal funds, firm size, asset intangibility and tangibility were the common variables in corporate diversification strategies and financial performance studies, and ITS, TCT, and ACTs were the three common theories that were used to explain the standalone contributions of the these variables on MTB, profitability, and RRP.

The second and the third sections of part two that is section 2.4 and 2.5 was intended to identify and analyse the source of the conflicting results that exists in corporate diversification strategies and financial performance studies and therefore identify the possible solutions for the conflicting results. The analysis confirmed that there are partial, fragmented, and conflicting results about corporate diversification strategies-performance relationships. These conflicting results were attributed to the inability of research methods to handle complex and asymmetric causality issues on the corporate diversification strategies-financial performance relationship. It appears that diversification per se does not enhance or destroy MTB, profitability and RRP, but, it is the presence or the absence of other firm attributes that enables a particular diversification strategy to enhance or destroy these financial performances (Delios and Beamish., 1999; Campa and Kedia., 2002; Denis et al., 2002; Matsusaka and Nanda, 2002; Malone and Rose, 2006, Barnes and Hardie-Brown, 2006).

It appears that levels of the identified firm attributes make “firms heterogeneous” (Lu and Beamish, 2004, pp.607-8), and these heterogeneities “account for the variability in diversification behaviour” (Gourlay and Seaton, 2004, p. 2059) and enable some firms to “drive relative value” (Barnes and Hardie-Brown, 2006, p.1526). However, the addition of an already discounted segment or firm can also lead to corporate diversification strategies that destroy financial performance (Graham et al., 2002).

There is evidence that the variables used in previous research are highly interactive and interdependent and the theories seem to support one another rather than competing in explaining how corporate diversification strategies enhance or destroy firm value, profitability, and RRP. However, researchers have been assuming that corporate diversification strategies and other firm attributes are competing for contribution in the financial performances and the relationship was explained through standalone theories, and their answers to the question how corporate diversification strategies enhance or destroy MTB, profitability, and RRP are partial, fragmented, inclusive, and largely conflicting.

It appears that theories could hybridise to provide an adequate explanation on the relationships. This has been largely ignored, perhaps because the net effect models that were applied in previous research do not adequately handle high levels of variable interactions in financial performance studies (Greckhamer et al., 2008; Crilly, 2011; Fiss, 2011).

2.6.2: CONCLUSION OF THE CHAPTER

Based on this critical review and the summary above this research concludes that the variables and the theories used in previous studies are interdependent, interactive, and hybridisable. Therefore there are complex relationships amongst corporate diversification strategies and the other firm attributes identified in this research for achieving favourable MTB, profitability, and RRP in LSE-FASI-Firms. These complex relations can be examined through fuzzy set analysis (FSA). FSA deals with high levels of variable interactions and hybridisation. In addition, FSA allows hybridisation of the three theories to explain how corporate diversification strategies enhance or destroys MTB, profitability, and RRP.

Based on configuration approach used to review the previous studies, three generic set-theoretic frameworks were developed to examine the three key questions of this thesis (see chapter 1). The next chapter 3 presents a review of literature that illuminates FSA in order to understand the what, why, and how questions about FSA method and its application in financial performance studies.

Chapter 3 : UNDERSTANDING FSA AND ITS CONTRIBUTION TO CORPORATE DIVERSIFICATION AND FINANCIAL PERFORMANCE: DESCRIPTIVE REVIEW

3.1. INTRODUCTION

Chapter 2 analysed past research on the question how geographic and business diversification enhance or destroy financial performance. It has shown that the question was addressed by estimating the average effect of diversification and other corporate attributes on financial performance. These studies identified a series of partial and fragmented answers as regards to the above question, and they lack robust and consistent set of conclusions (see sections 2.3, 2.4, and 2.5). This provides confusion as how to diversifications create or destroy value. It appears that measurements and determinants of performance are a function of the complex interaction of many attributes (Russell and Thomson, 2009)[32] that were highlighted but not cleraly addressed in previous studies used net effect models (see table 2.3). Net effect models were found unable to address this complex interaction among causes of financial performance (Purkayastha et al., 2011; Fiss, 2011). It is my argument that answers to the question requires the application of configuration approach (FSA) as suggested by Ragin, (2000; 2008) and Fiss, (2011).

This chapter provides a descriptive review on FSA to understand what, why, and how FSA is applied. The review intends to appreciate the contribution of FSA to corporate diversification and financial performance studies. FSA is based on a set-theoretic approach and this chapter starts with an overview of set-theoretic approach.

3.2: AN OVERVIEW OF SET-THEORETIC APPROACH

Set-theoretic approach was primarily introduced in social science studies by Ragin, (1987; 2000) as a research method for understanding the fundamental problem of complex/conjunctural causality that were overlooked in conventional net effect models. The approach views cases[33] as made up of different arrangements of

[32] For example Russell and Thomson, (2009) noted that sustainable development indicators are implicated in economic, social, and environmental progress as characterised by accounting technology calculated numbers.

[33] The terms cases and firms are used interchangeably, however, they are slightly different: whilst firm refers to corporate in its literally meaning, a case is referred as a company that has been defined

variables. These arrangements are referred to as configurations. FSA uses configurations as units of analysis and fuzzy set values for assigning degree of memberships of cases in different sets. Therefore, variables are measured to reflect memberships of cases in a set as demonstrated in chapter 1 section 1.1 (figure 1.2) of this thesis.

According to Ragin, (2000), firms are understood by examining configurations of their characteristics (differences and similarities) that influence an outcome of interest. Ragin contends that differences and similarities of cases can be determined using memberships in their basic elements/attributes. These memberships are referred to as fuzzy sets (Ragin, 2000).

In his book "*The Comparative Method: Moving beyond Qualitative and Quantitative Strategies*" Ragin, (1987), introduced the concept of crisp set analysis. He shows that a case can either hold or not-hold full membership in different elements, and he used 1s and 0s to denoted full memberships and non-full memberships respectively. For example based on this categorisation firms can be categorised as having full membership (1) or not-full membership (0) in a set of large firms, highly levered firms, high diversified firms, and so on. However, this dichotomisation appears more important for categorical variables than for continuous variables because in continuous variables, cases have gradual membership ranging from full nonmembership (0) to full memberships (1) (see figure 1.2 in chapter one). These gradual memberships are defined as fuzzy sets (Ragin, 2000).

Thus, in order to understand gradual memberships of cases of continuous variables, Ragin, (2000), advocates the application of fuzzy sets and recommended an application of FSA as a hybrid method that bridges the gap between quantitative and qualitative approaches (see also Fiss, 2011). Hybrid approaches allow researchers to identify core/predominant and supporting conditions (Russell and Thomson, 2009)[34]

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based on configurations. That is a case is a combination of different variables that are defined as a firm attributes.

[34] For example Russell and Thomson, (2009) used hybrid approaches to understand sustainable development indicators in Scotland Government. They noted that "A *Sustainable Scotland* was constructed from a hybrid of sustainable government styles with a predominance of elements of ecological modernisation" (p. 235)

Previous researchers on FSA such as Ragin, (2000; 2008) and Fiss, (2011), noted that FSA application is based on the argument that linear relationship models have limited ability to deal with complex causality because: (a) outcomes of interest are usually caused by multiple interactions of causal variables (conjunctural or complex causality), (b) causes rarely operate in isolation from one another (variable interdependences), and (c) a specific causal attribute may have different or even opposite effects on the outcome of interest depending on context (asymmetric causality)[35]. These premises are hard to address using linear models, but the configuration approach (FSA) can. FSA utilises basic features of Boolean algebra that enable FSA outputs to be analysed in a similar way as that of crisp set analysis (Greckhamer et al., 2008; Fiss, 2011).

According to Greckhamer et al., (2008, p.697), the basic features of Boolean algebra includes: (a) the use of binary data, (b) combinatorial logic; that is causes of an outcome are not viewed in isolation but in an interdependent manner, (c) the application of Boolean algebra operators (such as set logical "***and***" and *"**or**"* and ***"negation"***) that are used to express the combinatorial logic, and (d) Boolean minimization that reduces the number of logically possible configurations of complex causality. Therefore, FSA requires an application of Quine-McCluskey algorithm (hereafter QMA) to minimize the number of logically possible configurations (see section 3.3.3.1 for details). Further discussions on FSA terms are presented in the sub-sections that follow.

3.3: FUZZY SETS AND FUZZY SETS DEVELOPMENT PROCEDURES

3.3.1: WHY FUZZY SETS?

Section 1.2.1 of this thesis describes the concept of fuzzy set. The basic idea of fuzzy sets is to scale the original measures into membership scores that range between 0 and 1, as shown in figure 1.2. This section takes the definition of fuzzy sets further to understand why fuzzy sets were introduced in social science studies. Fuzzy sets are extensions of classical sets (Boolean or "crisp" sets) by allowing for degree of membership (Zadeh, 1965; Ragin, 2000; Ragin and Pennings, 2005; Fiss, 2011).

[35] See section 1.3 for details about these premises

In classical sets, cases are dichotomised and classified as members or not members of a particular set. Classical set theory views things in binary form that is, black or white, large or small, young or old, male or female and so on. This categorisation may not sufficiently define many accounting and finance concepts because many concepts in accounting and finance such as levered versus unlevered firms, profitable versus unprofitable firms, large size versus small size firms, diversified versus focused firms, business risk versus no business risks, and so on, requires gradual categorisation: between the two extremes there are graded sets that may remain unaddressed when a dichotomous categorisations are used. For example some firms can be highly, moderate, or not-highly levered. Fuzzy sets are used to understand the different levels that firms possess in different variables.

Fuzzy sets are like continuous variables that have been intentionally calibrated to show the degree of membership in a specified *set* (variable) (Ragin and Pennings, 2005). In fact, transformation of original variables to fuzzy sets is like scaling the variables to smaller and more manageable figures. This process does not significantly change the ranking but does increase the quality of analysis by including the idea of memberships which is not easily determined using original measures. According to Ragin, (2000; 2008), calibrated variables are superior to uncalibrated measures because uncalibrated measures only show the position of one variable in relation to another while fuzzy set value shows position in relation to another variable and the degree of a variable in relation to itself (Fiss, 2011).

3.3.2: CALIBRATION OF ORIGINAL VARIABLES TO FUZZY SETS

The calibration process refers to a process of transforming conventional (raw) variables to fuzzy sets values. The process of transforming original variable measures to fuzzy set values is long process; however fsQCA software helps this process see appendix 8. Calibration enables identification of meaningful groups of cases in accordance with their configurations (Crilly, 2011). It is argued that the original variable needs to be transformed to fuzzy set values in order to allow the assignment of cases into meaningful and objective set memberships (Ragin, 2000; 2008; Ragin and Pennings, 2005; Verkuilen, 2005; Greckhamer et al, 2008; Fiss, 2011). Thus, in order to establish objective sets, it is necessary to calibrate the original variables in conformity with an "external standard" (Ragin, 2008, p. 16). There are three benchmarks (qualitative thresholds) for the calibration process: full membership (fuzzy set value 0.95), cross over point (fuzzy set value 0.50), and full nonmembership (fuzzy set value 0.05) (see table 1.2 in chapter 1), these benchmarks need to be objectively determined through theoretical and substantive understanding of the cases (Ragin, 2000; 2008). This means that the original variables are calibrated to fuzzy sets using external criteria depending on the researchers' "conceptualization, definition, and labelling of the set in question" (Ragin, 2008, p.85)[36]. Chapter 5 discusses the external criteria applied to calibration process in this research.

The calibration process requires the identification of values of original variable that matches the three qualitative thresholds, then the determined values are entered in fsQCA 2.0 software and calibrated using the direct method (Ragin, 2000; 2008; Fiss, 2011). According to Ragin, (2008) and Fiss, (2011), the direct method of calibration is used to rescale the interval or scale measures using the three qualitative benchmarks so that interval measures range between 0 and 1. The task of the researcher is to objectively and correctly identify and enter the three benchmarks into the software; the software will produce the fuzzy set values.

On the other hand, when an indirect method is used, fuzzy set values are normally provided in advance (Ragin, 2000; 2008), such that the researcher has to assess the cases and assign each case into the corresponding fuzzy set value. Whichever method is used, the decision to assign the degree of membership in a set "should be based entirely on researchers' substantive and theoretical knowledge" (2008, p. 86). However, as noted in Greckhamer et al., (2008), it is time consuming and almost impossible to gain a better theoretical and substantive understanding of cases when the sample size is large. In this context, and consistent with Greckhamer et al., (2008), this research contends that better understanding on the *sets* (attributes) involved in the analysis is important for determining the benchmarks.

In addition, this research is interested to understand how geographic and business diversifications are theoretically connected with other firm attributes for favourable

[36] See chapter 2 for the discussion of how I arrived on the conceptualisation of the relationship amongst corporate diversifications, financial performance and other corporate attributes.

or unfavourable financial performance. Therefore, a case is conceptualised using configurations of geographic and business diversification, leverage, internal fund, firm size, asset tangibility and intangibility. The combinations of these attributes create different configurations that lead to different levels of firm value, profitability and risk-return performance as discussed in chapter 2. In this context, configuration is a central unit of analysis rather than cases or standalone variables.

In order to enhance objectivity, this research uses the existing literature to determine the benchmarks. Specifically, this research use percentiles of data distributions to determine the benchmarks of interval scale measures as in Greckhamer et al., (2008) and Fiss, (2011), as will be discussed in chapter 5 of this thesis.

3.3.3: KEY FEATURES OF FUZZY SET ANALYSIS

This section describes the key features of FSA relevant to the research questions of this thesis. I start with identifying some differences between FSA and other approach by showing that application of fuzzy sets and fuzzy values are essential features of FSA.

3.3.3.1: FUZZY SETS AND FUZZY SET VALUES

In FSA the term fuzzy sets usually is used in place of the term variable and the fuzzy set values replace ratio/scale or ordinal measures of variables in quantitative and qualitative research (Crilly, 2011). Furthermore, FSA have different definitive assumptions about nature and measurements from those of quantitative and qualitative variables as indicated in Meuer, (2011).

Table 3.1 indicates that the nature and measurement of variables under fuzzy set analysis differs in many ways from statistical analysis and case study analysis (Ragin, 2000; Kart et al., 2005; Fizz, 2007; Greckhamer et al., 2008). The differences are outlined below.

Table 3.1: Variables in FSA, statistical and case study analysis contexts

Variables	Statistical Analysis	Fuzzy set analysis	Case Study Analysis
Nature	• Unifinality • Additive • Symmetry causality	• Equifinality (explicit) • Interdependences • Asymmetric causality	• Equifinality (implicit) • Contextual dependence
Measures and characteristics	• Ratio/interval or ordinal scale • No sets are used • Ranking relative to each other	• Ranges from 0 to 1 (fuzzy sets) • Explicit calibration • Ranking relative to each other and relative to set memberships	• Ordinal scale • Implicit calibration

Source: Meuer, (2011)

Firstly, while conventional statistical approaches use linear and additive assumptions of causality that leads to unifinality and symmetric causality, FSA assumes "variable" interdependency and complex causality that leads to equifinality and asymmetric causality (Ragin, 2006; 2008; Fiss, 2007; 2011). Ragin, (2006; 2008). noted that asymmetric causality occurs when causes that lead to an outcome of interest are quite different from those that lead to absence of outcome. Causes are classified as symmetrical when their presence leads to the presence of outcome and their absence leads to the absence of outcome.

According to Fiss; (2007; 2011), equifinality occurs when different configurations from different causal conditions lead to the same outcome. In addition, Fiss noted that there are first and second orders of equifinality/ equifinal types. He defined first-order or across-type equifinality as "equifinal types that exhibit different core characteristics" across configurations, and second-order equifinality was defined as "neutral permutations within first-order equifinal type" (2011, p.398). Finally, unifinality refers to a situation whereby different causal conditions can lead to different outcomes.

Secondly, most statistical research concentrates on quantitative measures of independent and dependent variables, while FSA requires the transformation of raw variable measures to fuzzy set values in order to allow for both inductive and deductive reasoning to apply at the same time (Ragin, 2000), and assign cases with set memberships across different sets. Therefore FSA uses sets in place of variables as used in traditional statistical approaches.

Thirdly, while statistical approaches examine the significance of the relationship and correlation between independent and dependent variables and among independent variables, FSA examines whether a causal condition/configuration is necessary or sufficient for an outcome to occur (Kart et al., 2005; Greckhamer et al., 2008; Fiss, 2011). Fuzzy set values enable researchers to evaluate a set-theoretic relationship through examination of necessity and sufficiency of a cause for an outcome to occur. This relationship is difficult to evaluate using conventional approaches such as linear regression models (Ragin and Pennings, 2005, p.425).

3.3.3.2: THE TRUTH TABLE, PRIME IMPLICANTS AND CUT-OFFS

The second feature of FSA is application of truth table analysis. Truth table is the primary source of outputs for analysis in FSA. A truth table is a table that lists all possible configurations of causal conditions that might be associated with an outcome of interest (Ragin, 2000; 2008; Fiss, 2007; 2011; Crilly, 2011; Skaaning, 2011). The number of possible configurations depends on the number of causal variables involved in the study. The number of configuration is usually calculated as 2^k where k stands for the number of causal variables. In this study, there are seven (7) causal variables, therefore the truth table will display 128 (2^7) possible configurations.

Since the theoretical number of configurations increases with the number of variables, it can be hard to provide meaningful analysis when the variables are many (Ragin, 2000). In this context, Ragin, (1987; 2000; 2008) and Fiss, (2007), argued that Quine-McCluskey algorithm (QMA) could be used to reduce and determine set-theoretic connections that theoretically agree to form simpler configurations for an outcome of interest. This algorithm (QMA) uses prime implicants to create simpler configurations that can be easily interpreted (Ragin, 1987; 2000). A fuzzy set condition (X) is said to imply another fuzzy condition (Y) if the membership of Y is a subset of the membership of X, and X or Y can lead to similar outcome Z. For example if a combination of conditions A and B (A*B) lead to outcome Y, and condition A by itself leads to outcome Y, then A implies A*B because in fuzzy set theoretic relationship, “A” would always be superset of A*B. The fsQCA software performs this task.

The following hypothetical example would better help to explain how fsQCA software uses QMA (prime implicants) to create simplified configurations. While the software undergoes complex process to create configurations, this simple hypothetical example would help to understand how it works. I consider, three causal conditions A, B, and C for an outcome Y, and the truth table below is produced.

TABLE 3.2: DETERMINING PRIME IMPLICANTS

This table is was created to illustrate how fsQCA software use QMA (prime implicants) to determine simpler solutions/configurations. Rows = possible configurations (2^3 = 8). A, B, and C stand for hypothetical causal conditions, Y is an outcome. Cases = number of cases in particular configuration, and Consistency is the consistency of a respective configurations in been subset of Y.

Rows	A	B	C	Outcome Y	Case	Consistency
1	1	1	1	1	5	85%
2	1	1	0	0	10	72%
3	1	0	1	1	4	90%
4	1	0	0	0	5	40%
5	0	1	1	1	2	92%
6	0	1	0	0	6	60%
7	0	0	1	1	3	98%
8	0	0	0	0	6	32%

Table 3.2 shows that there are four configurations with 85% or higher consistency which can be used as sufficient configurations for achieving Y. These configurations can be explained that a combination of presence of high memberships in conditions A and B and C (A*B*C), ***or*** a combination of high membership in condition A and C and not high memberships in B (A*b*C), ***or*** combination of not high membership in conditions A and high memberships in B and C (b*B*C) ***or*** a combination of not high memberships in conditions A and B and high memberships in C (a*b*C) can sufficiently lead to Y[37]. These configurations can be associated with complex solutions (that is solution with less theoretical assumptions). Therefore, they may need to include some theoretical assumptions to minimise the complexity for meaningful interpretations.

[37] The word ***or*** used to join configurations, and implies alternative configurations. In FSA, it is known as "fuzzy set logical or". This can also be represented by plus (+) sign as indicated in the equation presented in this section.

$$A*B*C + A*b*C + a*B*C + a*b*C \rightarrow Y$$

Where: capital later indicate presence of high membership and small later indicate absence of high members. * is fuzzy set logical and which is similar to intersection in classical set theory. + is fuzzy set logical or which is similar to union in classical set theory. → stand to consistently lead to.

Minimisation of complex solutions to simpler solutions requires two or more steps. The first step of minimisation will be as follows

1. A*B*C combines to A*b*C to produce A*C this is because both presence and absence of high memberships in condition B lead to Y, therefore B is irrelevant in this combination. This means A*C is a superset of and therefore implies A*B*C and A*b*C (this is an easy counterfactual analysis to be discussed in section 3.3.3.3)
2. In the same way, A*B*C combines with a*B*C to produce B*C (condition A is irrelevant), B*C implies A*B*C and a*B*C, and
3. A*b*C combines with a*b*C to produce b*C (condition A is irrelevant), b*C implies A*b*C and a*b*C.

Therefore, A*C, B*C, and b*C are all prime implicants (these solution can also be associated with intermediate solutions resulted from easy counterfactual analysis: see section 3.3.3.3). However, in the second step of minimisation, further implicants can be produced from the above implicants such that B*C combines with b*C to produce C. Finally, A*C is implied in C because in fuzzy set-theoretic principles A*C is a subset of C (Ragin, 2000; 2008) (this is an example of difficult counterfactual analysis that results to parsimonious solution to be discussed in section 3.3.3.3). In this context, the final most parsimonious solution from the truth table analysis would be: C → Y, that is C is necessary and sufficient condition for achieving Y. Prime implicants can also be determined using prime implicant chart as shown below.

TABLE 3.3: PRIME IMPLICANT CHART

This table maps the link between prime implicants and the complex solutions. Xs across the rows indicate the combined configurations to produce simplified solutions (prime implicants)

A*B*C	A*b*C	a*B*C	a*b*C	Prime implicants
X	X			A*C
X		X		B*C
	X		X	b*C

In addition to QMA, the number of possible configurations can be reduced through application of frequency and consistency cut-offs (Von Eye, 1990; Ragin, 2000; 2008). Frequency refers to the number of cases that share the same configurations while consistency refers to the percentage of cases sharing the same configurations that consistently display the outcome of interest. In other words, the configuration consistently appears subset of the outcome of interest. Higher frequency and consistency implies better results.

Von Eye, (1990), suggested that the frequency of a certain configuration can be considered important for analysis if it is significantly greater than one divided by a total of possible configurations times the total cases involved in the analysis. For example, in a study with seven causal conditions (i.e., 2^7 = 128 logically possible configurations) and 1280 total cases, the frequency thresholds would be higher than ten (10) cases (i.e., 1/128 x 1280). It is further suggested that at least 70% of total cases have to be involved in the analysis (Ragin, 2000).

This research used a total of 836 cases. Therefore, the frequency cut-off of seven cases (836x1/128 = 6.5) is used, this frequency (seven cases) involves 76% (635 cases) or higher of all cases which is higher than the recommend level (70%). Although the frequency cut-off was decided basing on Von Eye, (1990) recommendation, this number of cases was also thought to be reasonable for testing significance of the sufficient configurations. However, decision on consistency cut-off is important to understand if a configuration with seven cases can be tested for significance.

In principle decisions on consistence cut-offs are flexible, and it is advised that researcher may try two consistency cut-offs before choosing the consistency cut-off: relatively permissive consistency cut-off of around 80% and relatively restrictive cut-off of around 90% (Ragin, 2008, p.144). Furthermore, Ragin, (2000) recommends an acceptable consistency cut-off to be 75%. However the consistency cut-off according to fsQCA 2.0 software is 80%. In practice, researchers usually use a consistency cut-off of around 80% or higher for example in Fiss, (2011) and Garcia-Castro, et al., (2013).

The current research is interested to test result configurations for significance, therefore basing on the frequency cut-off of seven cases established above, and on the significance test formula presented in section 1.5 and in section 4.3.3 of this thesis, it was decided that a consistency cut-off around 85% will enable at least to test for significance of a ***more often than not*** sufficient configuration with seven cases. However, lower consistency (around 80%) will be used when configurations appear to have consistency lower than 85% but this will mean that configurations with seven cases would automatically become not significant.

3.3.3.3: TRUTH TABLE SOLUTIONS AND COUNTERFACTUAL ANALYSES

The third feature of FSA is multiple solutions of a truth table and counterfactual analysis. The truth table usually provides three types of solutions: complex, parsimonious, and intermediate solutions. And, within these solutions there can be many different configurations leading to similar results. A complex solution is detail, and does not use any counterfactual analysis, and it is not based on theory but on logical possible combinations of the causes, in this context this solution is less useful to research (Fiss, 2007). Ragin (2008, p.150), argued that "a causal combination that lacks empirical incidences and therefore must be imagined is a counterfactual case; evaluating its plausible outcome is counterfactual analysis. This type of analysis is important to current research, therefore this concept is explained later in this section. A parsimonious solution permits the use of easy and difficult counterfactuals (see next paragraph)[38]. The role of parsimonious solution is to identify core conditions in an intermediate solution (Fiss, 2011). The intermediate solution is the solution

[38] See also Ragin, (2008, chapter 9) for details on easy and difficult counterfactual analysis.

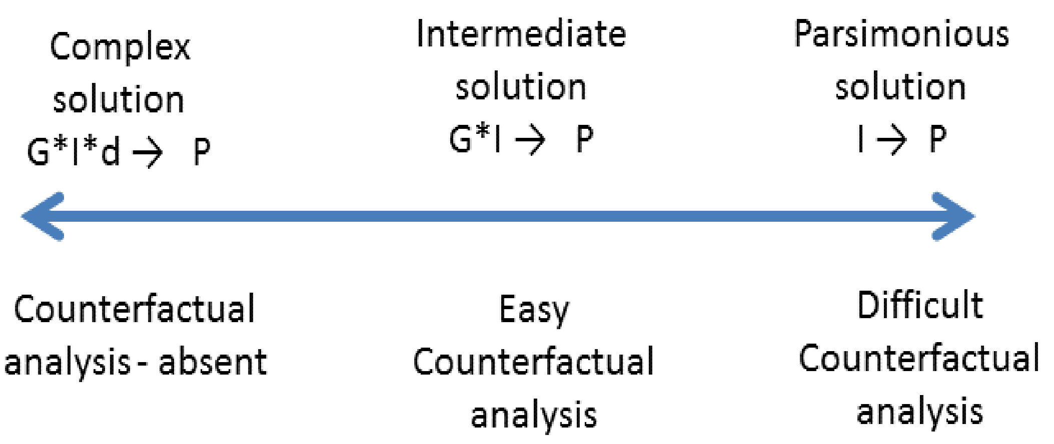
obtained from easy counterfactual analysis. It provides theoretical links among elements of a configuration and between configurations and the outcome. This is the most useful solution (Fiss, 2007), and it is used for result presentation and analysis. Now I will discuss the concepts of counterfactual analysis (easy and difficult), complex solution, parsimonious solution, and intermediate solution by using hypothetical but more relevant example to my research.

Imagine that basing on ITS and TCT a research found that a combination of high geographic diversification (***G***) and high level of intangible assets (***I***) and absence of high level of debt capital (***d***) is sufficient for high profitability (***P***) (that is ***G*I*d* → *P***). Assume that there is no incidence that shows presence of high level of debt ***(D***) leads high profitability that is (***G*I*D* → *P).*** However, from agency theory perspectives a research believes that high geographic diversification brings high agency problems therefore presence of high level of debt would reduce unnecessary geographic diversification that reduces firm's profitability therefore he (a researcher) imagines that a combination of ***G*I*D*** also will lead to favourable profitability, therefore he added ***D*** in place of ***d*** (***G*I*D* → *P***), and he confirmed that this combination also lead to high profitability. The evaluation of plausibility of addition D in this combination is ***easy counterfactual analysis.*** Basing on the two solutions (***G*I*d* → *P*** and ***G*I*D* → *P***) and the concept of prime implicants discussed above a research can conclude that because ***G*I*d or G*I*D*** configurations can lead to high profit, then level of debt is considered irrelevant (see section 3.3.3.2 above), therefore a combination of high geographic and high level of intangible asset leads to high profit and level of leverage has ambivalent impact on this combination (***G*I* → *P)***, this solution is called ***intermediate solution*** while the first two (***G*I*d* → *P*** and ***G*I*D* → *P***) can best be described as ***complex solutions***. To summarise, easy counterfactual analysis occurs when a researcher evaluates the plausibility of adding a redundant condition, and the implied result from this analysis is intermediate solution.

Difficult counterfactual analysis is the opposite of easy counterfactual analysis. In the example above the research would have a configuration ***G*I*D* → *P*** and then imagines if absence of ***D*** would lead to similar results. To make the example above interesting, the research imagines that what is important in the combination (***G*I* → *P)***, is presence of high level of intangible assets and not geographic diversification because of possible agency problems. Thus, he made a ***difficult*** with less theoretically informed decision to remove ***G*** and test for a combination of absence of high geographic diversification and high intangible asset, and he found similar result (***g*I* → *P)***. However, this solution is theoretically more difficult to explain. This analysis is difficulty counterfactual analysis, and basing on prime implicants discussions in section 3.3.3.2, the resulting solution is more parsimonious solution which shows that it is the level high level of intangible asset which is ***important*** for high profitability (***I → P).*** To summarise, difficult counterfactual analysis evaluates the plausibility of eliminating a condition from a plausible solution, and when the two counterfactual analyses are combined the implied result from the combined analysis is parsimonious solution. There are less theoretical supports to parsimonious solutions, but the solutions helps to identify most important (core) conditions. Figure 3.1 summarises the this discussion.

FIGURE 3.1: DEFINING COUNTERFACTUAL ANALYSIS AND TRUTH TABLE SOLUTIONS

This figure shows truth table solutions and their associated counterfactual analysis as discussed above.



Basing on the example discussed above, it can be argued that intermediate solutions appear important for presentation because they are associated with theoretical arguments. However, it is also important to include parsimonious solution to identify important (core) conditions in the intermediate solutions. Complex solutions are less relevant because of their complexity associated with including irrelevant conditions which adds less needed explanations. In these context, it was decided (Ragin, 2000; 2008; Fiss, 2007; 2011) and I decided to used intermediated solutions to presented my configuration results in which parsimonious solutions are used to identify core conditions in the configurations. It is further noted that parsimonious and intermediate solutions are important to deal with limited diversity problems (Fiss, 2007; 2011)[39].

Limited diversity occurs when the observed logically possible combinations of causal conditions do not empirically exist (Ragin, 1987; 2000; Fiss, 2007; 2011). Similar to Thomson and Bebbington, (2004, p. 614) limited diversity can also be referred to as "limited situations" which means "those things that oppress different" users of financial information in obtaining information to use as sufficient indicators of favourable financial performance.

According to Fiss, (2011), limited diversity problems can be reduced through "counterfactual analysis" (p. 403). Counterfactual analysis refers to the idea that causal conditions in a configuration leading to an outcome, can be manipulated by adding or removing a causal condition that is considered redundant and see if this impacts on the outcome. Addition and reduction of causal conditions are usually performed by the fsQCA software; however this can also be done manually depending on the theoretical arguments that are used to build the configurations in question.

The additions and reductions of causal conditions lead to different types of counterfactuals: easy and difficult counterfactuals. Easy counterfactual refers to the situation where a redundant causal condition is added to the causal conditions which have already expressed the result. This process examines whether the addition of a redundant cause has an impact on the outcome. On the other hand, difficult counterfactual refers to situations whereby a condition is removed from the configuration that has already demonstrated an outcome. This could explain whether removing a redundant condition from a configuration can lead to a different result.

[39] More discussion on truth table solution is found in (Ragin 2000; 2008; Fiss, 2011)

These two counterfactuals lead to two kinds of solutions: parsimonious and intermediate. The parsimonious solution is a solution which considers all the simplified assumptions regardless of the effects of either easy or difficult counterfactuals. In other words it assumes that easy and difficult counterfactuals are all considered in the solution (Ragin, 2000). Thus, parsimonious solutions provide configurations that have the lowest number of causal conditions which according to Fiss, (2011), are referred to as ***core*** conditions. Fiss defined conditions "which are eliminated from parsimonious solutions, and thus only appears in the intermediate solution" as ***supporting*** conditions (p. 403)**.**

Furthermore, limited diversity problems can be solved through the application of research methods that take into account the complexity of interacting forces. For example Thomson and Bebbington, (2004), noted that the best method of addressing a limited situation in teaching accounting is to design a holistic programme that takes into account "the complexity of interacting forces which exist at a point in time" (p. 614). In addition, it has been noted that accounting "should be viewed as a heuristic learning device" (Georgakopoulos and Thomson, 2005, p. 73). These imply that configuration approaches in an accounting context would reduce limited diversity problems.

3.3.3.4: Core and Supporting Conditions

The fourth feature of FSA is the identification of core and supporting conditions (Fiss, 2011). According to Fiss, core conditions are essential for an outcome to occur while supporting conditions are those that are less essential and "perhaps even expendable or exchangeable" in the configuration leading to an outcome of interest (p.394). Core and supporting conditions are usually differentiated using size of dots: large dots represent core conditions, and small dots represent supporting conditions[40]. Identification of core and supporting indicators can be done through hybrid theoretical and empirical analysis as discussed in chapter 2 (see also Russell and Thomson, 2009).

[40] See for example table 6.5 in chapter 6 of this thesis

3.3.3.5: Consistency and Coverage

The fifth feature of FSA is concerned with measuring the relevance and importance of FSA results. FSA uses ***consistency*** and ***coverage*** in place of significance tests and R-Square of conventional statistical models respectively (Ragin, 2006; Fiss, 2011). Ragin, (2006, p.291) noted that consistency is used to assess "the degree to which a subset relationship has been approximated" and coverage is used to assess "the empirical relevance of a consistency subset".

Consistency

The concepts of ***consistency*** and ***coverage*** are based on the idea that a specific configuration constitutes one of several possible configurations to an outcome. When this is true, cases displaying a particular configuration "constitute a subset of cases displaying the outcome" Ragin, (2006, p.292). Based on this idea, a fuzzy set-theoretic consistency is usually determined when causal conditions consistently appears to be a subset of the outcome, this means fuzzy set-theoretic consistency exists when the membership scores of causal conditions are consistently less or equal to their membership scores in the outcome.

Consistency is therefore, calculated using the following formula which is applied in the fuzzy set-truth table algorithm of fsQCA vision 2.0 software developed by Ragin et al., (2003).

$$\boldsymbol{Consistency}\ (\boldsymbol{Xi} \leq \boldsymbol{Yi}) = \frac{\sum(\mathbf{min}(\boldsymbol{Xi},\ \boldsymbol{Yi})}{\sum(\boldsymbol{Xi})}$$

Where: ***Xi*** represents membership scores in a combination of causal conditions, ***Yi*** represents membership scores in an outcome of interest, and ***min(Xi, Yi)*** indicates the choice of the lower of ***Xi*** and ***Yi***. When the values of **Xi** are all less than or equal to their corresponding values of **Yi**, the consistency will be 1.00. When few scores of ***Xi*** are higher than those of ***Yi***, then the consistency would be slightly less than 1.00. When there are many scores of ***Xi*** which are greater than their corresponding ***Yi*** values, then the consistency drops below 0.5.

For illustration purposes, Consider the following data randomly extracted from the sample used in this research for the 3-4year averages data (group 2010 – (2007-2010)). Based on internalisation theory of synergy discussed in Morck and Yeung, (1991; 1992; 1997), it is argued that a combination of geographic diversification (DG) and information based assets (intangibles) (INTA) usually leads to favourable firm value (MTB). In the context of set-theoretic framework this implies that cases with this combination form one of the many configurations to favourable firm value. This means cases with this combination ***(DG.INTA)*** are ***consistently*** a subset in the set of firms with favourable MTB.

To show this in practise, table 3.4 presents an illustration of how to calculate the consistency of a configuration to an outcome of interest. This table shows that causal condition DG.INTA ***(Xi)*** is created using fuzzy set logical operation "***and***" which advocates for the selection of DG or INTA whichever is the lower. Also it shows the last column (*Min(DG.INTA,MTB*)) records a value which is the minimum of ***Xi***, and ***Yi*** *(Min(Xi,Yi)*). This explains the consistency of ***Xi*** being a subset of ***Yi.*** The summation of *Min(Xi,Yi)* and ***Xi*** are then used to calculate the consistency level using the formula indicated above.

$$\textbf{\textit{Consistency}}\ (X_i \leq Y_i) = 15.55/15.98 = 0.97$$

The calculation shows that the consistency of combining high geographic diversification and intangible asset to bring about favourable firm value is 97%. That is 97% of cases with ***DG.INTA*** combinations consistently display favourable firm value.

Coverage

Given that an outcome of interest may be achieved through several alternative configurations (Ragin, 2006), then logically, every configuration covers a certain proportion in the outcome. This proportion is usually referred to as ***set-theoretic coverage***. Coverage is like R^2 in regression models as it measures the empirical importance of a configuration in the outcome. High coverage implies that the configuration is important and low coverage means that the configuration is less important for an outcome to occur (Fiss, 2011). Coverage is therefore defined as the degree to which a "cause or causal combination accounts for instances of an outcome" (Ragin , 2008, p.45).

Table 3.4: Illustration how consistency is calculated

This table illustrates a simple fuzzy subset relationship in order to explain how consistency is calculated. ***DG*** = membership of cases in geographic diversification sets**,** ***INTA*** = membership of cases in intangible asset sets, ***DG.INTA*** = combined membership of cases in both geographic diversification and business diversifications that is the minimum membership of the two. ***MTB*** = memberships in firm value set is considered as outcome (Yi). And, ***min(DG.INTA, MTB)*** which is translated as ***min(Xi, Yi)*** is the minimum of ***Xi*** and ***Yi***)

Company	*DG*	*INTA*	*DG.INTA (Xi)*	*MTB (Yi)*	*Min(DG.INTA,MTB) Min(Xi,Yi)*
GLAXOSMITHKLINE	0.95	0.71	0.71	1	0.71
HAYS PLC	0.99	0.82	0.82	1	0.82
HALMA PLC	1	0.99	0.99	1	0.99
TULLOW OIL PLC	0.65	0.99	0.65	1	0.65
SHIRE PLC	0.75	1	0.75	1	0.75
DIAGEO PLC	1	0.92	0.92	0.99	0.92
INMARSAT PLC	0.99	0.93	0.93	0.99	0.93
BRITISH AMERICAN TOB	1	0.99	0.99	0.99	0.99
UNILEVER PLC	0.98	0.99	0.98	0.99	0.98
DECHRA PHARMA	0.37	0.93	0.37	0.98	0.37
CPPGROUP PLC	0.88	0.65	0.65	0.97	0.65
BTG PLC	0.82	0.91	0.82	0.96	0.82
DOMINO PRINTING	0.92	0.92	0.92	0.96	0.92
ASTRAZENECA PLC	0.98	0.98	0.98	0.92	0.92
INVENSYS PLC	1	0.45	0.45	0.91	0.45
IMI PLC	1	0.8	0.8	0.9	0.8
AMEC PLC	0.99	0.54	0.54	0.89	0.54
HORNBY PLC	0.89	0.84	0.84	0.87	0.84
PZ CUSSONS PLC	0.95	0.41	0.41	0.83	0.41
JOHN WOOD GROUP PLC	0.97	0.65	0.65	0.82	0.65
WINCANTON PLC	0.65	0.46	0.46	0.37	0.37
ASHTEAD GROUP PLC	0.35	0.51	0.35	0.07	0.07
Summation	***19.08***	***17.39***	***15.98***	***19.41***	***15.55***

Since there are many configurations to the same outcome, it is possible that the coverage of the configurations in the outcome set overlaps (see figure 3.2). This implies that there is coverage that is unique to a configuration (*unique coverage*) and overlapped coverage that is coverage shared by other configurations (*raw coverage*). And, the coverage of all configurations together is usually referred to as *solution coverage*. Generally, here is the formula usually used to calculate coverage

$$\boldsymbol{Coverage}\ (\boldsymbol{Xi} \leq \boldsymbol{Yi}) = \frac{\sum(\mathbf{min}(\boldsymbol{Xi},\ \boldsymbol{Yi})}{\sum(\boldsymbol{Yi})}$$

Where: ***Xi*** represents membership scores in a combination of causal conditions, ***Yi*** represents membership scores in an outcome of interest ***(MTB***), and ***min(Xi, Yi)*** indicates the choice of the lower of ***Xi*** and ***Yi***. Note that the difference between coverage and consistency formula is denominator. $\sum \boldsymbol{Xi}$ is used in consistency formula; $\sum \boldsymbol{Yi}$ is used in coverage formula.

Based on this formula and information presented in table 3.4, the coverage of configuration DG.INTA on MTB is 80% that is 15.55/19.41. Further illustration on coverage is in table 3.5.

Table 3.5 illustrates how to compute ***Raw***, ***Unique, and solution coverage***. The first row indicates that the raw coverage of the configuration defined by a combination of geographic and intangible assets (configuration DG.INTA) is 0.32 (320/1000) on the first row and a configuration defined by a combination of level of intangible assets and retained earnings (internal funds) (INTA.RETA) is 0.18 (180/1000) on the second row of table 3.5. Logically this would translate that the coverage of the two configurations (DG.INTA + INTA.RETA) would be 0.50 (0.32 + 0.18) on the third row of table 3.5. However, the last column of the table shows that the ***solution coverage*** of DG.INTA + INTA.RETA is 0.38 which is lower than the expected total coverage of 0.50. This implies that there is overlap coverage of 0.12 (0.50-0.38) between the two configurations.

Table 3.5: Illustration of how coverage is calculated

This table shows how coverage is calculated. The first row represents configuration 1 and the second row represents configuration 2 and the last row represents the combination of configuration 1 and 2. DG.INTA represents a configuration of the presence of high memberships in geographic ***and*** intangible asset sets, INTA.RETA = configuration of high membership in intangible assets ***and*** retained earnings (internal fund) sets, and DG.INTA + INTA.RETA = configuration of high membership in DG.INTA ***or*** INTA.RETA. "+" represents a fuzzy set logical operation "***or***" which operate in a similar way to "union" in classical set theory. And "." is a fuzzy set logical operation which operates like classical set logical operation "intersection"

Causal Condition	Sum of consistent scores ***(min(Xi, Yi))***	Sum of outcome scores ***(Yi)***	Coverage
DG.INTA	320	1000	0.32
INTA.RETA	180	1000	0.18
DG.INTA + INTA.RETA	380	1000	0.38

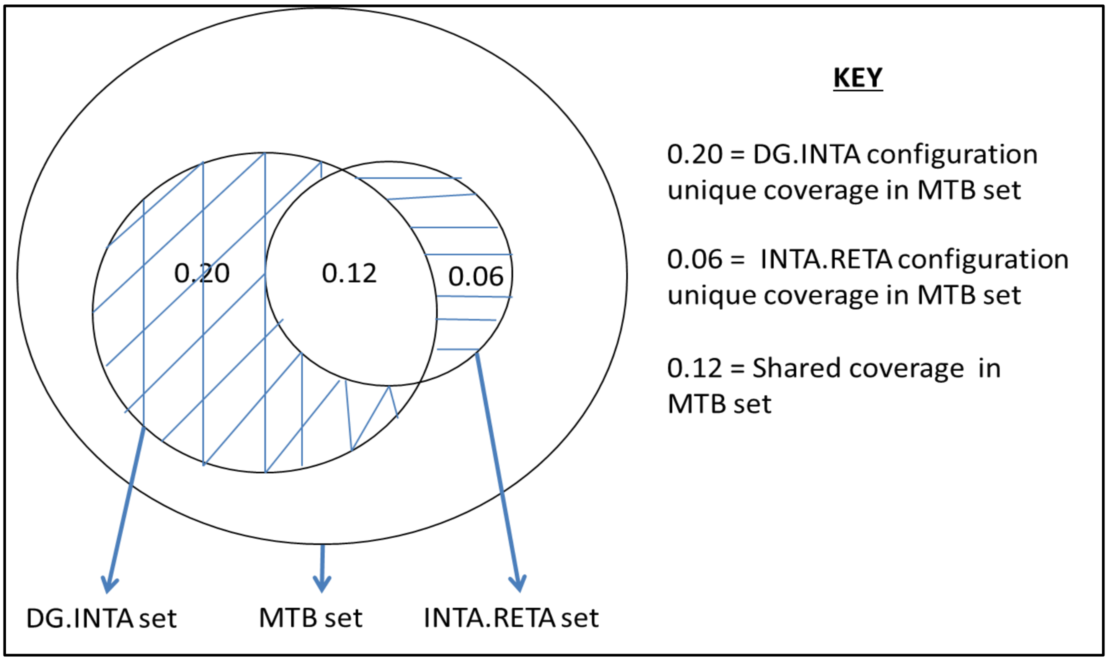
Source Ragin, (2006, p.305)

Therefore, the unique coverage of configuration DG.INTA is 0.20 (0.32-0.12) and that of configuration INTA.RETA is 0.06 (0.18-0.12). The raw coverage of configuration DG.INTA and INTA.RETA are unique coverage plus the shared (overlapped) coverage, 0.32 and 0.18 respectively (see figure 3.2).

Coverage can be illustrated using Venn diagrams as indicated in figure 3.2. Figure 3.2 shows a Venn diagram which indicates that cases with high memberships in DG.INTA and INTA.RETA sets are subsets of cases that have high memberships in MTB sets. DG.INTA cases uniquely cover 20% of cases with high MTB cases, while in INTA.RETA unshared coverage is 6%, and the total (solution) coverage of the two is 38% (i.e., 20%+12%+6%) as indicated in table 3.5 above.

Consistency and coverage are usually presented in the truth table where every configuration indicates coverage and consistency which are important for "understanding reliability and importance" of different configurations for an outcome of interest (Ragin, 2006, p.292; Fiss, 2011, p.403). Furthermore, consistency and coverage are used to assess whether the configurations are necessary or sufficient for an outcome to occur. The concepts of necessary and sufficient are described in the following section.

Figure 3.2: Illustration of coverage in Venn diagram.



3.3.3.6: Necessary and sufficient conditions

The sixth feature of FSA is the examination of ***necessary*** and ***sufficient*** conditions. According to Ragin, (2000, p. 203; 2008, p. 42), a causal condition or a configuration is considered necessary if it must be present for an outcome to occur, whilst a cause is defined as sufficient if, by itself, it can produce an outcome. A condition is considered both necessary and sufficient if it is the only cause that produces the outcome in its singular form and not in combination with other causes. A causal condition is considered neither necessary nor sufficient if it only appears in a subset of the configurations that produce a certain outcome. A condition is considered necessary but not sufficient if it appears in all possible combinations capable of producing an outcome. Finally a causal condition is sufficient but not necessary if it is capable of producing the outcome but is not the only cause with this capacity.

According to Ragin, the distinctions of these definitions are meaningful only when they have theoretical support. Therefore, the existence of necessity and sufficiency depend on the theories that propose the cause-effect relationship. In this context an examination of necessary and sufficient configurations for an outcome, must be accompanied by theory or theories.

The assessment of necessity and sufficient is normally considered jointly because they are equally important (Ragin, 2000). In order to determine if a condition is necessary or sufficient, the application of a *subset-superset* relationship is used. The following sections provide hypothetical examples of how subset-superset relationships can be used to define necessary and sufficient conditions based on fuzzy set theory.

Necessary Condition

To make sense of definition of necessary condition, I consider the following hypothetical example[41] of a set of pregnant people as an outcome, and a set of females as a causal condition see figure 3.3.

[41] Basically this example is based on Boolean crisp sets which are useful in truth table analysis. Currently the fuzzy set truth table takes the form of crisp sets. Therefore, the example is suitable to fuzzy sets as well. Furthermore, these examples have been used to enable easy understanding of the concepts.

Figure 3.3: Definition of "always necessary" condition

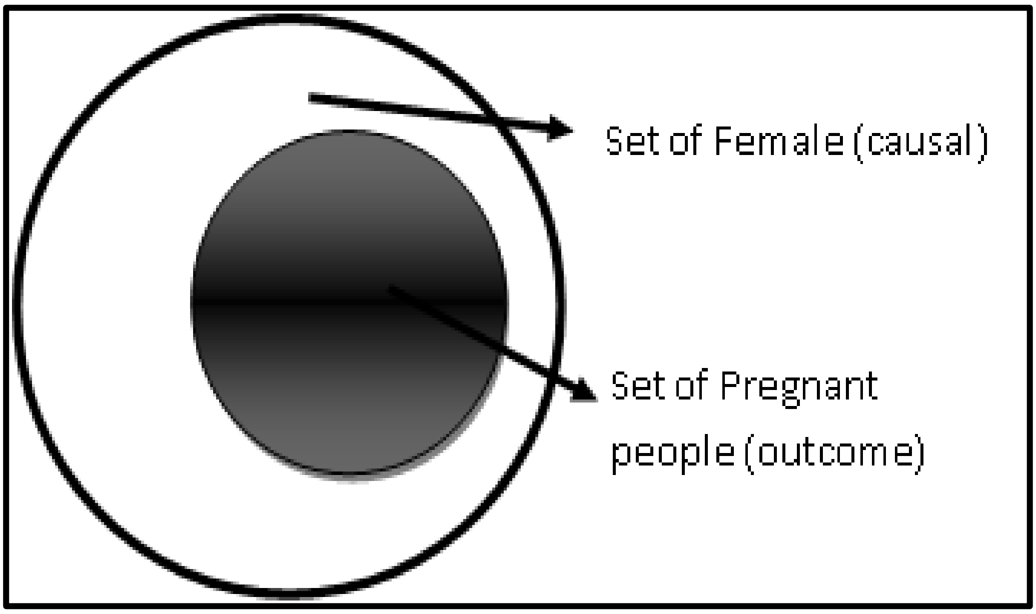


Figure 3.3 indicates that all members in the set of pregnant people (black coloured set) are found in the set of females. This figure shows that there are no males in the pregnancy set, and that all pregnant people are female but, not all female are pregnant. Furthermore, figure 3.3 shows that some females are closer to the black colour (pregnancy) while others are farther away, indicating that in addition to being a female there are other extra conditions which make females appear closer or further away to the set of pregnancy. In this context, although females are not different in kind they do differ in degrees of characteristics that lead to pregnancy.

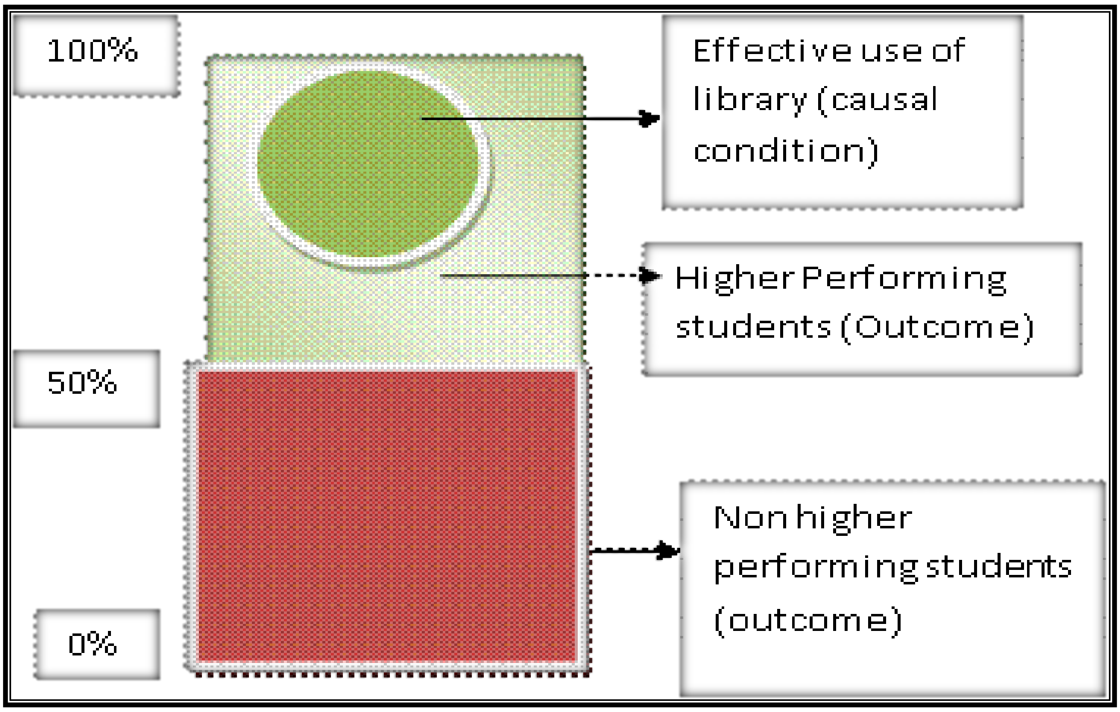
Figure 3.3 implies that being female is a necessary condition for pregnancy, because for any pregnancy to occur there must be a condition of being female, as such outcome (pregnancy) is a subset of a causal condition (female). However, being female is not a sufficient condition for pregnancy because there are a number of females who do not become pregnant. This indicates that there are other ***supporting conditions*** that combine with the ***core condition*** (female) to sufficiently enable pregnancy to occur. These supporting conditions may include: age (maturity), marital status, fertility, and interest in being pregnant. It may not be surprising that these factors are interdependent and they only function as a configuration for producing pregnancy (i.e., conjunctural causality), and that different configurations of these factors lead to pregnancy (the same result) (i.e., equifinality).

Sufficient condition

As explained above sufficient condition is that condition which by itself leads to an outcome to occur. Consider an example of students who have effectively made use of the library as a causal condition for passing examinations and that all students who effectively used the library had a higher performance in their exams and therefore all passed the exams (assuming a pass mark of 50%) as presented in figure 3.4.

Figure 3.4 indicates that when students effectively use the library they *must* pass the exams, however even students who did not effectively use the library also passed the exams. Some passed with higher marks than those who effectively used the library as indicated in figure 3.4. This implies that effective use of library is a *sufficient* condition to pass the exams but it is not a necessary condition because, some of the students who are not library goers passed the examination as well.

Figure 3.4: Definition of "always sufficient" condition



It appears that there are many factors that may enable a student to pass the examinations, for example: cheating during the exams, high level of intelligence quotient (IQ), readiness to do the exams, better lecturers, and class/lecture attendances. Therefore, it is not surprising to see that, attending the library and ignoring the other factors may not lead to better performances. Perhaps those students who effectively used the library also attended classes, had good and competent lecturers, or cheated to pass the examinations. Thus, a combination of these factors is important for examining sufficient conditions for better performance, and some conditions are more important (Core) while others are supporting conditions.

Based on the subset-superset relationships presented in the hypothetical examples above, the conclusion is drawn that a condition is necessary for an outcome to occur if an outcome is a subset of the causal condition. But when the causal condition appears to be a subset of the outcome then a cause is sufficient for an outcome to occur (Ragin, 2000). Therefore, according to Ragin, when fuzzy set scores of an outcome are consistently less than or equal to those of the causes, researchers can use this as evidence of necessity. While when fuzzy set scores of the causes are consistently less than or equal to those of an outcome, then researchers can use this as evidence of sufficiency. These FSA features appear suitable to this research in many ways as summarised in the section that follow

3.4: THE FSA FEATURES AND THIS RESEARCH.

The partial, fragmented, and conflicting results about how geographic and business diversification strategies and other firm attributes (leverage, internal funds, firm size, and asset intangibility and tangibility) influences financial performance presented in previous research analysed in chapter 2 indicated that every individual attributes can contribute to favourable firm value, profitability, and risk-return performance. However, none of these attributes is necessary or sufficient to explain its impact on these measures of financial performance.

As discussed in section 1.4 that firms are like living organisms that they accomplish their goals of enhancing firm value, profitability and risk-return performance through collectiveness, interdependencies, and interconnectedness of their attributes such as level of leverage, internal funds, firm size, asset intangibility and tangibility, and diversification strategies. These attributes when viewed in isolation of one another they usually provide conflicting indicators of financial performance because none of them appears a necessary or a sufficient indicator unless they are viewed in combinations.

The features of FSA discussed in section 3.3.3 has shown that the necessity and sufficiency of geographic and business diversification strategies for favourable firm value, profitability, and risk-return performance can be understood by considering other attributes as a configurations as clearly discussed in chapter 2 (see section 2.4 and 2.5 of this thesis). Since linear relationships and correlational studies seem "incapable of addressing set-theoretic relationships" (Ragin, 2000, p.313), and consequently, they cannot examine necessity and sufficiency of causal conditions for an outcome of interest (Fiss, 2011), then, FSA appears important to this research.

Generally, section 2.4 and 2.5 of chapter 2 has shown that business and geographic diversification complement one another in impacting on financial performance (Hitt et al., 1997; Davies et al., 2001; Singh et al., 2003; Matraves and Rodriguez, 2005 Malone and Rose, 2006). In addition, it shows that the impact of diversifications on financial performance depends on other firm characteristics like level of leverage (Li and Li, 1996), internally generated funds (Myers, 1977; Myers and Majluf, 1984; Jones and Danbolt., 2005); asset structure, and firm size, (Morck and Yeung, 1997). Furthermore, financing choice was found to depend on asset structures, firm size, and business and geographic diversification (Singh et al., 2003). This implies that there is a high level of interaction between geographic and business diversification, leverage, internal funds, firm size, and asset intangibility and tangibility to enhance financial performance which can be dealt with through FSA.

Therefore, it appears that the features of FSA presented in section 3.3.3 fits into the theoretical framework developed in section 1.5 of this thesis, and therefore FSA is suitable for this research.

3.5: Application of FSA in firm performance and related research

The application of fuzzy set analysis to deal with complex causality has been positively accepted by researchers in different fields of social science such as political science (Schneider and Wageman, 2003), international business (Pajunen, 2008; Crilly, 2011; Vis et al., 2013), strategic management (Greckhamer et al., 2008; Fiss, 2011), accounting and finance related problems (Kwak et al., 2003; Kwak et al., 2010, Wang and Lee, 2010), Corporate governance (Garcia-Castrol et al., 2013), expert systems (Bozbura et al., 2007), sustainability (Merad et al., 2013; Shaw et al., 2013), business research (Leischning et al., 2013), and in operational research. Basiaclly, these studies address issues related to financial/economic performance (Greckhamer et al., 2008; Pajunen, 2008; Crilly, 2011; Fiss, 2011; Garcia-Castrol, Aguilera, and Arino., 2013, Vis et al., 2013) and in multi-criteria decisions making (Kahraman et al., 2010; Greco et al., 2013; Luhandjula and Rangoaga, 2013; Merad et al., 2013; Serrano-Cinca and Gutiérrez-Nieto, 2013; Wang, et al., 2013) as summarised in table 3.6.

TABLE 3.6: RECENT APPLICATION OF FSA AND RELATED APPROACHES ACROSS STUDIES

This table outlines recent studies that applies FSA or close related approach in different research areas. The table indicate authors, area or topic or issue investigated, type of FSA approach or related approach, results and implication and conclusions are given. The purpose of this table is to enable future researchers to identify potentials of FSA in different area and issues.

Authors and area of study/topic	Type of FSA or related approach and issue examined	Results/implication/conclusion
Fiss, (2011), Strategic Management (Corporate structure, strategy, environment, and financial performance – typologies in organisations).	***FSA – Configuration approach*** was used to examine how firm's structure (size, formalisation, centralisation, and complexity), strategy (differentiation and low cost), and environment (rate of exchange and uncertainty) are connected for different levels of financial performance (return on sales – ROA) in UK based high-tech manufacturing firms	There are six and three configurations to high and very high profitability respectively, and some conditions in the configurations were core others peripheral (secondary). The results indicated presence of equifinality and asymmetric causality. Implication: researchers need to use FSA – configuration approach to complement linear models
Greckhamer et al., (2008), strategic management. (Determinants of firm performance).	Crisp set qualitative comparative analysis (csQCA) – Configuration approach was used to examine the relative importance of industry, corporate, and business-unit attributes for business-unit performance in US based firms across 1995-1998	Results: There different configurations for business-unit financial performance. However, abundance of corporate resources and corporate diversification are key attributes for superior business-unit performance. Implication: QCA is a tool for complementing linear relationship studies with necessity and sufficiency. They recommended FSA for future research
Garcia-Castrol, Aguilera, and Arino., (2013) Corporate governance (financial performance)	***FSA - Configuration approach in Corporate governance*** used to explore bundles of firm-level corporate governance practices (Board dependence, board information disclosure, remuneration disclosure, compensation, and employee royalty) for high financial performance (ROE).	There are multiple bundles of firm-level governance practices leading to high ROE (Equifinality). There is complementarities (interdependencies) among firm-level complementarities that indicate presence of conjuncture (complex) causality and asymmetric causality. This implies that: the idea of “one size fit all” does not always exist in corporate governance.
Pajunen, K (2008), International business (FDI attraction across countries) .	FSA – configuration approach was used to examine how and why countries (47) with different degrees of membership in different institutional factors either attract or do not attract FDI during 1999 to 2003,	Results: Institutional factors have different impact; countries' ability to attract or not attract FDI depends on presence or absence of certain factors; generally, there are several pathways for attracting FDI. Implication: policy makers can use the configurations to creative attractive environment for FDI; researchers need to think configuration to reduce inconsistent conclusions.
Vis, Wolderndorp , and Ken	FSA Configuration approach used to account for variation in	Results: FSA identified different combination of institutions

Authors and area of study/topic	Type of FSA or related approach and issue examined	Results/implication/conclusion
(2013) Qual Quant. 47 (economic performance)	economic performance across 19 OECD countries between 1975 and 2005.	(CBI, Corporatism, partisanship, and openness) appears to be conducive for economic performance across countries and periods. Implication:
Crilly, D (2011) International Business (Stakeholder orientation in multinational enterprise)	FSA – configuration approach and mid-range theory was used to understand the conditions that lead managers of subsidiaries to maximise shareholders' value or, maximise broad range of stakeholders' value in multinational firms.	Results: there are six configurations that predict a broad stakeholder orientation, and attributes of the local environment interact with subsidiary strategy and corporate-level forces to shape stakeholder orientation. The results have implications on Multinational enterprise literature that attention on subsidiary level is important because subsidiaries of the same firm are different.
Kwak et al., (2010), Multi-criteria decisions in accounting and finance (transfer prising, human resource allocation, accounting information system, and capital budgeting)	FSA - multiple criteria linear programming (MCLP) was used to provide a compromising solution on multiple objectives and multiple constraints decision problems in areas of international transfer pricing, human resource allocation, accounting information system selection, and capital budgeting problems.	Fuzzy set solutions reduced the problems of multiple objectives and solutions in accounting and finance. Implication: the results from fuzzy solution would help managers/CEOs to more realistic decision on various resource allocation constraints and overall strategic decisions.
Leischning, Geigenmueller, and Lohmann, 2013 Business research (technological transfer)	***FSA Configuration model in organisation studies.*** FSA was used to identify the role of alliance management capacity, organisational compatibility, and interaction quality in inter-organisational technological transfer. FSA was because the previous literature and theories have shown that these variables are highly interactive such that net-effect model may not sufficiently explain the role of the mentioned variables.	There are multiple ways in which alliances of management capabilities, organisational compatibility, and inter-organisational interactions quality lead to efficient technology transfer. Configuration thinking which enables to sufficiently understand the question at hand.
Kahraman et al., (2010), Multi-criteria decision making (Outsourcing)	**FSA – Analytical hierarchy process (AHP**) approach was used to assess enterprise resource planning (ERP) outsourcing alternative criteria (market leadership, functionality, quality, price, implementation speed, interface with other systems, and international orientation) for selecting outsourcers.	They were able to identify criteria associated to the best outsources. Implication: Decision makers can use fuzzy number to evaluate linguistic expressions related to ERP outsourcing alternatives for selecting the best outsourcer
Wang et al., (2013) Multi-criteria decision (outsourcing decisions)	FSA - multiple-goal programming model help selection of the cost-effective outsourcer s in restricted environments where there are interaction among multiple goals and cost-effective options such as total cost, holding cost, and rework.	Results: they found that fuzzy multiple-goal programming has potential for optimising outsourcing alternatives. However, the feasibility of the method requires further investigation because of obstacles related to multiple goal interactions. (I suggest FSA

Authors and area of study/topic	Type of FSA or related approach and issue examined	Results/implication/conclusion
		– configuration approach would help to solve the problems). Implication: helps decision makers to systematically analyse the cost effectiveness of outsourcing during capacity planning.
Merad et al., (2013), Multi-criteria decisions (Sustainability in organisations)	Multi-criteria decision aid (MCDA) was applied to choose a suitable combination (SD) of conflicting sustainability development dimensions (environmental, economic, and social) that compromise different expectations of stakeholders.	Results: although it is difficult to find a compromising point, MCDA is appears capable of compromising SD dimensions and stakeholders expectations. Implication: Practising managers helped to deal with diverse expectations and perceptions of stakeholders when fulfilling environmental, economic, and social obligations (FSA could do this batter)
Serrano-Cinca and Gutierrez-Nieto, (2013), Multi-criteria decisions (venture capital investment)	**Analytical hierarchy process (AHP)** was proposed to assess diverse aspects (past experience, present financial information, and proposed project expected financial and social impact) related to Social Venture Capital (SVC) investment decisions in order to integrate both financial and social aspects of investment decisions, without violating investor's mission.	Results: AHP simplifies the complexity. However, it appears hard to identify a combination of the diverse aspects for maximising different investors' decisions; I would propose FSA – configuration approach for this study.
Ahmed and Richard, (2013) Multiple criteria (Customers'' decisions on brands)	***FSA in multi-criteria decision.*** Customers' decisions on brand can be consideration, hold, foggy, or rejection and this depends on foreign and local brands and cultures. A brand can follow into two or more of the above customers' fuzzy decisions. In order to understand these customers' brand categorisation FSA was applies	Their results indicated that decision fuzziness on brand categorisation varies across cultures and across foreign and local brands. Implications: managers can advertising more on the brand that receive rejections because of lack of knowledge,
Bozbura et al., (2007). Journal: Expert Systems with Applications. Vol. 32	***Fuzzy AHP*** was used to measure and prioritising indicators of human capital. It is argued that since we cannot manage what we cannot control, and we cannot control what we do not measure, then measurement of HC is a very important issue so how the quality of prioritization of HC measurement indicators under fuzziness	they indicated that creating results by using knowledge, employees' skills index, sharing and reporting knowledge, and succession rate of training programs are the four most important measurement indicators for the better HC
Kahraman, et al., 2010 International journal of production research	***Fuzzy set analytic hierarchy process (AHP)*** in multi-criteria decisions (in manufacturing firms) relating to Outsourcing alternatives. The criteria for choosing the best outsourcers are usually subjective, expressed in linguistic terms, based on fuzzy numbers, and are associated with main-attributes as well as sub-attributes for enhancing performances. This to make decision on who is the best outsourcer therefore requires fuzzy AHP .	They noted that fuzzy (MCDM) grounded on AHP model allows decision makers to be flexible and use a large evaluation pool including linguistic terms, fuzzy numbers, precise numerical values, an ranges of numerical values. It take most of evaluation criteria that allow to achieve the best decisions.

Authors and area of study/topic	Type of FSA or related approach and issue examined	Results/implication/conclusion
Beynon and Clatworthy, (2013) multi-criteria decisions (identify model to help investors decisions on equity investments)	***Fuzzy set in Multi-criteria decisions***. They examined how investors can make decision to buy, hold, or sell equities basing on earning based (residual income) model. They applied fuzzy-based approach to solve the imprecision on the decision to buy, hold or sell shares that would be associated with inherent in certain parameters (e.g., discount rate and future residual income) in the model that are associated with uncertainties and information asymmetry .	They noted that Fuzzy-based residual income model was important for dealing with imprecision in parameters used in residual income model of firm valuation that lead investors to buy, hold, or sell shares.
Kwak et al., 2010 in Lee et al. (eds.), *Handbook of Quantitative Finance and Risk Management*	***Fuzzy multiple criteria linear programing (MCLP)*** was in accounting was used solve various accounting or finance problems such as international transfer pricing, human resource allocation, accounting information system selection, and capital budgeting problems.	Fuzzy numbers provide insight to solving problems relating to transfer prising, human resource allocation, and capital budgeting

For example Kwak, et al, (2010), adopted fuzzy set approaches to solve accounting and finance problems associated with international transfer pricing, human resource allocation in CPA firms, accounting information system allocations, and capital budgeting in different settings, and concluded that FSA is suitable for handing complex causality in accounting and finance problems.

Researchers interested in corporate financial and country level economic performance are also applying FSA or related approaches to explore configurations to favourable financial or economic performances (Pajunen, 2008; Greckhamer et al., 2008; Fiss, 2011; Garcia-Castrol et al., 2013). Pajunen, (2008), employed FSA to address the problem of complex causality and diversity of institutional factors in multinational firms on influencing foreign direct investment (FDI) across 47 host countries for the period of five years (1999-2003). Pajunen examined how and why countries with different memberships in institutional factors attract or do not attract FDI. The result shows that similar institutions experience different levels of FDI due to geographical categorisation. Also Pajunen noted that the presence or the absence of a single institutional factor may lead to an increase or decrease of FDI attraction. It was also found that there were several possible configurations to FDI attraction which can be captured through applications of FSA. In this context, it was concluded that FSA offers greater opportunity for future researchers to explore configurations that "sufficiently" lead to an outcome of interest. Ideally, Pajunen's research is not different from the assumptions of this research as explained in section 1.4 of this thesis.

Greckhamer et al., (2008), examined the potential for interdependence and complexity of firm's industry, corporate, and business-unit attributes for determining favourable performance of a business-unit by applying configuration approaches. They concluded that configurational approaches such as fuzzy sets analysis and crisp set analysis are ideal approaches for studying "sufficiency of combination of industry, corporate, and business-unit attributes for occurrence of superior and inferior business-unit performance" (p.696). They showed that there are interdependences among the attributes, and that "corporate factors are important to understanding performance" (p.717), such that "any particular attribute may have different and even opposite effects depending on the presence or absence of other attributes" (p.720). In addition, their results indicated that different combinations of industry, corporate, and business-unit attributes may lead to similar performance of business-units. The principal idea of Greckhamer and others was to understand whether the three attributes were likely to form a configuration sufficient to indicate favourable financial performance in business-units. This idea is similar to the current research idea as explained in section 1.4.

Fiss (2011), aimed to address the challenges on typological theory. He argued that the current typological theory cannot enable researchers and practitioner to understand elements that are relevant or irrelevant for enhancing financial performance. Thus, his concern was to provide theoretical and methodological move from a holistic view of typology to a fine-grained understanding of causes that are relevant and those that are not relevant for enhancing financial performance. He introduced the concept of core and supporting conditions (section 3.4).

In order to fulfil his curiosity, Fiss applied FSA to demonstrate how strategic, structural, and environmental factors are connected for different levels of profitability in high technological firms. Based on Miles and Snow, (1978; 2003) typology, Fiss, (2011) found that firms' strategic, structural, and environmental elements are differently connected for achieving very high profitability and high profitability. The results show that there are three different configurations that sufficiently lead to *very high* profitability and there are six different configurations that lead to *high* profitability. He also found that some elements in a configuration are core while others are supporting. Furthermore, he observed that conditions in the configurations that lead "to very high performance are frequently different from those leading to merely high or average performance" (Fiss, 2011, p.411). This is evidence of the existence of asymmetric causality[42] (Ragin, 2008), which has been neglected by previous researchers. Fiss was able to identify core and supporting conditions within configurations.

[42] Simple logic behind symmetric causality is that if condition A causes outcome B, then absence of A causes absence of B. In asymmetric causality if presence of A causes presence of B, absence of A may not necessarily lead to absence of B, as it may also lead to presence of B.

Based on these results Fiss, (2011), concluded that FSA provides better explanations on how causal conditions combine to create an outcome. FSA is a particularly useful tool for understanding both complementary and substitute causal variables in the configurations. Furthermore, FSA is an appropriate method for understanding complex cause-effect relationship and variable interactions. As such, Fiss concluded that FSA can complement other standard approaches like cluster analysis, deviation score, and statistical analysis.

FSA – configuration approach has also been recently used in corporate governance (Garcia-Castrol et al., 2013). Garcia et al, wanted to understand how the configurations (bundles) of firm-level corporate governance practices: board dependence, board information disclosure, remuneration disclosure, compensation, and employee royalty embedded in diverse national governance systems enable firms to achieve high financial performance (ROE). They applied FSA and used a sample of 393 firms across 31 European countries. The key issues in their research was to address the methodological problems associated with corporate governance problems highlighted in corporate governance research that is how "diversity of national governance systems and the complementarities of governance practices within systems" enhance or destroy financial performance (Garcia-Castrol et al., 2013, p.390). In principle, these problems are difficult to address using traditional net-effect approaches (Ragin, 1987, 2000; 2008; Fiss, 2007; 2011). Therefore Grarcia-Castrol et al., (2013), applied FSA configuration approach to address these issues, and found that there are multiple configurations (bundles) of the firm-level governance practices for high ROE which imply presence of equifinality (Fiss, 2011). It was also observed that these corporate governance practices were complementary (interdependent) which indicates presence of conjuncture (complex) causality and asymmetric causality (ibid). It was concluded that the idea of "one size fit all" does not always exist in corporate governance

In fact since "an official introduction" of FSA in the work of Zadeh (1965), researchers have been using this method in different ways such as FSA configuration approach, fuzzy set analytical hierarchy process (AHP), fuzzy set multi-criteria decision (MCD), and fuzzy set multiple criteria linear programming (MCLP) as indicated in table 3.6.

Table 3.6 indicated that FSA can be applied in difference areas of study and in different issues, and researchers have recently realised the potentials of FSA. While different FSA approaches appear particularly favourable in different issues, FSA configuration approach have advantages of been used in almost all of the studies presented in table 3.6 when it comes to identifications of configurations for an outcome of interest. For example it is possible to apply FSA configuration approach to identify bundle of constraints in multi-criteria decisions for making more appropriate decision, and to identify core and supporting constraints. This is important when it comes to prioritising of elements involved in decision making process. Therefore, I recommend the use of FSA (configuration) in areas like management accounting in helping managers to make "sufficient" decisions and prioritising elements in the decision process for their firms.

Although, advocates of configurational approaches are confident that FSA can examine complex relationships and complement regression analysis (Ragin, 2000; 2008; Fiss, 2011), other researchers do not agree as to whether FSA configuration approach provide improvements on net effect approaches. For example, Seawright, (2005) argued that assumptions of causality and complex relationship proposed in configuration approaches; do not hold in the *case of missing* variables. Thus, Seawright noted that in the case of missing variables, configurational approaches are weaker than regression analysis. In this context, Seawright concluded that a configuration approach "is not an improvement over regression analysis" (p. 25). In addition, Smithson, (2005), examined the link between FSA and mainstream approaches, believing that, FSA can produce better results if it is used together with statistical methods. Based on the Seawright, (2005) and the Smithson, (2005) observations, it might remain true that FSA and mainstream statistical approaches complement one another. This thesis uses FSA configuration approach, and employs statistical approaches to allow better theoretical supports of current FSA results and results from more traditional approaches.

3.6: SUMMARY AND CONCLUSION OF THE CHAPTER

FSA appears to solve the problems of partial, fragmented and inclusive results on the corporate diversification-financial performance studies identified in chapter 2. It appears that financial performance depends on different levels of firms' attributes which is consistent with fuzzy logic that "everything is a matter of degree" depending on the context (Kosko, 1994, p.18). In this chapter, I discussed essential characteristics of FSA, and presented a list of literature to show that FSA is a potent tool not only in financial performance studies but also in other areas and issues that appear complicated because of variable interaction and complementarity. It appears that FSA is capable of addressing problems relating to complex causality, asymmetric causality, and equifinality issues which seem to exist in financial performance studies (Ragin, 2000; 2008; Ragin and Fiss, 2008; Pajunen, 2008; Greckhamer et al., 2008; Rihoux and Ragin, 2009; Fiss, 2011), as identified in chapter 2. Therefore, FSA provides promising insight on how corporate diversification enhance or destroy financial performance.

Based on this conclusion, the next chapter discusses philosophical stances that lead to the application of FSA as a research method in this research.

Chapter 4 : RESEARCH PHILOSOPHY, METHOD, AND SEGMENTAL REPORTING PRACTICE

4.1: INTRODUCTION

Chapter 3 demonstrated the potential of FSA to provide additional insights in solving the problems of partial, fragmented and inclusive results on the corporate diversification-financial performance studies identified in chapter 2, particularly in understanding how geographic and business diversification strategies can hybridise with levels of leverage, internal funds, firm size, asset intangibility and tangibility to create configurations that sufficiently indicate favourable firm value (MTB), profitability, and risk-return performance (RRP).

Chapter 4 discusses philosophical stances and research method stages that lead to the application of FSA as a research method in this research. In particular, this chapter explains and justifies the research paradigm that would help to acquire knowledge and further understanding of the questions of this thesis. In addition, this chapter examined and present results on segmental reporting practice in the LSE-FASI-Firms to understand if accounting standards and financial reporting requirements have major impact on the practice. This is important stage in method development because; it helps to make objective decision on how geographic and business diversification sets can be determined and measured.

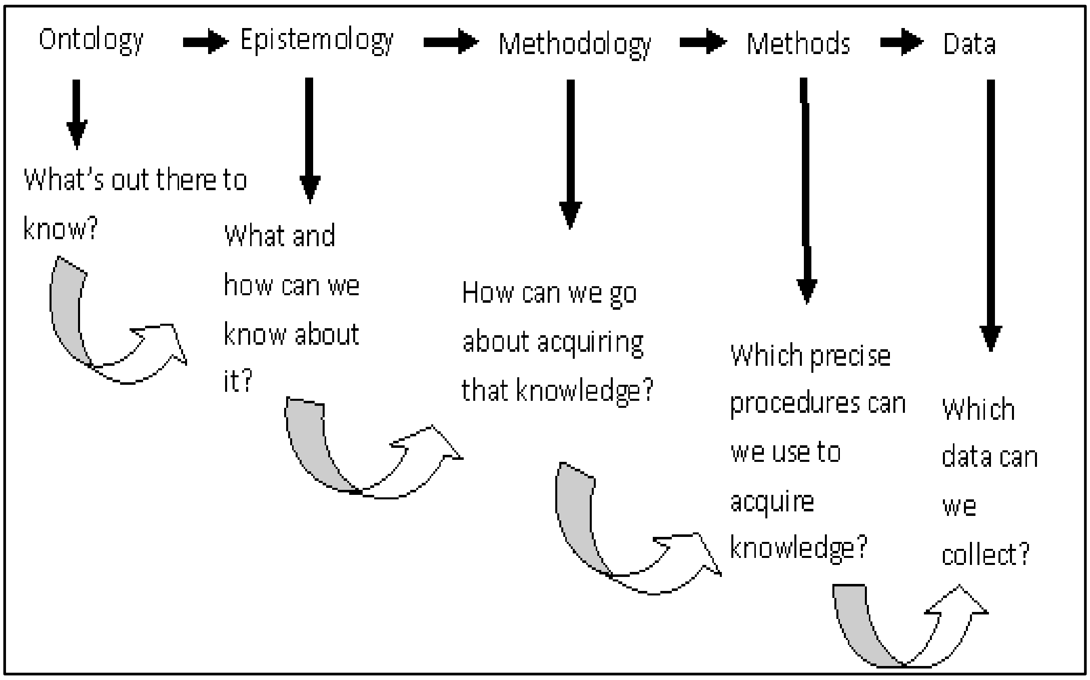
This chapter is organised into three main sections: research philosophy, research method stages, and summary and conclusion of the chapter. However in the method stages section, the research on segmental information disclosure in LSE-FASI-Firms was conducted in detail to understand how segments are determined in these firms.

4.2: RESEARCH PHILOSOPHY

4.2.1: INTRODUCTION

Philosophy can be defined as a study of fundamental problems about the nature of reality. It includes the issues of source of knowledge, reasoning, and how knowledge is acquired (Grayling, 1998; Teichmann and Evans, 1999). According to Grayling, (1998, p.1), the purpose of philosophical enquiry is “to gain insight into questions about knowledge, truth, reasons, reality, meaning, mind, and value”. In addition, Teichmann and Evans, (1999, p.1), defined philosophy as a study of problems that are concerned with the “nature of existence, knowledge, morality, reason and human purpose”, research philosophy includes: ontological, epistemological, and methodological questions as indicated in figure 4.1. Figure 4.1 shows how research philosophical terms depend on one another and their corresponding key questions.

Figure 4.1: Philosophical terms flowchart



Source: Hay, 2002, p.64

4.2.2: ONTOLOGICAL POSITION

Ontology is concerned with the nature of social reality that which is believed to be the reality – “what is out there to be known?” (Grix, 2002). Guba and Lincoln, (1994) stated that in order to develop an inquiry paradigm[43] the first question to be addressed is the ontological question. The ontological question is concerned with whether the “world” is real and external to researchers or the reality about the world

[43] The word paradigm has it origin in Greek language “paradeigma” meaning example or model. Philosophically the term refers to the way researchers perceive the world. Guba and Lincoln, (1994), defines paradigm as a worldview describing the nature of the world, a researcher’s place in it and the relationship to the rest of the world. In this context research paradigm can be described as a researcher’s best perspective about answers of the metaphysical questions which are ontological, epistemological, and methodological questions.

is socially and internally constructed, that is social reality is to be known either naturally existed (objective) or constructed by social actors (subjective) (Guba and Lincoln, 1994). Social reality is therefore viewed in “binary” paradigms, either completely “hard” (objective paradigm) or completely “soft” (subjective paradigm). This is consistent with a classical set theory (i.e., an element has to be included or excluded from a specified set). It is like an Aristotelian type of ontological paradigm where things are viewed as either black or white.

In reality, Aristotelian ontological paradigms may not always exist, as there are possibilities for quasi-hard or quasi-soft social realities to be found between hard and soft extremes of social reality. These quasi objective-subjective paradigms combine the views of both the subjectivists’ and objectivists’ camps to create a ***hybrid paradigm*** referred to as ***fuzzy paradigm***. The logic behind *fuzzy paradigm* is addressed in Burrell and Morgan, (1979) and Morgan and Smircich, (1980).

Morgan and Smircich, (1980, p.492), showed a way out of the “binary” view of social reality by introducing additional four *fuzzy sets* between the two extreme camps. According to Morgan and Smircich, there are four mediating camps between objectivists and subjectivists as shown in table 4.1. This is consistent with the fuzzy principle of Kosko, (1994), which states that “everything is a matter of degree” (p.18) implying that, objectivity and subjectivity are also a matter of degree.

This research is built on a *fuzzy paradigm*, aiming to understand how corporate diversification sufficiently leads to favourable financial performance. Within this research there are questions as to how financial performance is perceived in terms of a *social reality*. These appearances of reality are known through application of certain principles of causality, space, and time which are deduced from a general principle (Kant, quoted in Ryan et al., 2002, p.15).

This thesis argues that causes of financial performance are based on the principle of complex and asymmetric causality, and financial performance can be explained through interconnections and interdependencies of causal factors which work together to influence the desired results (Fiss, 2011).

Table 4.1: Basic assumptions of subjective-objective debate within social science

Subjective approach to Social Science						Objective approach to Social Science
Assumption about Ontology	Projection of human imagination	Socially constructed	As a realm of symbolic discourse	As a contextual field of information	As a concrete process	As a concrete structure
Assumption about human nature	Man as pure sprit, consciousness, being	Man as a social constructor, symbol creator	Man as actor and symbol user	Man as an information processor	Man as an adaptor	Man as a responder
Epistemological Stance	To obtain phenomenological insight, revelation	To understand how social reality is created	Understand pattern of symbolic discourse	To map context	To study systems, process, and change	To constructs a positivist science
Favoured Metaphor	Transcendental	Language game, text	Theatre, culture	Cybernetic	Organism	Machine
Research Method	Exploration of pure subjectivity	Hermeneutics	Symbolic analysis	Contextual analysis of Gestalten	Historical analysis	Lab experiments, survey

Source: Morgan and Smircich (1980, p.492)

This table indicate the networks of assumptions that subjectivists and objectivists apply when forming/developing their research paradigm. The green highlight indicate the position stance taken by my research on the subject-objective debate about research philosophical assumptions.

I believe that in order to understand the impact of corporate diversification (geographic and business diversification) on financial performance one has to understand how other parts (factors) synergistically influence geographic and business diversification to bring positive financial results. The ontological position of this research is a ***hybrid*** of subjectivists and objectivists (see the highlighted column in table 4.1). This research is therefore based on *fuzzy paradigm*.

4.2.3: EPISTEMOLOGICAL POSITION

Epistemology is concerned with the acquisition of knowledge about the nature of social reality. It tries to answer questions like how and what can we know about the "reality out there?" (Morgan and Smircich, 1980, p.180). According to Morgan and Smircich, epistemology is concerned with the theory of knowledge, especially with regards to the method of knowledge acquisition and validation. The word epistemology has its origin in Greek words *episteme* (knowledge) and *logos* (reason). Thus epistemology is about how can we know what we want to know? It is more about how we acquire knowledge.

It is believed that knowledge can be acquired in two ways: firstly, it can be acquired by researchers seeking to understand how the static systems, processes, and changes of the world relate (Morgan and Smircich, 1980). Researchers apply natural science methods (quantitative) to study social reality and their results are always assumed to be objective. Secondly, knowledge is subjectively, socially, or individually acquired by constructing meanings subject to social actions and interpretations. Researchers construct, interpret and take meanings from reality (Marsh and Furlong, 2002).

As discussed in section 1.4, this research assumes that complex causality, equifinality, and causal asymmetry are important features in financial performance studies. The epistemological stance that best fits these assumptions is based on *fuzzy paradigm*, as such although the researcher can be viewed as an "adaptor" (Morgan and Smircich, 1980, p.492), he requires to provide some theoretical and substantive interpretations and understanding about how corporate characteristics combine for favourable financial performance. Therefore, the epistemological position for this complex situation is ***post-normal science*** (Funtowicz and Ravetz., 1993; Ravetz, 2004).

Post-Normal Science (hereafter PNS) is an alternative approach for managing complexity in science-related issues (Funtowicz and Ravetz, 2003). According to Funtowicz and Ravetz (2003), PNS aims at solving problems which were found difficult to solve by traditional science practices, and is seen as a movement from hard science towards soft science. Originally, PNS was developed as an epistemological stance for solving ambiguities and complexity in areas of medicine, public health and environmental toxicants (Ravetz, 2004). Ravetz argued that, PNS addresses issues where, “typically, facts are uncertain, values in dispute, stakes high and decision urgent” (p. 349).

The facts about causes of financial performance are typically complex and ambiguous because the relationship between causes and outcomes are in most cases not known with certainty. The epistemological stance to be adopted in studying this relationship must incorporate both objective and subjective understanding as ways of acquiring knowledge; which is post-normal as suggested in (Ravetz, 2004).

4.2.4: METHODOLOGICAL AND RESEARCH METHOD

Methodology is about how can we go about acquiring knowledge (Grix, 2002). Methodology is defined as “the study of methods by which we acquire knowledge about the world” (Hibbitt, 2004, p.116). In this context, methodology and methods are different terms. Indeed Hibbitt, (2004), made a clear distinction between method and methodology, he stated that while “methodology in its philosophical sense refers to study of methods, method refer to a particular research approach used to investigate and learn about phenomena” (p. 148).

Like the epistemological position which was developed from the ontological position, the methodological stance is developed from the epistemological position. While epistemology is concerned with “what and how can we know about the reality (knowledge)?” Methodology is about how can we acquire that knowledge? (Grix, 2002) (see table 4.2).

I believe that the impact of geographic and business diversification on financial performance can be understood through a configurational approach, whereby cases are grouped according to similarities in their characteristics. Kim et al., (1993, p.

277), noted that grouping "firms with similar … diversification strategy" has considerable potential in understanding the impact of diversification on financial performance (see also Bettis and Mahajan, 1985). Furthermore, theories used to explain corporate diversification-performance relationships sometimes do complement or substitute one another (Williamson, 1988). This means, hybridisation of theories is necessary to provide a sufficient explanation about the complex cause-effect relationship as suggested in this research.

The methodology adopted in this research is both qualitative and quantitative; however there are more quantitative elements than qualitative. Specifically, this research applies FSA as a research method. FSA is based on fuzzy logic principle that "everything is a matter of degree" depending on context (Kosko, 1994, p.18). In other words taking a quantitative or a qualitative stance is in fact a matter of degree.

FSA can be traced back to the work of Zadeh, (1965), who extended classical set theory (0,1) to fuzzy set theory in order to explain and handle concepts of partial truth or approximate reasoning. Zadeh's aim was to examine how people make decisions based on "imprecise, incomplete, and totally not reliable" information (Treadwell, 1995, pp.93-94). Zadeh indicated that conclusions drawn by people based on the information supplied to them, are based on fuzzy set quantifiers such as few, seldom, always, usually, often, large, small, etc. which by nature represent fuzziness, imprecision, or vagueness and therefore carries fuzzy set values, that is values between 0 and 1[44].

Configurational approaches such as FSA in social sciences were introduced in order to resolve the methodological debate between objectivists and subjectivists camps (Ragin., 2000). Ragin argued that a configurational approach mediates between objective and subjective researchers. A configurational approach is used to "integrate the best features of case oriented approach with the best features of variable-oriented approach" (Ragin, 1987, p.84)[45].

[44] See chapter 1 figure 1.2 for definition and example of fuzzy set values.

[45] FSA is referred to as a case approach in the sense that individual cases are considered separately. A case is considered as a "whole" made up of different "parts" and these parts are understood in relation to one another in influencing the outcome (Ragin, 2000; 2008). FSA can be considered

4.2.5: ADVANTAGES AND LIMITATIONS OF FUZZY SETS ANALYSIS

FSA was introduced to social science to solve problems associated with complex causality, asymmetric causality, and equifinality (Ragin , 2000; Kart et al., 2005; Greckhamer et al., 2008; Fizz, 2007; 2011)[46]. In order to appreciate the contribution of FSA in this research, the benefits and limitations of applying FSA are discussed and the differences between statistical approach (linear regression analysis) and FSA are summarised in table 4.2.

Table 4.2: Differences between regression and fuzzy sets analysis methods

Regression Analysis	Fuzzy Set Analysis
Independence of causal variables	Interdependency of causal variables
Linear and additive relationship	Interaction and complex relationship
Variable competing for outcome	Mutualism affecting outcomes
Symmetric causality	Asymmetric causality
Concerned with significant correlations/relationships of causes for an outcome	Concerned with Necessity and Sufficiency of causes for an outcome

Source: Constructed from current research literature

Advantages

FSA has many unique benefits over pure variable and case-oriented analysis. Firstly, whilst most statistical models focus on individual contributions of causal variables by examining net-effects of each variable in an outcome of interest, and provide limited understanding of the synergistic-effect of the causal variables (Gujarati, 1988; Kart et al., 2005), FSA provides insight on impact or synergistic-effect of combined causal variables on an outcome. FSA allows researchers to examine multiple complex causations: FSA assumes that "different parts of the whole are understood in relation to one another and in terms of the total package that they form" (Ragin, 2000, p.68), this allows FSA to examine the synergistic-effect of causal variables.

quantitative in the sense that the results from the fuzzy set analysis are replicable and variables are quantified; the only difference is that in variable oriented research variables are considered independent while in FSA variables are seen to be interdependent.

[46] Definitions of conjunctural causation, asymmetric causality, and equifinality see appendix 1

Secondly, the benefit of FSA is derived from its ability to study firms that consist of a combination of varying characteristics. This allows researchers to observe the consistencies in certain combinations of firm characteristics that serve as sufficient or necessary configurations for an outcome of interest. Consequently, this would help both researchers and practitioners to identify combination of conditions (configurations) that sufficiently or necessarily lead to a desired outcome.

FSA is a hybrid approach (Fiss, 2011), that allows researchers to identify important (core) and relatively less important causal conditions for an outcome to occur. It also allows practitioners and other decision makers to prioritise strategies that bring benefits to the object of interest (Russell and Thomson, 2009). For example Russell and Thomson, applied a hybrid approach and managed to identify that although sustainable development indicators of Sustainable Scotland were built on strong economic growth such as fair-trade and eco-tourism, “still the main priority was on its citizens” (2009, p. 234).

Limitations of FSA

Every research method has limitations, and FSA has its limitations. First, FSA appears particularly appropriate for the study of multiple interactions, but the method is more appropriate in some contexts than others. In particular, FSA is based on fully interactive models which assume that all variables involved in the analysis interact so that the possible numbers of interactions are equal to 2^k configurations. However, it may be impossible for all variables involved in the analysis to interact; some may not interact.

Secondly, due to the high number of possible interactions, frequency cut-offs must be applied. This eliminates some configurations from the analysis and as a result some important combinations may be missed. This problem however can be reduced by ensuring that there are sufficient cases involved in the analysis (Von Eye, 1990; Ragin, 2000; 2008) and application of robusted test and test of significance as it was the case in this research.

Thirdly, the process of determine the three thresholds is basically based on researchers theoretical and substantive knowledge about the case or sets (Ragin, 2000). This means, the thresholds appear to be subjective and may lead to researchers biased results. However, this limitation can be reduced through application of theoretical and practical judgements that have been objectively verified in previous literature. In this context, the current research has used previous literature to identify the benchmarks for full membership, cross-over point, and full nonmembership. In addition, this research applied different method to test robustness of the configurations in order to obtain less researcher's biased results.

Fourthly, although FSA can be used to reduce the problem of multidimensional concept misrepresentation through application of macrovariables; application of macrovariable can be easily mistaken as "vague variable" in representing a multidimensional concept because determinants of different variables that may be used to create a macrovariable may often be different. However, in FSA is more focused on cases' membership representation in a particular set (concept) rather than proxies of a concept. For example traditionally, firm size set (concept of firm size) is represented by volume of sales "***or***" amount of assets, these concepts equally represent firm size as any them can be used. However, since these proxies can lead to different classification of same size in different sizes (relatively large or not large)(see table 1.2), then selection of one proxy may lead to misclassification of the firm's memberships in the set. In this case macrovariable may be mistaken to be vague variable in net-effect models, it is important in configuration approach in representing case's memberships in a set.

Finally, FSA cannot enable researchers to understand the contribution of individual causal variable on the outcome of interest. FSA remains important in configuration approach but not in net-effect models. Therefore, FSA cannot replace but complement net-effect models.

4.3: RESEARCH METHOD - STAGES

Figure 4.1 above demonstrated that research methods are derived from a methodology stance. While the methodological question is about "*how* can we go about acquiring that knowledge?" The method question is about "*which* or *what* precise procedures can we use to acquire knowledge? And which data can we collect? Therefore, the research method is more about the procedures for acquiring knowledge.

This section discusses the main research method stages of this thesis (see table 4.3). Specifically, it discusses different stages that were used to arrive at application of FSA as a research method; issues of data and sample size; data analysis; and robust test.

4.3.1: DETERMINATION OF RESEARCH METHOD AND VARIABLES STAGE

Research is a process that requires a researcher to go through different stages (Bryman and Bell, 2007). Table 4.3 is derived from figure 1.3 of chapter 1 of this thesis. While figure 1.3 provides general plan of this thesis, table 4.3 specifically displays the research method plan for this research.

Table 4.3: Research method stages

This table shows stages of research method in which time scale, activity, and details of different stages have been outlined.

Time Scale	Activity	Details
January 2011	Analytical review on previous studies	To identify methodological gap, identify explanatory variables and understand how they are measured. This includes segmental disclosure and pilot studies (most of the analytical review was presented in chapter 2)
February – May 2011	Descriptive review on FSA issues and studies	To understand key features of FSA and how FSA is used in social science research. This includes FSA value and macrovariable development processes (see chapter 3)
June –October 2011	Data Collection and management	Data source and period, sample size, variable characteristics. This includes examination of segmental disclosure across the sample period.
January – May 2012	Data Analysis	- Mean comparisons - Factor analysis - Regression analysis - Fuzzy set analysis

Table 4.3 shows processes or stages which were undertaken when selecting research method for this research. The table shows that the process starts with an analytical review of research literature, followed by descriptive review of research literature, data collection and management, and data analysis as discussed below.

4.3.1.1: ANALYSIS OF LITERATURE TO IDENTIFY METHODOLOGICAL GAP AND VARIABLES.

One of the objectives of the analytical review presented in section 2.3, 2.4, and 2.5 of this thesis was to understand the variables, theories, and methods that previous researchers employed in corporate diversification-financial performance relationship studies. The review of studies in section 2.4 and 2.5 has shown that the failure to capture complex causality and application of standalone theories and variables were sources of conflicting results in examining corporate diversification-performance relationships. In addition, variable selection biases and measurement diversity led to inconclusive results (see table 2.3 and table 2.4). These resulted in the methodological gap that this research intends to fill.

The analysis of the literature in section 2.3 has identified that there were basically three categories of explanatory variables that were used as control variables when examining relationship between corporate diversification and financial performance namely: financing choice (leverage and internal funds), asset structure (asset tangibility and intangibility), and firm size. These variables were assumed to have a standalone effect on financial performance, yet the literature clearly indicates the presence of the synergistic-effect of corporate diversification and other firm characteristics on financial performance (see for example Morck, 1991; 1992; 1997; Li and Li, 1996; Drugun, 2002; Qian, 2002; Qian et al., 2003; Jones and Danbolt, 2005; Canbäck et al., 2006). However, these synergistic effects remain largely under-investigated so this research aims to fill this gap by using similar variables as defined in table 4.4, but using configurational approach - FSA.

The variables presented in table 4.4 were defined according to previous research or DataStream database as discussed in section 2.3. This allows a degree of consistency and comparability of my results to prior research

Table 4.4: Original variable definitions.

This table provides definitions of the original variables (sets) used in this research. The source of the definitions is also indicated. All the variables were obtained from the DataStream.
**all measures are determined using 3-4years averages (see section 4.3.2). * implies code of segment one and the other segments code follows chronologically in the interval of ten e.g., DGA, codes are 19603, 19613, and 19623 to stand for segment 1, 2, and 3 respectively.

Variables	Variable measures/definitions**
Market value (MTB)	**MTB**-market to book – is calculated as total asset plus market value of equity minus book value of equity divided by total assets as in (Denis et al., 2002).
Profitability (PROF)	**ROA**-return on assets (DataStream code WC08326) , that is (net Income before Preferred Dividends - Preferred Dividend Requirement) / Last year total assets) * 100 **ROS**-return on sales. Defined as (net Income before Preferred Dividends - Preferred Dividend Requirement) / total sales) * 100
Business Risk	**SDROA**-std deviation - business risk is measured using standard deviation of ROA as in (Bettis and Hall, 1982; Kogut, 1985; Kim et al, 1993; Goldberg and Heflin, 1995), **SDROS**-std deviation – this is calculated as standard deviation of deviation of ROS
Geographic Diversification (DG)	**DGA**-segmental assets – Segmental assets are obtained from the Data stream (code 19603*)and an entropy measure of diversification is calculated using D = $\sum_i \left[Pi\ X \ln \frac{1}{Pi}\right]$ as in (Hitt et al., 1997), this formula is explained later in section 5.3.2. **DGS-**segmental sales - Segmental sales are obtained from the DataStream (code 19601*) and an entropy measure of diversification is calculated using the above formula
Business Diversification (DB)	**DBA**-segmental assets – Segmental assets are obtained from the DataStream (code 19503*) and an entropy measure of diversification is calculated using D = $\sum_i \left[Pi\ X \ln \frac{1}{Pi}\right]$ as in (Jacquemin and Berry, 1979; Palepu, 1985). **DBS**-segmental sales – Obtained from the DataStream (code 19501*) Entropy measure as defined in (Jacquemin and Berry, 1979; Palepu, 1985). And calculated as per formula above
Financing Choices	**TDTA**-leverage – is defined as a ratio of total debt (WC 03255) to total assets (WC 02999) (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008) (obtained from the DataStream code WC 08236. . **RETA**-retained earnings to total assets: represent the accumulated after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve (WC03495) divide by total assets (DataStream code WC02999)
Firm size in £ (SIZE)	**SIZEA** = Total assets in billions: represents the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, and net property, plant and equipment (DataStream code WC02999). **SIZES** = Net sales in billions £: represent gross sales and other operating revenue less discounts, returns and allowances (WC01001)
Asset Structures	**INTA**-Intangibility percentage of total intangible assets (WC 02649)on total assets as in (Caves, 1996; Morck and Yeung., 1991; 1992; 1997) **TANG**-Tangibility: represents Gross Property, Plant and Equipment less accumulated reserves for depreciation, depletion and amortization (WC02501) divided by total asset *100 as in (Morck and Yeung, 1991; Hitt et al., 1997; Rocca et al., 2009).

4.3.1.2: Segmental disclosure practices and diversification measures

As noted in the previous chapters, this research is interested on how levels of corporate diversification impacts financial performance. Therefore geographic and business diversifications are important variables and require better understanding on how levels of geographic and business diversification can be determined. In this section I examine the segmental reporting practices in the LSE-FASI-Firms in order to understand if the changes in accounting and financial reporting standards have significant impact on segmental information. This helps to make decision on levels of diversification (high or not-high diversification).

Previous researchers on segmental reporting have noted that changes in segments reporting standards have impact on diversification levels. For example, evidences have shown that changes SFAS 14 to SFAS 131 encouraged US firms to disclose more information on corporate diversifications and increased the number of reported business segments (Botosan and Stanford, 2005; Ettredge et al., 2005; Paul and Largay., 2005). Similarly in the UK listed firms Aleksanyan and Danbolt, (2012), examined segmental reporting practice across the three segmental reporting practice regimes: Statement of Standard Accounting Practice (SSAP) 25, International Accounting Standards (IAS) 14R (revised), and International Financial Reporting Standards (IFRS) 8 [47], they found that although there were no significant changes of the number of segments reported due to adoption of IAS 14R, there appears to be significant changes in segments reported after implementation of IFRS 8 (2010) (see Aleksanyan and Danbolt, 2012, table 1). This implies that it is important to understand whether these three segmental reporting regimes have influence on corporate diversifications in the UK listed firms.

Segmental reporting in the UK listed firms has experienced three main regimes associated with changes in segmental reporting standards. In 2005, all public companies in Europe were required to apply IAS 14R, this made UK listed firm to comply with this regulation and therefore shift from UK GAAP (SSAP 25) to IAS 14R with effect from 2005. Furthermore, the convergence of IASB and FASB resulted to another change where UK listed firms were to adopt IFRS 8 with effect

[47] See appendix 7, for details on changes in segmental reporting standards.

from January 2009. These three regimes were different in terms of underlying principle of segment identification, types of segments to be reported, types and number of items to be reported, and to whom the reported information is intended (Aleksanyan and Danbolt, 2012)[48]. These differences are expected to lead to different levels of firms' diversification across these regimes (ibid). Since this research is based on diversification, and geographic and business segments are used to determine degree of geographic and business diversification, then more concern is given on segment identification.

In an accounting context, geographic and business diversification strategies are defined by geographic and business segmental information (Barnes and Hardie-Brown, 2006; Rocca et al., 2009). According to SSAP 25, IAS 14(R), and IFRS 8; listed firms are required to separately disclose net assets, net sales and profits for a *discrete segment*[49] which has at least 10% of firm's assets, sales or profit (see appendix 7 for definition of a segment). However, the accounting and financial reporting standards do not prevent firms from disclosing segments that have less than 10% of segmental assets, sales or profit. In this context, most firms voluntarily disclose segments with less than 10% of assets, sales, or profit[50]. The DataStream disclose segmental information that show amount of assets and sales across geographic segments (code 19601 for segmental sales and code 19603 for segmental assets) and product/business segments (code 19501 for segmental sales and code 19503 for segmental assets) (see table 4.4) with less than that 10% materiality rule and without categorising them into primary and secondary segments. Therefore, because this research uses segmental data from the DataStream, I do not distinguish

[48] The difference in the three segmental reporting regimes are presented in appendix 7, also table 1 in Aleksanyan and Danbolt, (2012), clearly shows the changes across regimes (see also table 4.5 of this thesis)

[49] Rumelt, (1974.p 12-13) defined a discrete business as one that could be managed independently of a firm's other activities. He noted that since business activities interdependencies vary from one firm to other, developing an exhaustive description of the properties of a discrete business to establish degrees of diversification is difficult, so he suggested the identification of the firm's largest discrete business is useful to understanding the degree of diversification.

[50] Accounting standards such as IAS 14: segmental reporting and IFRS 8: operating segments require listed firms to disclose discrete segments with 10% or more of net assets, sales, or profit of the firm. However, firms are not protected to voluntarily disclose segments with less than 10% of assets, sales, or profit of the firm. In this context, this research considers disclosure of segments with less than 10% of firm's assets as a voluntary disclosure because the firm has no obligation to disclose this information.

primary and secondary segments; rather segments are defined by number of geographic locations and business lines without further categorisation.

In order to examine if LSE-FASI-Firms discloses geographic segmental information as per requirements of accounting and financial reporting standards, I selected 137 firms from the sample and counted the number of disclosed segments with less than 10% of total assets across the ten year period. A firm was selected, if it has information on diversification for the whole period of ten years (that is from 2001-2010). In other words, a firm is included in the sample of 137 firms if has two or more geographic segments as measured by segmental assets. I used same firms and same number of firms (no firm was allowed to enter and leave in this sample) in order to understand the firms' persistence in disclosing segments with less than 10% of segmental assets. The results are presented in table 4.5. The table is divided into two main parts: the percentage of number of segments that disclosed segments with less than 10% of total assets and the percentage of firms that disclosed segments with less than 10% of total assets.

Table 4.5: Geographic segments with less than 10% of total assets

This table presents the number of segments and firms disclosed two or more segments of which at least one segment has less than 10% of total assets over ten years. Total means total disclosed segments or firms, less than 10% means number of segments and firms with less than 10% of total assets and numbers. The number of segments and firms were taken from the DataStream (part of the sample) code 19603, 19613, 19623, 19633 etc., for segment number 1, 2, 3, 4 etc., respectively.

Year	Number of Segments				Number of firms		
	Total	Average	less than 10%	% of total	Total	less than 10%	% on total
2001	484	3.53	155	32	137	94	68.6
2002	487	3.55	155	31.8	137	92	67.2
2003	490	3.58	149	30.4	137	91	66.4
2004	496	3.62	149	30	137	91	66.4
2005	513	3.74	169	32.9	137	92	67.2
2006	515	3.76	167	32.4	137	94	68.6
2007	523	3.82	169	32.3	137	93	67.9
2008	528	3.85	172	32.6	137	94	68.6
2009	517	3.77	182	35.2	137	97	70.8
2010	523	3.82	196	37.5	137	93	67.9

Table 4.5 shows that average number of geographic segment ranges from 3.53 (2001) to 3.85 (2008). These results are somehow similar to those of Aleksanyan and Danbolt, (2012). Table 1 in Aleksanyan and Danbolt has shown for example that average number of geographic segment in 2002 was 3.56 (this research is 3.55) and in 2004 was 3.60 (this research is 3.62). This indicates that segmental information reported from the DataStream are not significantly different from those reported in the annual reports. Aleksanyan and Danbolt, collected their data manually from UK listed companies annual reports. However, a slight difference is expected because of different sample size and firms. For example table 4.5 has shown that average number of geographic segments in 2010 were 3.82 which is not significant different from year 2008 (3.85). While in Aleksanyan and Danbolt (2012), average reported geographic segment was 4.53 in 2010 and 3.70 in 2008 this is significant gap (see table 1 in Aleksanyan and Danbolt, 2012). To test further the robustness of segments reported in table 4.5, I randomly selected few annual reports across the period of ten years (2001-2010) and counted the number of geographic segmental assets, I found similar results.

Generally speaking the results presented in table 4.5 indicates that adoption of IAS 14R did not lead to changes in segmental reporting this is consistent with (Aleksanyan and Danbolt, 2012), similar adoption of IFRS 8 also appear to have less impact, this contradict Aleksanyan and Danbolt who found significant increase of in reported geographic segment after adoption of IFRS 8. Perhaps this different is attributed by different measure used, while in my research I only used segmental assets, Aleksanyan and Danbolt did not specify whether segmental assets, sales or profit were used to count the number of segments.

Furthermore, it appears that 30% or more of the disclosed geographic segments had less than 10% of total assets. The table also shows that more than 66% of 137 firms disclosed at least one segment with less than 10% of total assets. This implies that most LSE-FASI-Firms voluntarily disclose segments with less than 10% of net assets which means that segments with less than 10% net assets are practically considered as "*discrete segments"* (Rumelt, 1974.p 12-13) in this sample. It appears that the total number of segments are generally increasing slowly (second column), however the number of less than 10% materiality disclosed segments and firms with less than 10% segment fluctuates in random bases. This may imply that increase of number of segments does not imply increase of less than 10% segmental asset disclosure. Furthermore, it appears that segmental disclosure requirements before 2005 (SSAP 25/IAS 14: Segmental reporting), before 2009 (IAS 14R), and 2009 onwards (IFRS 8: operating segment), has some impact as regards to disclosure of segments with less of less than 10% of firms' assets. In general changes from SSAP 25 to IAS 14R have less impact on 10% materiality rule, it appears that percentage of reported segment with less than 10% of total assets during SSAP 25 was lowest (30%) in 2004, and the highest reported number of reported segment with less than the 10% materiality rule during IAS 14R (32.9%) was in 2005 an increase of 6.3% which is not significantly high. Furthermore, the shifts from IAS 14R to IFRS 8 appear to bring relatively high level of less than 10% materiality disclosure practices. It appears that there was an increase of 8% from 2008 (32.6%) to 2009 (35.2%) and increase of 8%, and increased to 37.5% in 2010 (an increase of 15%). However, the change from IAS 14R to IFRS in 2009 appears to have less impact on the number of reported segments (see table 4.5).

I also reviewed the literature from other fields such as international business and management and I found that less than 10% segmental assets or sales were considered as discrete segments (Rumelt, 1974). Therefore, in this research, the degrees of corporate diversification are defined to include segments with less than 10% segmental assets or segmental sales as discussed in the next chapter. However, to keep consistency with other research, a firm is classified as an ambiguously not diversified when its largest segment has 95% or more of total sales or asset (see section 5.3.2 in the next chapter).

Based on the sample of 3129 year firms (see section 4.3.2.2 and table 4.13), I also calculated the percentage of firms with three or more geographic and business segments across the ten year period. The results are presented in table 4.6 and on figure 4.2 and 4.3. It shows that most companies maintained the same number of segments, and those firms which did increase or reduce the number of segments did so in different unspecified periods. This means changes in segmental information reporting standards had little impact on diversification decisions in LSE-FASI-Firms.

Table 4.6: Diversifications of LSE-FASI-Firms based on number of segments

This table presents the percentage of firms with three or more segments and one segment to the left and right side of the table respectively. The table shows that numbers of geographic and business segments are determined by segmental assets and sales. The terms used in the table are defined as follows: DGA and DGS stands for the percentage of firms with three or one geographic segmental assets and sales respectively. DBA and DBS stands for percentage of firms with three or one business segmental assets and sales respectively. Firms with two segments are not reported to avoid ambiguities regarding the classification of high and not high diversified firms.

YEARS	% of firms with three or more segments				% of firms with less than two segments			
	DGA	DGS	DBA	DBS	DGA	DGS	DBA	DBS
2001	57.4	60.1	43.0	48.2	23.1	20.2	35.4	30.0
2002	56.4	60.4	43.6	47.6	24.6	20.5	36.1	30.4
2003	56.2	60.4	43.3	47.7	23.1	20.0	36.6	31.2
2004	56.2	60.0	42.2	46.4	23.8	21.7	35.7	32.6
2005	59.6	63.8	45.5	47.9	23.5	20.7	33.4	30.8
2006	59.2	64.0	46.1	48.1	22.6	19.0	29.9	28.1
2007	62.2	65.4	47.4	48.5	20.6	18.7	28.7	27.0
2008	63.5	65.0	49.3	47.1	20.6	18.5	29.0	28.9
2009	64.7	65.2	55.4	50.0	20.2	17.4	28.5	27.2
2010	65.1	66.6	51.9	51.0	21.9	17.3	32.0	26.5

This result is consistent with Graham et al., (2002) who examined the impact of external diversification (mergers and acquisition) and internal diversification (adding new business segments) on firm value for the period between 1980 and 1990, and found that the results were not influenced by changes in accounting (segmental) reporting. However, there are some conflicting observations from this research with those of Aleksanyan and Danbolt, (2012), this requires further attention in future research, and I attach the sample firms for future researchers' follow-ups.

Furthermore based on the sample of 836 cases, I examined the average numbers of disclosed geographic and business segments across the three groups: 2003, 2006, and 2010. The results are presented in table 4.7 and in table 4.8 and these tables are graphically represented in figure 4.4 and in figure 4.5 respectively. The tables show the number and the percentage of segments disclosed by the cases across the three groups. It shows that there are no significant changes of numbers of disclosed segments across the groups.

Figure 4.2: Percentage of firms with three or more segments (2001-2010)

This figure graphically presents percentages of firms with three or more segments. The figure indicates that numbers of geographic and business segments are determined by segmental assets and sales. The terms used in the table are defined as follows.

DGA and DGS shows the percentage of firms with three or more geographic segments represented by segmental assets and segmental sales respectively

DBA and DBS shows the percentage of firms with three or more Business segments represented by segmental assets and segmental sales respectively

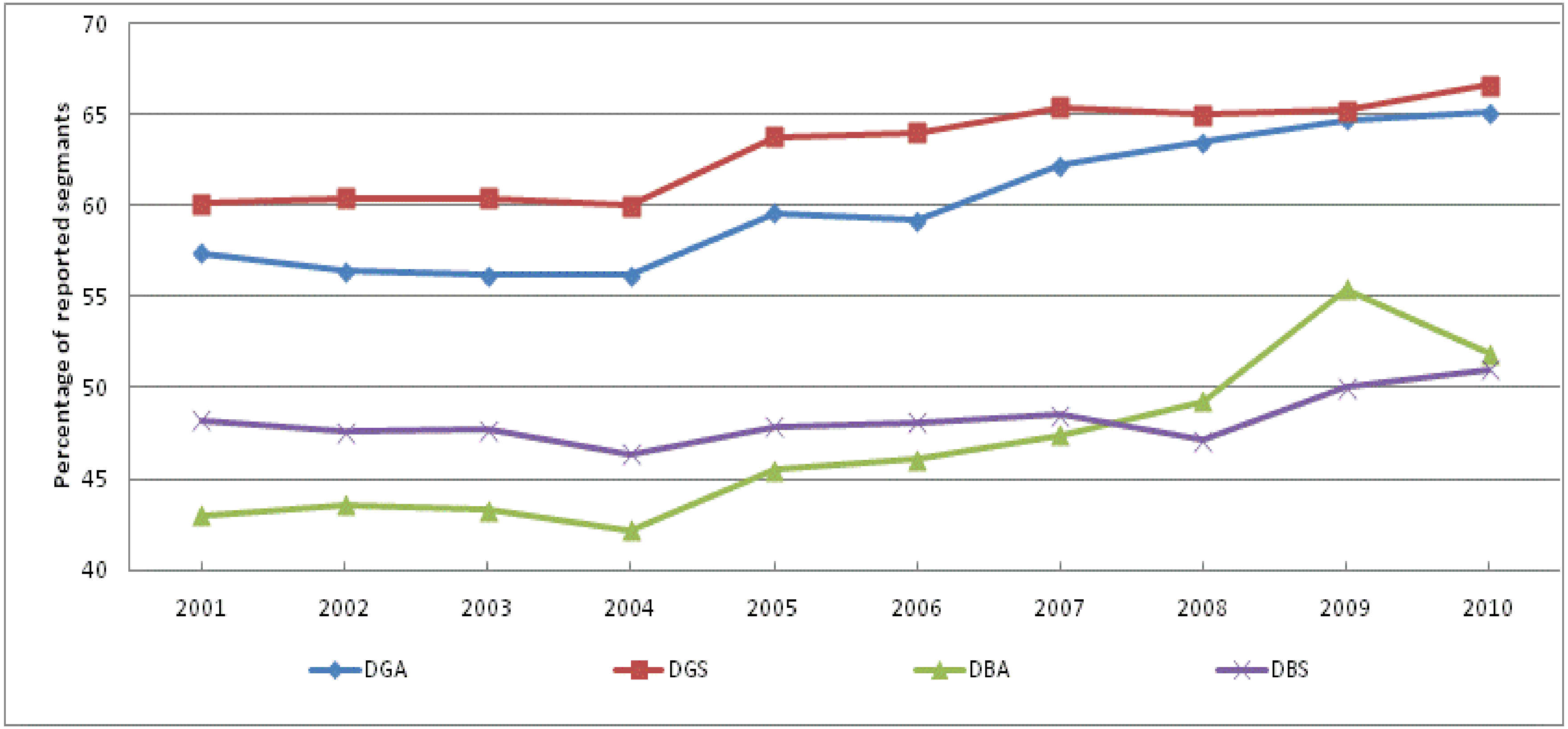
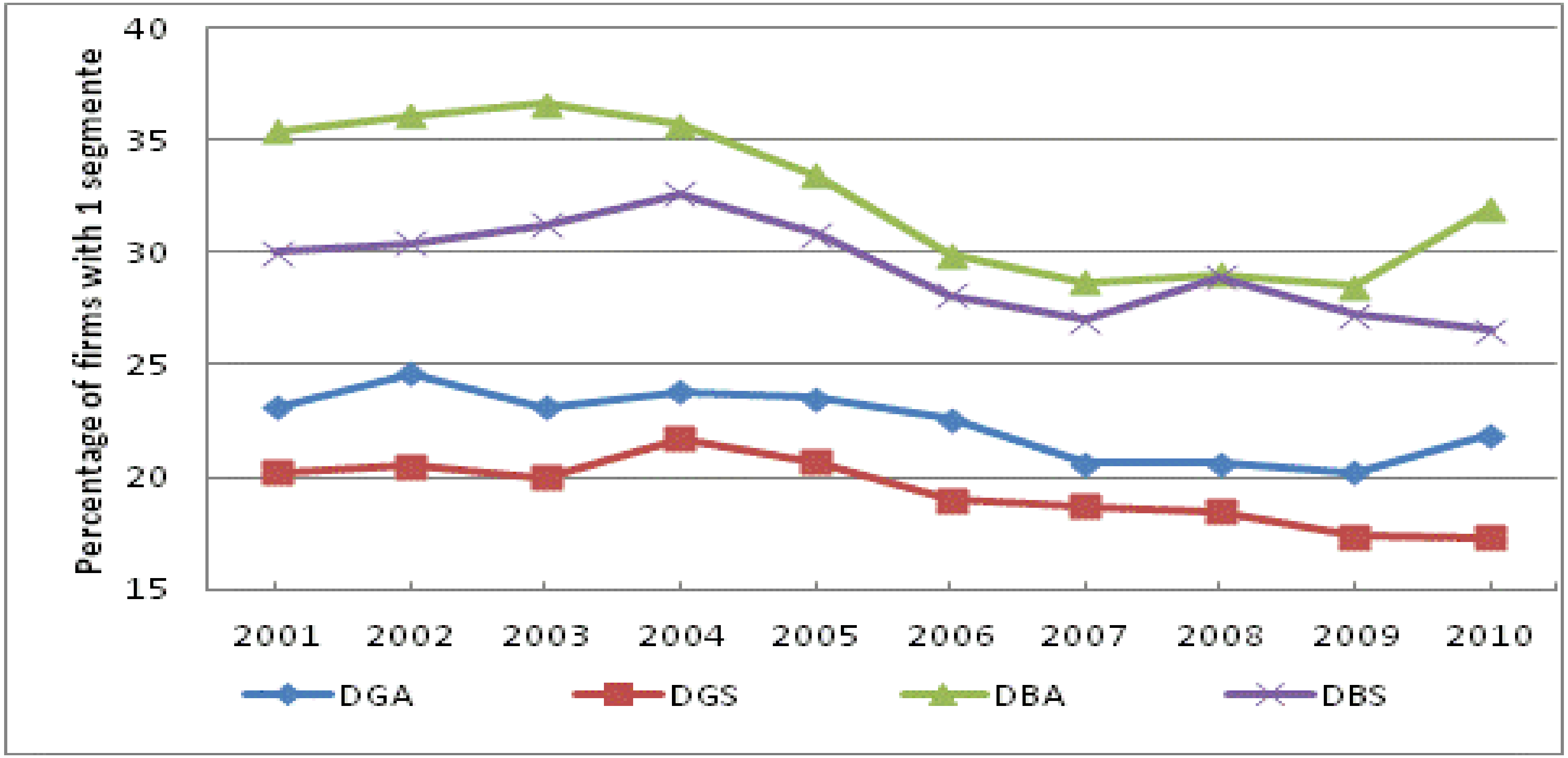


Figure 4.3: Percentage of firms with less than two segments (2001-2010)

This figure graphically presents the percentage of firms with one segment. The figure indicates geographic and business segment is determined by segmental assets and sales. The terms used on the table are defined as follows.
DGA and DGS shows the percentage of firms with one geographic segment represented by segmental assets and segmental sales respectively
DBA and DBS shows the percentage of firms with one business segment represented by segmental assets and sales respectively



The figures 4.4 and 4.5 clearly show that the numbers of firms operating in single geographic segments in LSE-FASI-Firms are fewer than firms operating in single business segments. The results also indicate that most LSE-FASI-Firms have three or more segments in both geographic and business diversification.

Table 4.7: Number of disclosed geographic segments

This table shows the average number of geographic segments disclosed by firms across the three sample groups. No. indicates the number of cases that disclosed the corresponding number of geographic segments as defined by segmental assets. % represents the percentage of cases that disclosed the corresponding number of segments.

No. of segments	2003		2006		2010	
	No.	%	No.	%	No.	%
1	45	21.6	68	22.8	65	19.7
2	39	18.8	51	17.1	57	17.3
3	54	26.0	79	26.5	89	27.0
4	38	18.3	57	19.1	67	20.3
5	20	9.6	23	7.7	27	8.2
6	8	3.8	12	4.0	14	4.2
7	2	1.0	5	1.7	6	1.8
8	0	0.0	1	0.3	1	0.3
9	1	0.5	1	0.3	2	0.6
10	1	0.5	1	0.3	2	0.6
Total	**208**	**100**	**298**	**100**	**330**	**100**

Figure 4.4: Percentage of geographic segments across groups

This figure presents the percentage of the number of geographic segments as represented by segmental assets across the 3-4-year groups. The figure is constructed from table 4.7. 2003, 2006, and 2010 represent the three groups

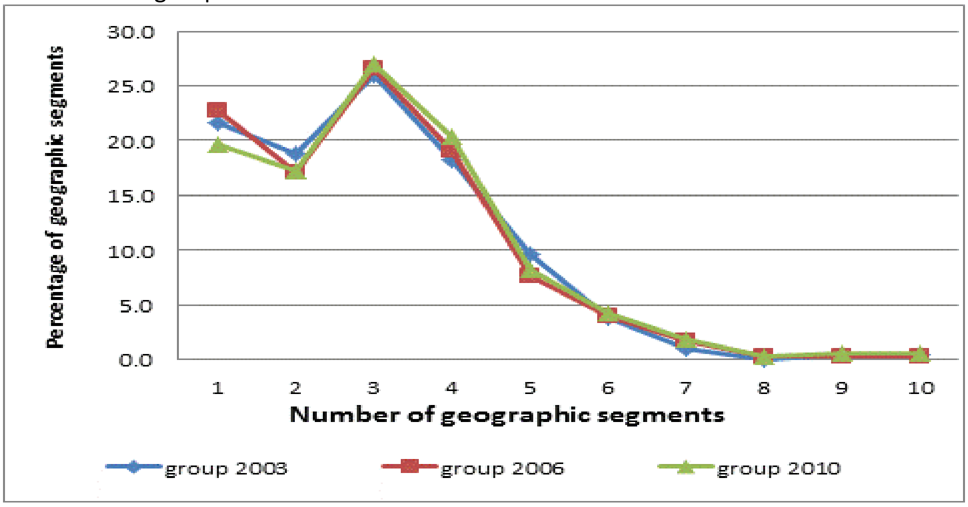


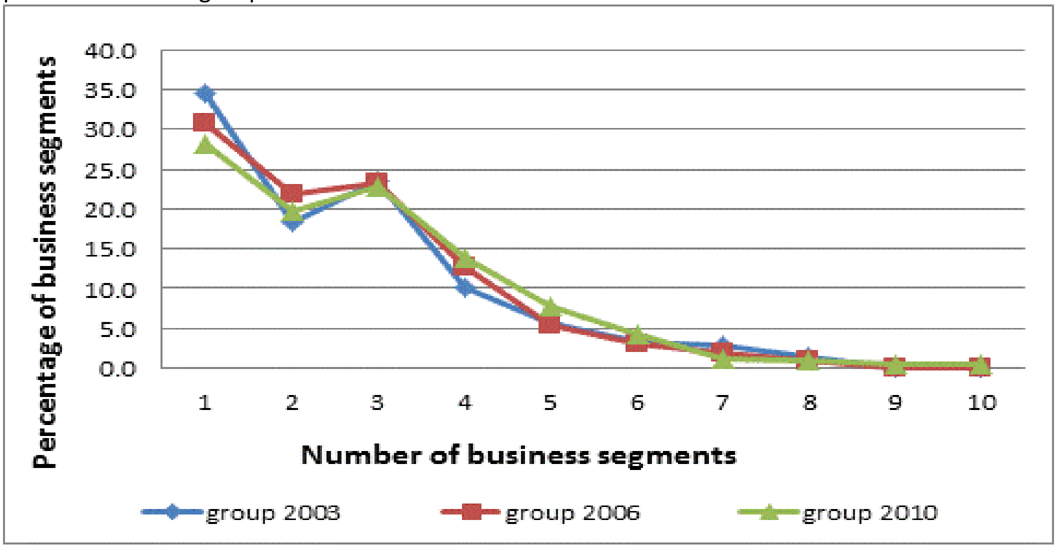
Table 4.8: Number of disclosed business segments – segmental assets

This table shows the average number of business segments disclosed by firms across the three sample groups. No. indicates the number of cases that disclosed the corresponding number of business segments as defined by segmental assets. % represents the percentage of cases disclosed by the corresponding number of segments. 2003, 2006, and 2010 represent the three groups

No. of segments	2003		2006		2010	
	No.	%	No.	%	No.	%
1	72	34.6	92	30.9	93	28.2
2	38	18.3	65	21.8	65	19.7
3	49	23.6	69	23.2	75	22.7
4	21	10.1	38	12.8	46	13.9
5	12	5.8	16	5.4	26	7.9
6	7	3.4	9	3.0	14	4.2
7	6	2.9	6	2.0	4	1.2
8	3	1.4	3	1.0	3	0.9
9	0	0.0	0	0.0	2	0.6
10	0	0.0	0	0.0	2	0.6
Total	**208**	**100**	**298**	**100**	**330**	**100**

Figure 4.5: Percentage of business segments

This figure presents the percentage of the number of business segments as represented by segmental assets across the 3-4-year groups. The figure is constructed from table 4.8. 2003, 2006, and 2010 represent the three groups.



To summarise, the results presented in this subsection clearly shows that the changes in accounting and financial reporting standards have little impact on the number of disclosed segments. Specifically, it appears that most firms consider segments with less than 10% segmental assets as discrete segments (table 4.5). This is important observation because it allows me to consider segments with less than 10% sales or asset in the analysis as discussed later in chapter 5

Empirical and theoretical evidences have shown that entropy index of diversification is still important and superior to other measures of diversification [51], and I use entropy index in the current research to measure level of diversification. According to Jacquemin and Berry, (1979), the entropy index is calculated using the formula below.

$$D = \sum_{i} \left[Pi\; X \ln \frac{1}{Pi} \right]$$

Where: D represents degree of business/geographic diversification; P_i is the proportion of sales (assets) attributed to business/geographic segment$_i$, and $\ln \frac{1}{Pi}$ is the natural logarithm of the inverse of P_i that is $\ln \frac{1}{Pi}$ represents the weights given to each segment.

Analysis of the research literature has also shown that corporate diversification and firm performance are measured differently in different studies (table 2.3 and table 2.4 in chapter 2). These different measures appear to only partly represent the underlying concepts, for example proxies of corporate diversification (Sullivan, 1994) and growth opportunity (Danbolt et al., 2011) were empirically found to not sufficiently represent the concepts. Danbolt and others empirically verified that most proxies of growth opportunity do not sufficiently represent growth opportunity. They noted that measures of growth have differing abilities to predict the growth of firms. They found that "none of the measures are successful in predicting earning growth" (p.21). This implies that multidimensional concepts such as profitability, diversifications, and firms size are often misrepresented when a single measure is used to represent these multidimensional concepts as suggested in Sullivan, (1994), and discussed later in chapter 5. Therefore this research uses macrovariables to reduce the problem of multidimensional concepts misrepresentation as suggested in Ragin, (2000)[52]

[51] Section 5.3.2 provides a discussion as to why entropy index is superior to other corporate diversification indexes.

[52] The problem of multidimensional concept misrepresentation and macrovariable development are discussed in chapter 5

4.3.1.3: Descriptive literature to fill methodological gap

One of the objectives of chapter 3 was to explain how FSA fits to this research. This literature was therefore used as a second stage of research method development. This stage was used to justify the FSA for this research. The key features presented in section 3.3.3 in chapter 3 clearly indicated that the use of FSA can reduce the partial, fragmented, and conflicting results indicated in chapter 2.

FSA uses fuzzy set values that enable a researcher to assign cases into different configurations. Each case is a unique configuration of 3-4 year averages of geographic and business diversification, leverage, internal fund, firm size, and asset intangibility and tangibility fuzzy set values[53]. Each configuration comprise of a series of fuzzy set values in a series of fuzzy sets. Each fuzzy set is associated with categories of variables drawn from the literature review in section 2.3 and listed and defined in table 4.4. Criteria that were used to calibrate the original variables to fuzzy sets are summarised in table 1.3 and discussed in chapter 5.

Furthermore, the combination of analytical and descriptive literature indicated the need to use macrovariables to define multidimensional concepts as discussed in chapter 1 section 1.5 of this thesis. Specifically, geographic and business diversification, profitability, and firm size are all measured using macrovariables. The following subsection provides illustrative examples of calibration process and how macrovariables are developed.

4.3.1.4: Calibrated variables and Macrovariable development

Section 3.3.2 of this thesis discusses how and why original variables need to be calibrated, and why this research applies calibrated variables. In order to calibrate original variables into fuzzy set values, researchers are required to apply external standards (Ragin, 2000; 2008; Ragin and Pennings, 2005; Verkuilen, 2005; Greckhamer et al., 2008; Fiss, 2011), as such this research uses the existing research to establish the three thresholds (full membership, cross-over point, and full non-membership) for calibration processes.

[53] Section 4.3.2.2 of this thesis explained how and why the sample was split into 3.4 years

Previous researchers, who used accounting data like return on assets (ROA), transformed original variable to fuzzy set by using percentiles. 75^{th} or 80^{th} percentiles were frequently used for benchmarking full membership, while medians or means were used to benchmark cross-over point, and 25^{th} or 20^{th} percentiles were used to benchmark full non-memberships (see for example Greckhamer et al., 2008; Fiss, 2011). In this research all variables are represented by accounting measures (ratios), therefore the original variables are benchmarked using percentiles unless there is a theoretical and practical implication for using alternative criteria. Means or medians are used interchangeably depending on data skewness. In highly skewed data the median is used, while in normally distributed data mean is usually used to determine the cross-over point (fuzzy value 0.5) (Fiss, 2011). More discussion of the calibration process is given in chapter 5 of this thesis.

Macrovariable

Multi-dimensional concept misrepresentation was argued to be one of the sources of biased, trivial and unreliable results (Nunnally, 1978; Sullivan, 1994), and misleading conclusions (Purkayastha et al., 2011) in corporate diversification-performance relationships. This research intends to reduce this problem using macrovariables as suggested by (Ragin, 2000; 2008).

Advantages of using macrovariables include: (1) reduction of the problems of variable selection bias for representing multi-dimensional constructs as documented by previous researchers (Nunnally, 1978; Sullivan, 1994), (2) reduction of the problem of missing values as one variable can substitute the other, and (3) based on strongest link rule, macrovariables tend to satisfactorily represent the construct (Ragin, 2000), and therefore reduces the possibility of rejecting or accepting wrongly the null hypothesis in the case of hypothesis testing as noted in (Bagozzi et al., 1991). Therefore, the application of macrovariables is likely to lead to more reliable and valid results.

The logic behind the application of macrovariables lies in the "substitutability principle" which puts more emphasis on the "strongest link"; that is, if two variables measuring the different aspects of a multi-dimensional concept, then, the variable with highest membership (strongest link) substitutes for the other variables in representing a multidimensional concept (Ragin, 2000, p.322). The determination of a macrovariable is based on the fuzzy set logical "or" which advocates the selection of a variable with the highest membership in the concept of interest (ibid).

Table 4.9 and table 4.10 illustrate how the macrovariables index is created. These tables show that degrees of geographic and business diversification can be measured using both segmental assets and sales entropy index. These entropy index values are then transformed to fuzzy set values. These fuzzy set values then allow each case to be assigned a membership state in geographic and business diversification ***sets*** (see figure 1.2). A case is classified as high diversified if its entropy measure of diversification is higher than 0.6 (fuzzy set value 0.5), otherwise, it is classified as not-high diversified.

Table 4.9: Illustration of geographic diversification macrovariable development

This table illustrates how fuzzy set logical ***"or"*** is used to develop macrovariables. Bold figures are used to represent macrovariables; they are relatively greater than their corresponding alternative measure. This is consistent with macrovariable development requirements as defined in (Ragin, 2000). **Entropy** represents entropy index which refers to the degree of geographic diversification in firms as measured by segmental assets and sales. **Fuzzy set** represent fuzzy set values that show firms' memberships in geographic diversification across segmental assets and segmental sales, the higher the value the higher the memberships

COMPANY - 2006	Degree of Geographic Diversification					
	Segmental assets		Segmental sales		higher of segmental sales *or* assets (Macrovariable)	
	Entropy	Fuzzy set	Entropy	Fuzzy set	Entropy	Fuzzy set
AEGIS GROUP PLC	0.9	0.9	**0.92**	**0.92**	**0.92**	**0.92**
AGGREKO PLC	**1.35**	**1.0**	1.24	0.99	**1.35**	**1.0**
ANITE PLC	0.66	0.61	**1.16**	**0.99**	**1.16**	**0.99**
ARM HOLDINGS PLC	**0.73**	**0.73**	0.59	0.48	**0.73**	**0.73**
BLOOMSBURY	0.63	0.56	**0.76**	**0.77**	**0.76**	**0.77**
CSR PLC	0.3	0.1	**0.65**	**0.59**	**0.65**	**0.59**
DEBENHAMS PLC	0	**0.01**	0	**0.01**	**0.01**	**0.01**
DECHRA PHARMA	0.02	**0.01**	0.01	**0.01**	**0.01**	**0.01**

More specifically, table 4.9 shows that when geographic segmental sales are used to measure the degree of geographic diversification of Arm Holdings Plc, its degree of geographic diversification becomes 0.48 (entropy 0.59) and therefore classified as not-highly diversified. However, when geographic segmental assets are used, this firm is classified as highly geographically diversified (entropy measure 0.73 which is equivalent to 0.73 fuzzy value).

The question here is, is Arm Holdings Plc highly geographically diversified? If the aim is to determine the degree of ***geographic*** diversification, the answer will be "yes" because Arm Holdings Plc's 'strongest link' to geographic diversification is segmental assets and not segmental sales. In this context a macrovariable is used (that is the higher of the two measures – fuzzy set value 0.73) as shown in the last column of table 4.9. In the same way table 4.9 shows that geographic diversification of Anite Plc, Bloomsbury, and CSR Plc are determined by the segmental sales entropy index rather than segmental assets.

Table 4.10: Illustration of business diversification macrovariable development

This table illustrates how fuzzy set logical "or" is used to develop macrovariables. Bold figures are used to represent macrovariables; they are relatively greater than their corresponding alternative measure. This is consistent with macrovariable development requirements as defined in (Ragin, 2000). **Entropy** represents entropy index which refers to the degree of business diversification of firms as measured by segmental assets and sales. **Fuzzy set** represents fuzzy set values that show firms' memberships in business diversification across segmental assets and segmental sales, the higher the value the higher the memberships. Bold figures are used to represent macrovariables; they are relatively greater than their corresponding alternative measure. This is consistent with macrovariable development requirements as defined in (Ragin, 2000)

COMPANY - 2006	Degree of Business Diversification					
	Segmental assets		Segmental sales		higher of segmental sales *or* assets (Macrovariable)	
	Entropy	Fuzzy set	Entropy	Fuzzy set	Entropy	Fuzzy sets
AEGIS GROUP PLC	0.50	0.33	0.67	**0.64**	**0.67**	**0.64**
AGGREKO PLC	**0.62**	**0.54**	**0.62**	**0.54**	**0.62**	**0.54**
ANITE PLC	1.17	0.99	**1.23**	**0.99**	**1.23**	**0.99**
ARM HOLDINGS PLC	0.80	0.82	**0.83**	**0.84**	**0.83**	**0.84**
BLOOMSBURY	0.58	**0.46**	0.50	0.31	**0.58**	**0.46**
CSR PLC	0	**0.01**	0	**0.01**	**0**	**0.01**
DEBENHAMS PLC	0	**0.01**	0	**0.01**	**0**	**0.01**
DECHRA PHARMA	**0.53**	**0.37**	0.26	0.07	**0.53**	**0.37**

In the same way, table 4.10 shows that Aegis Group Plc's has 0.33 and 0.64 memberships (fuzzy set values) in the set of business diversification when the entropy measures are calculated using assets and sales respectively. These memberships are combined using fuzzy set logical "or" to give membership value of 0.64 which represents a macrovariable. This implies that segmental sales as a measure of business diversification has stronger link than segmental assets in Aegis group. The same procedures have been used to determine macrovariables for other multi-dimension variables as will be discussed in chapter 5.

Basically in FSA research, it can be simply argued for example that geographic segmental assets and sales are like two ***"tickets***" that enable firms to enter into a set of high geographic diversified firms such that any of these tickets allow the firm to enter the set. Assuming that every firm is interested to enter into the set, then it follows that every firm choose a ticket that would give better chance of entering the set. This means a ticked that gives a strongest link to the set will be chosen to represent the firm in the set. Basing on this idea, this research is intending to identify firms that have high or not-high memberships in geographic diversification set and other firm attributes in order to understand the consistency of their memberships in financial performance sets (firm value, profitability, and risk-return performance). Therefore, macrovariable have been used as mean to allow all the "tickets" for entering the set to have equal representation in the set.

4.3.2: DATA AND SAMPLE

4.3.2.1: DATA SOURCE AND SAMPLE PERIOD

This research uses data from firms listed in London Stock Exchange FTSE AllShare Index (LSE-FASI-Firms) for a ten-year cross-sectional period (2001-2010). The ten-year cross-sectional period was selected not only because previous researchers have noted that the consequences of geographic and business diversification is seen over a longer period rather than a one-year period (Bodnar et al., 1999; Barnes and Hardie-Brown, 2006), but also because geographic and business diversification is not a one-year strategic decision as it needs a longer time-period window. In this case, cross-sectional one-year data may not only lead to year-specific biased results but also would not capture the impact of geographic and business diversification strategy on financial performance. Consequently researchers on corporate diversification usually use average cross year periods (see for example Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993; Barnes and Hardie-Brown, 2006). Therefore a ten-year cross-sectional period (2001-2010) is important to establish a better understanding of how geographic and business diversification sufficiently leads to favourable financial performance.

Because corporate diversification is a strategic decision that can be examined over longer period, and in order to avoid the impact of differences in economic and corporate governances in geographic and business diversification across the sample period (Bodnar et al., 1999; Barnes and Hardie-Brown, 2006) in data set, and in consistent with previous researchers like (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993), the ten-year period (2001-2010) was subdivided into three year groups with 3-4year averages namely: 2003, 2006, and 2010 in order to create data that reflect longer period and create data set that would provide more than not similar information as regards to corporate governance and economic conditions across the ten years period as will be discussed later. The 2003 group represents the averages of variable measurements for the first three years (2001-2003), the 2006 group represents the next three years (2004-2006), and the 2010 group represents a 4-year average (2007-2010). I call these groups 3-4year average groups because they were created using 3-year averages and 4-year averages. The 3-4year average groups were then pooled together in order to create large data set that would allow to do significance testing on configurations to be obtained from the truth table analysis (see empirical chapters).

I examined the statistics of the variables across these periods and I noted that although geographic and business diversification across the periods were not significantly different, the market value, profitability, business risk, financing choice and asset structure were significantly different across the period as indicated in table 4.11. This implies that the impact of corporate diversification on financial performance need to be examined in connection with other firm attributes (Morck and Yeung, 1991; 1992; 1997; Bodnar et al., 1999; Martin and Sayrak, 2003; Barnes and Hardie-Brown, 2006) as suggested in chapter 1 of this thesis.

Table 4.11: Descriptive statistics and means comparison across the groups

This table compares means of the cases across the three groups involved in this study. **MTB** = Market to book ratio is the measure of market value. **ROA** and **ROS** are profitability measures that represent return on assets and return on sales respectively. **SDROA** and **SDROS** are business risk measures defining volatility in profitability as measured by standard deviation of ROA and standard deviation of ROS respectively. **DGA** and **DGS** - these are diversification measures defined by geographic segmental assets and sales respectively: **DBA** and **DBS** – these are diversification measures defined by business segmental assets and sales respectively. **TDTA** and **RETA** are financing choice measures defined as percentages of total debt on total assets and percentage of retained earnings on total assets respectively. **SIZEA** and **SIZES** = measures of firm size, defined as total firm assets and sales in billions £ respectively. **INTA** and **TANG** are asset structure measures defined as a percentage of total intangible assets on total assets and a percentage of total tangible assets on total assets respectively. All measures are in 3-years averages or 4-year averages as discussed above (for more definitions of terms see table 4.4 above). 2003, 2006, and 2010 represent the three groups and the numbers in the brackets represents the number of firms.
***, **, and *, implies conventional significant levels at the 1%, 5%, and 10% (2-tailed t-test) respectively

Variables	2003 (208)		2006 (298)		2010 (330)		2003/ 2006	2003/ 2010	2006/ 2010
	Mean	SD	Mean	SD	Mean	SD	t-test	t-test	t-test
MTB	1.58	0.90	1.87	1.10	1.61	0.81	-3.088***	-.445	3.285***
ROA	4.77	9.57	8.17	8.32	7.17	7.85	-4.253***	-3.177***	1.546
ROS	10.10	12.75	13.49	14.02	13.04	15.61	-2.776***	-2.276**	.380
SDROA	4.29	6.78	4.22	5.22	6.21	7.70	.148	-2.943***	-3.763***
SDROS	3.40	6.62	3.60	6.08	4.99	8.45	-.346	-2.308**	-2.353**
DGA	0.61	0.48	0.61	0.50	0.66	0.53	-.104	-1.103	-1.107
DGS	0.64	0.50	0.67	0.52	0.72	0.55	-.455	-1.643*	-1.324
DBA	0.55	0.52	0.54	0.48	0.62	0.52	.286	-1.491	-2.025**
DBS	0.62	0.54	0.59	0.49	0.62	0.50	.562	.033	-.614
TDTA	24.60	17.93	23.98	17.76	25.71	17.05	.382	-.723	-1.243
RETA	11.63	31.08	13.77	31.85	19.36	32.17	-.751	-2.751***	-2.186**
INTA	15.57	17.12	18.84	19.10	24.55	21.68	-1.974*	-5.058***	-3.486***
TANG	36.82	26.83	32.78	26.31	31.63	26.14	1.687*	2.220**	.548
SIZA	2.98	8.27	3.14	10.89	5.34	18.85	-.174	-1.706*	-1.771*
SIZS	2.60	9.56	2.51	9.37	4.31	19.44	.108	-1.183	-1.457

Given these ending, it appears necessary to conduct configurational approach to identify configurations of corporate diversification and other attributes that consistently show favourable or unfavourable financial performance. In order to ensure that the resulting configurations are sufficient for favourable financial performance, I also intended to use probabilistic test to understand if the resulting configuration are significant. In this context, it is necessary to pool together the data that specifically reflects these periods in order to obtain enough cases to test significance of configurations and reduce chances of obtaining period biased results.

It should be noted that the groups are ***not*** intended for longitudinal study; rather they are used to obtain relevant cases across the ten year period. I examined configurations in every period to understand if the three periods matters, It appears that the periods matters when it comes to determination of sufficient configurations. However, the robust configurations observed in the pooled sample were also found among configurations in the sample across the period. This implies that individually the 3-4year average sample groups may not provide robust evidence about sufficiency of geographic and business diversification for favourable financial performance indicators. However, it could interesting but challenging to future research to consider the three groups using longitudinal research design to identify specific configurations across the three periods. I will now explain the logic underlying the selection of the three periods

The 3-4year average groups (2003, 2006, 2010), have been created based on corporate governance effectiveness and economic conditions observed over the ten-year period. The 2003 group is associated with the lack of effectiveness of non-executive directors in monitoring managers (Solomon, 2007). This period is also associated with mushrooming of corporate scandals associated with corporate performance "masking" (see table 4.12). Although, table 4.12 involve most firms from USA, it is expected that the impact of the scandals would not exclude firms listed in London stock exchange. Solomon noted that the collapse of Enron in 2001 was associated with lack of effective corporate governance, and this had greater contribution for the issuance of the Higgs Report and the Smith Report in 2003 (Solomon, 2007, p.11). The issuance of these reports may imply that during and before 2003, corporate governance in the UK listed firms was less effective (Faure-Grimaud et al., 2005)[54]. Thus, I consider the period of 2001-2003 as a period of less effective corporate governance such that diversification during this period might be associated with "growth masking" that favour managers' rather than shareholders' interest. In this context, average of data during this period is important to understand

[54] Faure-Grimaud et al., (2005), noted that compliance to the combined code (1998-2004) of the sample firms drawn from FTSE 350 indicated increased sharply in 2004 (figure. 1) which implies that there is improvement on corporate governance after issuance of the Higgs Report, Smith Report and other related corporate governance reports in 2003.

configurations with similar corporate governance regime this reduces the need to include this variable.

Table 4.12 shows that most of the scandals that were associated with accounting transactions were aimed at falsifying growth and expansion. This implies that corporate diversification decisions during the period of 2001-2003 might be aimed at benefiting executives rather than shareholders. Therefore, across this period, diversification might have a negative impact on firm value, profitability and risk-return performance. Indeed, table 4.11 shows that there is relatively lower firm value and profitability of group 2003 than in the other groups.

The second group (2006) is associated with a series of corporate governance reports in the UK such as: the Higgs report January 2003, the Tyson report June 2003, the Smith report 2003, and the combined code July 2004 (reviewed in 2006). These corporate governance reports were aimed at ensuring good corporate governance in order to restore the trust of investors in managers' strategic decisions such as geographic and business diversification (Solomon, 2007). During these periods, the corporate diversification strategy might be for the interest of shareholders[55]. Indeed, table 4.11 indicates that during this period average firm value and profitability appear to be higher than in other periods. These changes in financial performance may be associated and corporate governance effectiveness and economic cycle, and it may be interesting for future research to examine the impact of changes in corporate governance and economic conditions on financial performance to understand how the combination of these conditions may explain financial performance. However, for the purpose of this research, attention has been given on how corporate diversification and other corporate attributes combine for better financial performance across the different corporate governance regime and economic cycle.

The period of 2004-2006 is therefore used to create data that would have more than not similar effectiveness of corporate governance and economic cycle that those of the 2003 and 2010 groups. It can be recalled that financial crisis hit the world since

[55] This thesis assumes that the corporate governance reports might impact on the next accounting periods rather than current. Thus corporate governance reports in year 2003 would have made an impact in 2004 and the next years.

2007. In this cases, this research also create group of data that will reflect similar impact of the financial crisis as explained below.

Table 4.12: List of major corporate scandals (2000-2002)

This table shows list of scandals that happened between 2000 and 2002 that used accounting numbers to mask reality of financial performance across different corporations

Company Name	Time	Key Allegations
Adelphia Communications	April 2002	Over stated results by inflating capital expenses and understated or hide liabilities.
AOL Time Warner	July 2002	During the merger of AOL with Time Warner in January 2001, Executives inflated the value of AOL stock, inflated sales by booking barter deals and "round-trip" deals. Round-trip deals refer to an attempt to inflate the number of purchases and sales of certain assets/securities in order to increase volumes of business transactions. The round-trip deal of AOL was with advertisers and suppliers that led to a loss of more than $500 million
Bristol-Myers Squibb	July 2002	Inflated revenue by forcing wholesalers to take inventory above their capacity in order to get stock off the books and be replaced by sales (cash).
CMS Energy	May 2002	Engaged in round-trip trade deals to boost energy trading volume
Duke Energy	July 2002	Engaged in round-trip trade deals to boost trading volumes and revenue.
Dynegy	May 2002	Engaged in round-trip trade deals to falsely enhance trading volume and cash flow
El Paso	May 2002	Engaged in round-trip trade deals to boost energy trading volume
Enron	October 2001	Boosted profits and equity while understating liabilities in order to shows high growth and expansion. Enron also bribed foreign governments to win contracts abroad.
Global Crossing	February 2002	Inflated revenues
Homestore.com	January 2002	Inflated sales by booking barter transactions as revenue.
Kmart	January 2002	Mislead investors about company’s financial health.
Mirant	July 2002	Overstated assets and liabilities.
Peregrine Systems	May 2002	Overstated sales/revenue from third-party resellers
Qwest Communications International	February 2002	Inflated revenue
Reliant Energy	May 2002	Performed round-trip business deals to increase sales volumes and revenue.
WorldCom	March 2002	Overstated cash flow and overstatement of assets and understating of expenses. Operating expenses were recorded as capital expenditures
Xerox	June 2000	Boosted income

Finally, group 2010 is marked by financial crisis which may have negative or positive impact on financial performance depending on corporate diversification level. During this period LSE-FASI-Firms are expected to make different decisions about diversification strategies in response to the impact of the crisis on financial performance. It has been noted that high level of corporate diversification (conglomerate) gave firms financing and investment benefits (Kuppuswamy and Villalonga, 2010; Rudolph and Schwetzler, 2013), which may enhance financial performance. In specific, for example Kuppuswamy and Villalonga, (2010) find that the financial crisis that hit the world (2007-2009) enhanced the efficiency of internal market allocations, and because high diversification enables firms to access external funds (debt capital) at relatively lower cost, then high diversified firm appeared to benefit more from two effects: “more money” and smart “money effects” than focused firms. More mony effect results from consurance feature of congromentes (Lewellen, 1971), and the smart money effect arise from increased internal capital market effeciency (Rudolph and Schwetzler, 2013, p.154). in this context, Kuppuswamy and Villalonga, (2010) conclued that impact diversification and its drivers on financial performance vary with economic cycles and financial limitations, and high corporate diversification can serve as insurance for investors. In the similar ways, Rudolph and Schwetzler, (2013) noted that discounts on conglomerate was lower during the financial crisis (2008-2009).

Basing on these studies, it appears important to create data set that would show more than not similar economic conditions. In this context, group 2010 data was created by computing the average of 2007-2010 period.

This research uses set-theoretic framework that requires to identify memberships of cases (firms) into a particular set (variables). Therefore, average measures of variables (three or more years period) are important to obtain average membership of a case into a particular set. This will help provide batter classification of a case in a particular set rather than using one year memberships. In this context, although the three groups (2003, 2006, and 2010) were creating basing on different corporate governance and economic cycle, they also meant to provide better classification of cases in different sets.

LSE-FASI-Firms are used because; *firstly*, previous research on corporate diversification-performance relationship focused more on US firms and there is limited research on UK firms (Barnes and Hardie-Brown, 2006). However, the history of corporate diversification indicated that UK and US listed firms have similar diversification trends (see section 2.2 of this thesis).

Secondly, there are contradicting results as to whether business and geographic diversification are complementary or substitutable (Davies et al, 2001). However, Matraves and Rodriguez, (2005), concluded that the two strategies are complementary rather than substitutable in the firms listed in UK capital market. This raised the question of how geographic and business diversification complements for favourable financial performance of LSE-FASI-Firms.

Thirdly, it shows that LSE-FASI-Firms are increasing their degree of diversification (see figure 2.3).[56] But, evidence shows that high corporate diversification destroys financial performance (Berger and Ofek, 1995; Lins and Servaes, 1999; Barnes and Hardie-Brown, 2006). The open question therefore is that if geographic and business-diversified firms destroy value, why LSE-FASI-Firms are increasing geographic and business line operations? The simple answer to this question is that "diversification is bad for some firms and good for others" (Matsusaka and Nanda 2002, p.176). This research has chosen LSE-FASI-Firms in order to understand how diversification is good or bad for them.

4.3.2.2: DATA SAMPLE SIZE

Table 4.13 shows sample size based on diversification categories across the ten year cross-sectional period (2001-2010). This table lists data from firms with not missing geographic and business segmental data in the DataStream across the period and the four diversification strategies. A total of 3129 year-firms sample have been arrived after eliminated firms with missing data on geographic and business diversifications. Firms with missing data were eliminated because FSA require cases with complete data in order to provide good analysis (Seawright, 2005), I used this dataset (3129 observations) for examining diversification trend (see figure 2.3) and selection of

[56] See section 2.2.4 and section 4.3.1.2 for details on diversification trend of the LSE-FASI-Firms

sample (137) firms for examination of segments with less than 10% of firm's assets (see table 4.6). This dataset was also used to create four diversifications strategies: HGHB, HGLB, LGHB, and LGLB as defined in table 4.16 which were further used analysis the results of this thesis. Therefore, table 4.13 presented the distribution of the 3129 observation across the four diversification strategies. This dataset was therefore important for understand diversification trend and strategies in LSE-FASI-Firms. However as explained above, the dataset would not be able to provide good picture about firms' memberships in a corporate diversification set.

Table 4.13: Sample size on a yearly basis and configuration

This table shows the number of firms listed in the London Stock Exchange FTSE All Share Index (defined in this research as LSE-FASI-Firms) for the last ten years (2001-2010). The table lists only firms that appear to have geographic and business segmental information disclosed in the respective year. The table also shows four diversifications strategies as defined below, and further discussions are in section 5.1 of this thesis:

HGHB = Percentage of firms with high membership in both geographic and business diversification whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to fuzzy set value (fs) higher than 0.5.

HGLB = Percentage of firms whose entropy measures are above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB= Percentage of firms with non-high memberships (entropy measure equal or less than 0.6 (fs ≤ 0.5) in either geographic segmental assets ***or*** segmental sales and high memberships in business diversification that is business segmental assets ***or*** segmental sales entropy measure higher than 0.6 (fs > 0.5)

LGLB= Percentage of firms with low memberships in both geographic and business diversification, that is entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

No. = Number of firms in a particular year and diversification category

% = Percentage of firms in a particular year and diversification category.

YEARS	HGHB		HGLB		LGHB		LGLB		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
2001	76	**32.8**	49	**21.1**	36	**15.5**	71	**30.6**	**232**	**100**
2002	83	**32.4**	51	**19.9**	44	**17.2**	78	**30.5**	**256**	**100**
2003	89	**33.2**	63	**23.5**	48	**17.9**	68	**25.4**	**268**	**100**
2004	102	**33.8**	76	**25.2**	58	**19.2**	66	**21.9**	**302**	**100**
2005	105	**34.0**	78	**25.2**	58	**18.8**	68	**22.0**	**309**	**100**
2006	128	**37.3**	84	**24.5**	59	**17.2**	72	**21.0**	**343**	**100**
2007	138	**39.0**	87	**24.6**	58	**16.4**	71	**20.1**	**354**	**100**
2008	143	**39.4**	92	**25.3**	59	**16.3**	69	**19.0**	**363**	**100**
2009	138	**39.4**	86	**24.6**	58	**16.6**	68	**19.4**	**350**	**100**
2010	138	**39.2**	86	**24.4**	58	**16.5**	70	**19.9**	**352**	**100**
TOTAL	**1140**		**752**		**536**		**701**		**3129**	

Furthermore, basing on this sample, I created three groups: 2003, 2006, and 2010 by calculating 3-4year averages as explained above. In making this calculation, I considered only those firms with complete 3-4years geographic and business diversifications data this leads to a total of 884 observations 3-4years average data which in this study are referred to as *cases* (see figure 4.6 below). Since the missing data are not allowed in this research (Seawright, 2005), and since the aim is to understand how corporate diversification and other firm characteristics are "connected" to create configurations that sufficiently indicate favourable financial performance, then every case must have all the variables without any missing data. Seawright, noted that unless missing variables are avoided, a configuration approach "is not an improvement over regression analysis" (p. 25). This because missing variables would not allow better connection of case's memberships across variables (sets). Therefore, all cases with missing data on any of the 884 cases were eliminated from the analysis to obtain the 836 "***clean cases***" as shown in table 4.14.

Table 4.14: Sample size in 3-4year average and configuration

This table shows the number of LSE-FASI-Firms across the three groups: 2003, 2006, and group 2010, and their four diversification strategies. Definitions of terms are summarised here below

HGHB =	Percentage of firms with high memberships in both geographic and business diversification whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to fuzzy set value higher than 0.5.
HGLB =	Percentage of firms whose entropy measures are above 0.6 (fs > 0.5) in geographic diversification and equal to or below 0.6 (fs ≤ 0.5) in business diversification
LGHB=	Percentage of firms with non-high memberships (entropy measure equal to or less than 0.6 (that is fs ≤ 0.5) in either geographic segmental assets ***or*** segmental sales and high memberships in business diversification that is business segmental assets ***or*** segmental sales entropy measure higher than 0.6 (fs > 0.5)
LGLB=	Percentage of firms with low memberships in both geographic and business diversification, that is entropy measure of diversification equal to or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales
No. =	Number of firms in a particular year and diversification category
% =	Percentage of firms in a particular year and diversification category.

Groups	HGHB		HGLB		LGHB		LGLB		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
2003	76	36.5	49	23.6	33	15.9	50	24.0	**208**	100
2006	101	33.9	74	24.8	55	18.5	68	22.8	**298**	100
2010	138	41.8	70	21.2	56	17.0	66	20.0	**330**	100
TOTAL	**315**	**37.7**	**193**	**23.1**	**144**	**17.2**	**184**	**22.0**	**836**	100

To summarise, the sample of 3129 year firms was arrived after dropping all the cases with missing geographic and business diversification variables. This allowed examination of diversification trend, segmental reporting practices, and creation of the four diversification strategies. The sample of 836 cases was arrived after calculating 3-4year averages across all the variables used in this research and dropping the cases with any missing data. The average was done for two purposes: first, to create a longer "window" for examining corporate strategies which normally their impact takes longer period, this window allows better assignment of cases' memberships into sets. Second, the 3-4year average allows obtaining data that would provide configurations with more than not similar information about corporate governance and economic cycles. Finally, the sample of 137 firms, although was first randomly selected but was then screened to keep 137 firms with two or more geographic segmental assets.

The sample presented in 4.14 may appear not very large when related to econometric models criteria. However, FSA is different from econometric models which assume that data is randomly drawn from certain probability distributions, and sample size is important to justify whether the selected sample adequately represents the target population.

FSA is grounded on non-random samples (Fiss, 2011). What is important to FSA is to assign cases with memberships in variables of interest based on the theoretical and substantive knowledge of the researcher (Ragin, 2000). The FSA's main proposition is that cases are best understood by looking at how their attributes are connected and how cases are grouped to create configurations that consistently show certain behaviours (outcome). This leads to the sample size appearing less important when FSA is used (Fiss, 2011). However, this research initially employs a relatively large sample size. It uses 3129 year firms as indicated in table 4.13 which were then transformed into 3-4year averages and "cleaned" for missing data to reduce the sample to 836 cases as in figure 4.4. The next subsection presents characteristics of the variables with regard to descriptive statistics and correlations based on the sample of 836 cases.

4.3.2.3: Sample Characteristics – Descriptive statistics.

This subsection provided characteristics of the variables used in this research with regards to mean, standard deviations, skewness and correlations. Table 4.15 is divided into two parts: lower and upper in order to clearly see how proxies of multidimensional concepts are likely to provide conflicting results. The descriptive statistics helps to identify features of the data collected and provide a summary of the sample in terms of centrality and disparity tendencies.

The proxies of profitability, business-risk, geographic diversification, business diversification, and firm size at the lower part of the table are return on assets (ROA), geographic segmental assets (DGA), business segmental assets (DBA), and total assets (SIZEA) respectively. While in the upper part the proxies of the concepts are: return on sales (ROS), geographic segmental sales (DGS), business segmental sales (DBS), and net sales (SIZES) respectively

Table 4.15 shows that different proxies of multidimensional concepts exhibit different means, standard deviations, and degrees of skewness. This leads to differences in the correlations of measures of a multidimensional concept with other variables. For example, leverage is positively and significantly correlated with firm profitability at 1% significant level when profitability is measured ROS, but leverage is negatively and significantly correlated with profitability when measured by ROA at 5% significant level. Also asset tangibility is positively correlated with ROS, while ROA is negatively and significantly correlated to asset tangibility.

Based on these observations, it is clear that when multidimensional concepts are represented by single measures, there is the possibility of misrepresentation as a result of variable selection bias, and this could lead to the partial, fragmented, and inclusive results observed in prior studies (see for example Sullivan, 1994), and the FSA will provide solution to this problem (see section 5.2 in chapter 5).

Table 4.15: Descriptive statistics and correlation of the “raw” case data.

This table shows descriptive statistics of the original data. The table includes different measures of multidimensional concepts that were also correlated and it appears that the correlations are perfect (1.00).

MTB = Market to book ratio is the measure of market value. **ROA** and **ROS** are profitability measures that represent return on assets and return on sales respectively. **SDROA** and **SDROS** are business risk measures defined volatility in profitability as measured by standard deviation of ROA and standard deviation of ROS respectively. **DGA** and **DGS** - these are diversification measures defined by geographic segmental assets and sales respectively: **DBA** and **DBS** – these are diversification measures defined by business segmental assets and sales respectively. **TDTA** and **RETA** are financing choice measures defined as percentages of total debt on total assets and percentage of retained earnings on total assets respectively. **SIZEA** and **SIZES** = measures of firm size, defined as total firm assets and sales in billion £ respectively. **INTA** and **TANG** are asset structure measures defined as a percentage of total intangible assets on total assets and percentage of total tangible assets on total assets respectively. All measures are in 3-year averages or 4-year averages as discussed above (for more definitions of terms see table 4.4 above). 2003, 2006, and 2010 represent the three groups and the numbers in the brackets represent the number of firms.

**, *, and ^ implies conventional significant levels at the 1%, 5%, and 10% (2-tailed t-test) respectively. Note the further definition of the variable see table 4.4

	1.70	12.47	4.10	0.68	0.61	24.82	15.45	3.24	20.28	33.33	*Mean*	***N = 836***	
	0.95	14.43	7.25	0.53	0.51	17.52	31.92	14.27	20.03	26.42	***S.D***		
	3.29	0.54	3.97	0.12	0.37	0.91	-1.18	11.42	1.04	0.76	***Skew***		
SETS	***MTB***	***ROS***	***SDROS***	***DGS***	***DBS***	***TDTA***	***RETA***	***SIZES***	***INTA***	***TANG***	***Skew***	***S.D***	***Mean***
MTB	***1***	.14**	-.05	.06^	-.02	-.07*	-.05	-.02	.05	-.22**	3.29	0.95	1.70
ROA	.41**	***.39*****	-.07*	-.00	-.05	.13**	.25**	-.02	-.06^	.21**	-1.00	8.56	6.93
SDROA	.17**	-.16**	***.38*****	-.13**	-.16**	.08*	-.14**	-.04	-.15**	.19**	3.87	6.73	5.02
DGA	.04	-.05	-.02	***.90*****	.27**	-.07*	-.06^	.16**	.27**	-.27**	0.09	0.51	0.63
DBA	-.03	-.05	-.09**	.29**	***.89*****	.09*	-.04	.05	.22**	-.13**	0.42	0.51	0.57
TDTA	-.07*	-.08*	.05	-.04	.03	***1***	-.27**	-.04	.04	.32**	0.91	17.52	24.82
RETA	-.05	.35**	-.21**	-.06^	-.02	-.27**	***1***	.08*	-.14**	.12**	-1.18	31.92	15.45
SIZEA	-.03	.00	-.03	.21**	.13**	.00	.05	***.90*****	-.03	.04	8.74	14.16	3.97
INTA	.05	-.11**	-.05	.24**	.17**	.04	-.14**	-.00	***1***	-.55**	1.04	20.03	20.28
TANG	-.22**	-.02	.01	-.27**	-.14**	.32**	.12**	.06^	-.55**	***1***	0.76	26.42	33.33

4.3.3: DATA ANALYSIS STAGE

The approach to data analysis in this thesis draws from the idea of Smithson, (2005), who argued that mainstream statistical approaches and FSA provide better results when used together. Therefore, the research questions are tested using a combination of traditional approaches such as cluster analysis, independent sample means comparison, and linear regression analysis and configuration approach - FSA. As mentioned previously this research uses two categories of research questions: supporting and key questions. The supporting research questions are analysed using the traditional approaches using SPSS software, while the key research questions are analysed using FSA and fuzzy set qualitative comparative analysis (fsQCA) software as discussed below. The list of statistical analysis mentioned above are individually outline below.

Independent sample means comparison

Independent sample means comparison is used to explain whether differences in degrees of corporate diversification lead to significant differences in financial performance and other firm characteristics. Therefore, the means of the four diversification groups: HGHB, HGLB, LGHB, and LGLB would be compared (table 4.16).

Table 4.16: Definitions of corporate diversification strategies

This table provides definitions of diversification strategy that are frequently used in this research.

Strategy	Definitions
HGHB – High geographic and high business diversified firms	Percentage of firms with high memberships in both geographic and business diversification whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to fuzzy set value higher than 0.5
HGLB – High geographic and not-high business diversified firms	Percentage of firms whose entropy measures are above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification
LGHB = Not-high geographic and high business diversified firms	Percentage of firms with non-high memberships (entropy measure equal or below than 0.6 (that is fs ≤ 0.5) in both geographic segmental assets ***and*** segmental sales and high memberships in business diversification that is business segmental assets ***or*** segmental sales entropy measure higher than 0.6 (fs > 0.5)
LGLB – Not-high geographic and not-high business diversified firms	Percentage of firms with low memberships in both geographic and business diversification, that is entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

These groups are treated as independent samples. The independent sample t-test would be used to determine whether there is a statistically significant means difference between the unrelated groups.

The null hypothesis commonly used in independent t-test states that the population means of the unrelated groups are equal:

$$H_0: u_1 = u_2.$$

Where u_1 represents the mean of cases from group 1 and u_2 represents the mean of cases in another group

The task of the researcher is to show if the null hypothesis can be rejected in favour of the alternative hypothesis, which states that the population mean of the unrelated groups is not equal:

$$H_1: u_1 \neq u_2$$

Where u_1 represents the mean of cases from group 1 and u_2 represents the mean of cases in another group

The independent sample t-test therefore assumes that the variances of the two unrelated groups are equal. This assumption of homogeneity of variance is usually tested using Levene's Test of Equality of Variances in SPSS software. SPSS usually produces results of an independent sample t-test together with ***F*** statistic and a significance value (***P***-value) of the test of homogeneity. According to SPSS results, when ***P***-value is greater than 0.05, then equal variance is assumed. While, if ***P***-value is less or equal to 0.05, then unequal variance is assumed because this violates the assumption of equality of variance and the null hypothesis is rejected.

K-mean cluster analysis

The K-mean cluster analysis is a method that groups together relatively homogenous cases based on pre-determined characteristics. Groups/clusters are determined using distances from a certain point (centre of a group) that is cases which surround a certain centre (centroid) are classified as a cluster. This method requires a researcher to specify the number of clusters to be involved in the analysis.

Cluster analysis assumes that observable variables of a latent variable exhibit linear combinations (Rodgers and Guiral, 2011), such that causal variables are grouped according to their relatedness, and highly related variables are put together. In this context, factor analysis in this research is used to identify groups of cases that have related characteristics as in (Bettis and Mahajan, 1985; Kim et al., 1989; 1993).

Regression analysis

Regression analysis in this research is used to examine if standalone geographic and business diversification brings different impacts on financial performance across the four different diversification strategies: HGHB, HGLB, LGHB, and LGLB firms. Basically, I use conditional regression analysis to understand contribution of diversification given a particular strategy. Since researchers in corporate diversification financial performance relationship found both positive and negative relations, then I expect that the impact of geographic and business diversification may be influenced by diversification strategy of firms. However, the type of diversification strategy that favours additional diversification, to the best of my knowledge is not yet identified. Therefore, this research apply condition regression analysis to reveal this issue and provide empirical evidence of how hard it is to understand the contribution of standalone geographic and business diversification on financial performance.

Fuzzy set analysis - FSA

The use of FSA to investigate the research question is one of the unique features of this thesis. The contribution of this thesis draws upon the application of FSA to analyse the data sample. In this study, the key research questions are analysed using truth tables. The truth tables are produced using the identified hypotheses that were developed using a combination of two or more theories identified in prior research. Based on the truth table outputs are used to analyse sufficiency of configurations. Furthermore, significance of configurations will be tested using Hays, (1981)'s formula as proposed in (Ragin, 2000, p.111-114).

As advised by previous researchers, in order to understand the impact of corporate diversification on financial performance, firms have to be grouped according to their similarities (Bettis and Mahajan, 1985; Kim et al., 1989; 1993; Singh et al., 2003); similar cases are assigned memberships in the variables of interests. In short, the membership assignment process is done by transforming original variables to fuzzy sets. This is done using fsQCA software[57] which uses direct methods of calibration to create a fuzzy set table.

The fuzzy set truth table produces a large number of possible configurations (see section 3.3.3.2), such that based on the possible configurations it is difficult to establish logical and theoretical understanding of the results, then application of frequency and consistency cut-offs is recommended to reduce the number of configurations to be involved in the analysis (Von Eye, 1990; Ragin, 2000; 2008)[58]

After the cases have been assigned memberships using a truth table and the minimum number of configurations established, then the configurations with similar characteristics in terms of memberships in geographic and business diversification, leverage, internal fund, intangibility, tangibility, and firm size sets that consistently display high membership (fs > 0.5) in favourable financial performance sets: firm value, profitability, and risk-return performance are identified. The configurations that display high memberships in financial performance sets are determined using truth table solutions: intermediate and parsimonious solutions[59]. These solutions usually show consistency and coverage which are used to assess importance of the configurations

As discussed in section 3.3.3.5 of this thesis and in Ragin, (2006, p.292), consistency and coverage in FSA have a similar implication as significance and R-square in statistical models respectively. Consistency is used to measure how theory and data fits together. Coverage indicates the portion of the outcome covered by a configuration, and provides information on how important a causal condition or a configuration is for an outcome to occur. In this context, coverage is like R-square in regression models. High coverage indicates that the solution (configuration) is important in displaying the outcome (Fiss, 2011), very low coverage implies trivialness of a configuration (Ragin, 2000).

[57] fsQCA 2.0 software was developed by Ragin et al., (2003) and obtained free from www.fsqca.com
[58] Section 3.3.3.2 of chapter 3 provides discussions on frequency and consistency cut-offs adopted for this research.
[59] See section 3.3.3.3 of this thesis for the definitions of intermediate and parsimonious solutions.

As discussed in section 3.3.3 in chapter 3, every configuration shows consistency and coverage values. Consistency levels are always below 100% which is commonly referred to as quasi-sufficiency as summarised below. And, the minimum recommended consistency is 75% (Ragin, 2000).

The Quasi-sufficiency

Due to the possibility of data errors, chances, randomness, and human errors, it is difficult to find a consistency of 100% sufficiency of a configuration that leads to an outcome of interest. Therefore, the application of probabilistic criteria is highly recommended in sufficiency tests (Ragin, 2000). Under probabilistic criteria, linguistic qualifiers like: "more often than not, usually, and almost always sufficient" are represented by 50%, 65%, and 80% consistencies (proportions) respectively (Ragin, 2000, p.109). These proportions serve as benchmarks for the mentioned linguistic qualifiers. For example, when the observed consistency is significantly greater than 65% then the solution is considered *usually sufficient* for an outcome to occur.

According to Ragin, "a one-tailed simple Z-test" is used to determine significance (sufficiency) of the configurations. It is calculated using the formulae introduced by Hays, (1981). When the observed proportion (consistency ratio) is "significantly greater than the benchmarks", then the solution is considered sufficient (Ragin, 2000, pp. 111-114) and the researcher can claim that there is enough evidence to support sufficiency of a condition or a configuration for an outcome to occur. Below are the recommended formulas for testing sufficiency.

$$z = \frac{(p-b) - \frac{1}{2N}}{\sqrt{\frac{bq}{N}}}$$

Where: z = statistic test of the difference between the observed proportion and the population (benchmark) proportion for large sample (sample above 30 cases), p = observed proportion; b = benchmark proportion, N = number of cases displaying the outcome or causal condition depending on whether we are testing necessary or sufficient condition respectively and q = 1- b.

Basically, this formula examines the degree to which the observed consistency (proportion) is greater than the targeted benchmark for sufficiency (more often than not – 0.5, usually – 0.65, or almost always – 0.8) relative to the relative to the standard error of targeted benchmark. Therefore, it uses one-tailed Z-test. When the gap between the observed consistency and the benchmark proportion is greater, Z becomes large and the significance level appears better. The formula also shows that large number of cases will increase the Z value. This implies that number of cases to be involved in the analysis becomes important when it comes to testing of significant of a sufficient configuration for an outcome.

The above formula is used when N is higher than 30. When cases are less than 30, a binomial probability test is can be used in place of Z-test formula. However, the binomial probability formula below the formula below and the Z-test formula above are essentially one thing in the sense that the Z-test formula "is a large-N approximation of the binomial test" (Ragin, 2000, p. 112). The binomial test formula is as indicated below[60].

$$P = \binom{N}{r} b^r q^{N-r}$$

Where P = probability which determines significance level; N = number of cases displaying the desired outcome, r = number of cases whose causal conditions display the outcome; b = benchmark proportion; q = 1-b

4.3.4: ROBUSTNESS CHECKS

Robustness test is the last stage in methodology development for this research. This is an important stage because FSA depends on researchers' theoretical and substantive understanding of the task at hand which is not necessarily objective. Therefore, robust testing is highly recommended (Skaaning, 2011).

The empirical findings of supporting questions are considered as part of a robustness test (Fiss, 2011). They are intended to justify that fuzzy set values do not change the meaning of the variables. Fuzzy sets are meant to scale the variables in order to allow

[60] More discussion on significance test of configuration see Ragin, (2000, p.109-115)

the examination of a case as a configuration of attributes. Therefore, it is expected that calibrated variables would not significantly change the meaning of the variables but rather would improve the level of analysis.

Given that FSA uses QMA which is based on prime implicants (that is solutions are reported based on the minimum possible configuration), then it is possible for the configurations to happen by chance. Configurations from the same theoretical background may appear different in different settings. In this context Greckhamer et al., (2008), suggested a robust test using post hoc analysis [61] to check if the configurations remain the same across different settings. In addition to application of tradition statistical analysis, this research uses post hoc analysis to test the robustness of the configurations.

Furthermore, FSA allows researchers to establish criteria (thresholds) for transforming raw variable measures to fuzzy set values, and determination of a reasonable number of cases and minimum consistency (cut-offs) for analysis. These decisions are likely to deliver biased results. In this context, Fiss (2011) applied sensitivity analysis in order to check robustness of the solution (see also Skaaning, 2011). In this context, this research also used sensitivity analysis to test the robustness of the FSA results.

The analysis of the results will only use robust configurations. Therefore, I am confident that the results to be presented in this thesis are robust and replicable.

4.4: SUMMARY AND CONCLUSION OF THE CHAPTER

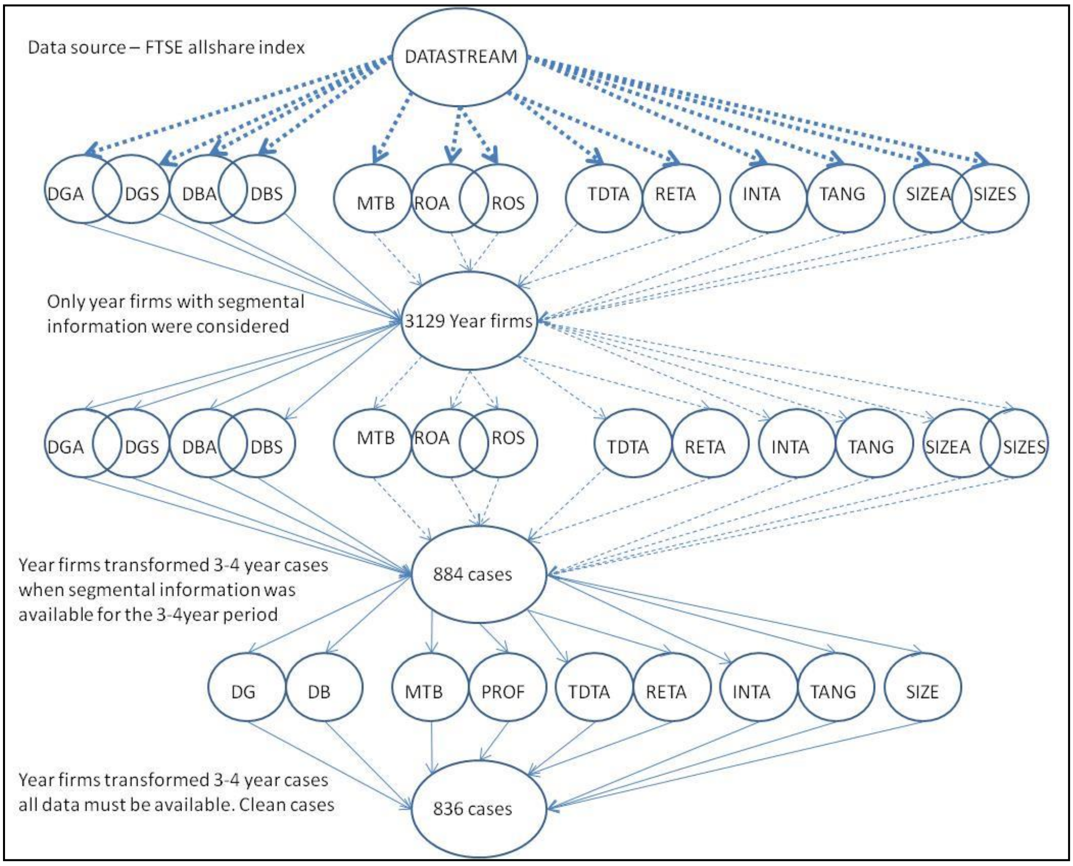
The purposes of this chapter were to align this research with a suitable research paradigm. Specifically, the chapter was intended to provide a clear outline of how FSA was decided as an ideal method for this research, to indicate the data collection and data management processes for this research, to examine segmental information disclosure practices, and to outline data analysis and robustness test procedures.

[61] Post hoc analysis in the current research intends to look a pattern/relationship of subgroup results and those of the populations for comparison purposes

It appears that financial performance as a social "reality" is neither objective nor subjective, but it is a matter of degrees and as such this research is positioned in the hybrid paradigm that combines both subjectivist and objectivist camps. This paradigm was labelled as *fuzzy paradigm*, and FSA is a suitable method of enquiry in this paradigm.

Figure 4.6: Data collection process.

This figure shows data collection process and management, DATASTREAM is the data base from which the 3129 year firm data were collected, 884 cases refers to 3-4 year averages data drawn from the 3129 years firms that had all the diversification data. And 836 cases represent 3-4 year average data drawn from the 884 cases that had all the data of the variable involved in the analysis. See table 4.4 for their definitions. The small circles indicate the variables collected. Overlaping circles indicate the variables defines same concept, while touch and apart circles indicate that the variables are closely related and not closely related respectively. The heavy dotted line imply data collected from the Datasream basing only on theory. Continuous lines indicate data must be present for the respective variable otherwise the firm/case is eliminated. The not-heavy dotted lines indicate that presence of data is not considered when collecting data.



This chapter has shown that the application of FSA is associated with some uncommon research terms. In particular the common terms in traditional statistical models such as firms, variable, and the scale measure of variables are replaced by cases, sets, and fuzzy set values respectively. This led to the sample size be reduced from 3129 year firms to 836 cases as clearly summarised in figure 4.6.

Figure 4.6 shows that the "raw" data were collected from the DataStream data base. The figure also shows that the thirteen variables that were originally collected were reduced to nine variables through application of macrovariable. The variable of most interest was corporate diversification strategy, therefore figure 4.6 shows that the data were cleaned to keep only those firms with geographic and business diversification data, and 3129 an initial sample firms were obtained.

In order to obtain data that show persistence of the firms' memberships in diversification and other variables (sets), I had to create 3-4 year average data; this reduced the 3129 year firms to 884 cases. Furthermore, since missing data have to be avoided in FSA research (Seawright, 2005), then all cases with missing data on any variable were eliminated this reduced the 884 cases to 836 cases[62]. The 836 cases was the final sample used in this research, and chapter 5 will show how the fuzzy set values were created for this sample

This chapter also has shown that most firms consider segments with less than 10% assets as discrete segments, and it appears that corporate diversification decision are not significantly affected by changes in accounting and financial reporting standards (see appendix 7). Furthermore, the research method stages used in this research have clearly shown the robustness and quality of the data used in this research. In addition, the data analysis procedures and the robustness test adopted in this research indicate that the results to be produced are robust and replicable.

Based on this summary, chapter 5 provides discussion on why and how the "raw" variable measure are calibrating to fuzzy set values.

[62] The 836 cases are presented in the appendix 5

Chapter 5 : MULTIDIMENSIONAL CONCEPT MISREPRESENTATIONS AND FUZZY SET VALUES DEVELOPMENT

5.1: INTRODUCTION

Chapter 4 and the generic plan of this thesis in figure 1.3 indicated the generic process of FSA application, and showed that FSA requires original variables to be transformed (calibrated) into fuzzy set values by using external criteria (see also Ragin, 2000; 2008; Fiss, 2011). As previously discussed, the calibration process requires establishment of three thresholds: full membership, cross-over point, and full nonmembership in different sets. These thresholds require being objectively and theoretically justifiable. In this context, this chapter presents and discusses in detail how the external criteria for calibrating the scale variables were decided and applied.

In addition, the application of FSA in this research has been supported by the arguments that causal variables sometimes interdependently interact and combine in different ways for an outcome to occur (Ragin, 1987; 2000; 2008; Ragin and Pennings, 2005; Greckhamer et al., 2008; Fiss, 2011). It appears also that multidimensional and inter-disciplinary concepts are often misrepresented (Russell and Thomson, 2009; Danbolt, et al., 2011). Failure to consider these methodological problems has been found to lead to biased, unreliable, and misleading conclusion about corporate diversification-performance relationships (Sullivan, 1994; Purkayastha et al., 2011)[63].

However, there is limited empirical evidence as to whether measures of multidimensional concepts usually misrepresent the concepts. Therefore, this chapter starts by providing empirical evidence on multidimensional concept misrepresentation. The empirical results show that a single measure/variable used to represent a multidimensional concept at the expense of others often misrepresents the concept, and it appears that macrovariables provide better representation as suggested in Ragin, (2000, p.321; 2008, chp.7).

[63] Sullivan, (1994), noted that out of 17 studies included in his research 16 used foreign sales to total sales (FSTS) as a single proxy of degree of internationalization, and only one used both FSTS and foreign assets to total assets (FATA) measures to proxy for DOI. In this context, Sullivan concluded that the single measure of diversification concept contributes to misleading results.

This chapter is divided into three main sections: firstly, the chapter presents empirical evidence of multi-dimensional concept misrepresentation and misleading conclusions. Secondly, this chapter will discuss how the three benchmarks for variable calibrations are established. Finally, the third section of this chapter will empirically show how calibrated variables, especially macrovariables, are important in this research; the chapter ends by providing a summary and contribution.

5.2: MULTIDIMENSIONAL CONCEPTS MISREPRESENTATION

In order to understand if variable choices are likely to mislead results, this research employs Pearson pairwise correlation and regression analysis. First, corporate diversification proxies are correlated with financial performance and other firm characteristic variables. Where the Pearson pairwise correlation appears to be different across different proxies of same concepts then I conclude that multi-dimension variables are misrepresented and leads to conflicting conclusions. Secondly, corporate diversification measures are regressed on different measures of financial performance and observed to see if they behave differently.

Specifically, the chapter starts by examining the supporting research question 1 which stated that:

> ***Does a single measure of a multi-dimensional concept sufficiently proxy the concept?***

Hypothesis

H0: ***The use of a single measure to represent a multidimensional concept is <u>not</u> a sufficient proxy of a multidimensional concept. Therefore this leads to conflicting results***

H1: ***The use of a single measure to represent a multidimensional concept is sufficient proxy of a multidimensional concept. Therefore this leads to similar results.***

5.2.1: EMPIRICAL RESULTS AND PRESENTATIONS

5.2.1.1: DESCRIPTIVE STATISTICS

Table 5.1 presents characteristics of variables used in this research. The first column shows the variable names, N represents the number of cases used in this research. Furthermore, table 5.1 presents means, medians, standard deviations, skewness measures, and minimum and maximum values of all variables used in this research. The table also presents 20th and 80th percentiles, which have been used by previous researchers to determine full nonmembership and full membership thresholds respectively (see for example Fiss, 2011). Therefore, most variables used in this research are calibrated using the 20th and 80th percentiles to benchmark full nonmembership and full membership respectively.

Table 5.1 shows that the mean of MTB is 1.7 and median is 1.45 and skewness measure is 3.29. This implies that the value around median can be used as a cross-over point because the MTB variable is highly skewed. Return on assets (ROA) and return on sales (ROS) are profitability measures, they are not highly skewed. However, variables used to measure business risks (standard deviation of ROA (SDROA) and standard deviation of ROS (SDROS)) are highly and positively skewed. This indicates that cross-over points will be determined using mean and median for profitability and business risk respectively.

The primary causal variable of interest of this research is corporate diversification: geographic diversification (DGA and DGS) and business diversification (DBA and DBS). These variables seem to be normally distributed as the values of skewness are less are than 0.5 in all measures and their mean and median are all around entropy index value of 0.6. This indicates that the entropy value of 0.6 can reasonably be used to determine the cross-over point for both geographic and business diversification memberships as will be discussed later.

Table 5.1: Descriptive statistics

This table indicates descriptive statistics of original variables involved in the analysis for the 836 cases. All the variables were measured using three year or four year averages as discussed in section 4.3.2 of this thesis. The definitions of the variables are shown below

MTB = Market to book – is calculated as total asset plus market value of equity minus book value of equity divided by total assets as in Denis et al., (2002).

ROA = Return on assets (DataStream code WC08326), that is net Income before Preferred Dividends - Preferred Dividend Requirement / Last year total assets x 100

ROS = Return on sales. Defined as (net income before Preferred Dividends - Preferred Dividend Requirement)/ total sales)x100

SDROA=Business risk is measured using standard deviation of ROA (Bettis and Hall, 1982; Kogut, 1985; Kim et al, 1993; Goldberg and Heflin, 1995).

SDROS=Business risks, calculated as standard deviation of ROS

DGA = Degree of geographic diversification is calculated using segmental asset, and entropy index of diversification D = $\sum_i \left[Pi\ X \ln \frac{1}{Pi}\right]$ as suggested in Jacquemin and Berry, (1979) and Palepu, (1985)

DGS = Degree of geographic diversification, is established using segmental sales as calculated by entropy index of diversification as for DGA above

DBA = Degree of business diversification is calculated by segmental assets using entropy index as for DGA above.

DBA = Degree of business diversification is established using segmental sales and calculated using entropy index as for DGA above

TDTA= Leverage is defined as a percentage of total debt on total assets (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008).

RETA= Retained earnings to total assets: percentage of after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve (Data Stream code WC03495) divide by total assets (DataStream code WC02999)

SIZEA= Firm size, defined as total assets in billions £ (DataStream code WC02999).

SIZES = Firm size (net sales in billions £) is defined as gross sales and other operating revenue less discounts, returns, and allowances (The DataStream code WC01001).

INTA = Asset intangibility is defined as percentage of total intangible assets (WC 02649) on total assets

TANG = Asset tangibility is defined as percentage of net Property, Plant and Equipment (DataStream code WC02501) on total asset (code WC02999) (Rocca et al., 2009).

Variables	N	Mean	Median	S.D	Skewness	Percentiles		Min	Max
						20	80		
MTB	836	1.70	1.45	0.95	3.29	1.07	2.09	0.36	11.76
ROA	836	6.93	6.73	8.56	-1.00	2.69	11.56	-49.73	52.78
ROS	836	12.47	10.17	14.43	0.54	4.38	20.05	-72.64	98.65
SDROA	836	5.02	2.82	6.73	3.87	1.03	7.06	0.02	74.18
SDROS	836	4.10	1.67	7.25	3.97	0.63	4.78	0.02	57.69
DGA	836	0.63	0.68	0.51	0.09	0.00	1.11	0.00	1.97
DGS	836	0.68	0.69	0.53	0.12	0.00	1.18	0.00	2.07
DBA	836	0.57	0.55	0.51	0.42	0.00	1.05	0.00	2.05
DBS	836	0.61	0.61	0.51	0.37	0.00	1.07	0.00	2.06
TDTA	836	24.82	22.71	17.52	0.91	9.57	38.22	0.00	97.75
RETA	836	15.45	18.68	31.92	-1.18	2.74	36.28	-165.2	164.12
SIZEA (£billions)	836	3.97	0.66	14.16	8.74	0.20	3.18	0.02	176.66
SIZES (£billions)	836	3.24	0.56	14.27	11.42	0.15	2.47	0.00	210.41
INTA	836	20.28	13.91	20.03	1.04	1.86	37.88	0.00	89.60
TANG	836	33.33	27.71	26.42	0.76	8.75	58.13	0.10	98.51

Firm size measures: SIZEA and SIZES are reported in terms of billions of pound of total asset and net sales respectively. It shows that cases involved in this study are highly skewed in terms of size. On average the mean firm size is £3.97 billion and £3.24billion of assets and sales volumes respectively. The medians on the same measures are £0.66billions and £0.56billions respectively. Furthermore, the 80th percentile of SIZEA and SIZES are £3.18 and £2.47billions respectively which is lower than the mean. This indicates that the mean cannot be used to determine cross-over point between very large and not-very large firms. Further discussion on multidimensional and other variables see section 5.3.3.

5.2.1.2: Empirical results from Pearson correlation

Table 5.2 presents the Pearson correlation of original variables used in this research (see also table 4.15). The table indicates that when geographic and business diversification are measured using segmental assets or segmental sales, it does not always lead to conflicting results as proposed by previous researchers (e.g., Sullivan, 1994). The table shows that geographic diversification whether measured using segmental assets or segmental sales has positive but not significant correlation with MTB, and insignificant negative correlation with all measures of profitability. Furthermore, geographic diversification measures show negative correlation with business risks which is only significant (1% significant level) when risk is measured using standard deviation of return on sales (SDROS).

The table also shows similar results in respect of business diversification. Business diversification measures: DBA and DBS show negative correlations with MTB, profitability measures (ROA and ROS), and business risks measures (SDROA and SDROS). Furthermore, different proxies of corporate diversification do not usually lead to different correlations of other variables as clearly shown in table 5.2. Although different proxies of corporate diversification do not usually lead to conflicting conclusions, different proxies of firm performance (profitability and business-risks) may lead to different conclusions.

Table 5.2: Pearson correlation results

This table presents correlation of the original measures of the variables used in this research. All the variables were measured using three year or four year averages as discussed in section 4.3.2 of this thesis. The definitions of the variables are shown below.

MTB = Market to book – is calculated as total asset plus market value of equity minus book value of equity divided by total assets as in Denis et al., (2002).

ROA = Return on assets (DataStream code WC08326), that is net Income before Preferred Dividends - Preferred Dividend Requirement / Last year total assets x 100

ROS = Return on sales. Defined as (net income before Preferred Dividends - Preferred Dividend Requirement)/ total sales)x100

SDROA=Business risk is measured using standard deviation of ROA (Bettis and Hall, 1982; Kogut, 1985; Kim et al, 1993; Goldberg and Heflin, 1995).

SDROS=Business risks, calculated as standard deviation of ROS

DGA = Degree of geographic diversification is calculated using segmental asset, and entropy index of diversification D = $\sum_i \left[Pi\ X \ln \frac{1}{Pi}\right]$ as suggested in Jacquemin and Berry, (1979) and Palepu, (1985)

DGS = Degree of geographic diversification, is established using segmental sales as calculated by entropy index of diversification as for DGA above

DBA = Degree of business diversification is calculated by segmental assets using entropy index as for DGA above.

DBA = Degree of business diversification is established using segmental sales and calculated using entropy index as for DGA above

TDTA= Leverage is defined as a percentage of total debt on total assets (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008).

RETA= Retained earnings to total assets: percentage of after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve (Data Stream code WC03495) divide by total assets (DataStream code WC02999)

SIZEA= Firm size, defined as total assets in billions £ (DataStream code WC02999).

SIZES = Firm size (net sales in billions £) is defined as gross sales and other operating revenue less discounts, returns, and allowances (The DataStream code WC01001).

INTA = Asset intangibility is defined as percentage of total intangible assets (WC 02649) on total assets (WC 02999)

TANG = Asset tangibility is defined as percentage of net Property, Plant and Equipment (DataStream code WC02501) on total asset (code WC02999) (Rocca et al., 2009).

This table presents the results of Pearson correlations of original variables of the whole sample. ^, *, and ** represents 10%, 5% and 1% significant levels (two-tailed significance test)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. MTB	1														
2. ROA	.41**	1													
3. ROS	.14**	.38**	1												
4.SDROA	.17**	-.16**	-.070*	1											
5. SDROS	-.045	-.20**	-.070*	.377**	1										
6. DGA	.038	-.053	-.031	-.015	-.128**	1									
7. DGS	.064	-.046	-.001	-.031	-.132**	.899**	1								
8. DBA	-.030	-.048	-.087*	-.092**	-.151**	.289**	.277**	1							
9. DBS	-.020	-.048	-.052	-.083*	-.158**	.260**	.270**	.893**	1						
10. TDTA	-.07*	-.08*	.127**	.049	.079*	-.042	-.072*	.030	.089*	1					
11. RETA	-.050	.35**	.247**	-.212**	-.135**	-.064^	-.056	-.024	-.035	-.274**	1				
12. SIZEA	-.034	.000	.047	-.030	.000	.211**	.207**	.130**	.080*	.003	.051	1			
13. SIZES	-.015	.019	-.016	-.052	-.042	.178**	.160**	.130**	.050	-.039	.077*	.898**	1		
14. INTA	.045	-.11**	-.065^	-.047	-.151**	.242**	.265**	.171**	.22**	.044	-.137**	-.001	-.034	1	
15. TANG	-.22**	-.017	.214**	.008	.189**	-.265**	-.27**	-.14**	-.13**	.316**	.124**	.058^	.037	-.552**	1

Table 5.2 shows that proxies of firms' profitability ROA and ROS have different correlations with leverage measure. It shows that ROA has a significant negative correlation with leverage at 10% significant level while ROS has a positive and significant correlation with leverage at 1% level. Furthermore, asset tangibility seems to be positively and significantly correlated with ROS but insignificantly negatively correlated with ROA. This indicates how it might be difficult to draw conclusion on the impact of a standalone causal variable on the outcome of interest.

In addition, the table shows that the correlations between the proxies of multidimensional concepts like geographic diversification (DGA and DGS), business diversification (DBA and DBS), profitability (ROA and ROS), and firm size; (SIZEA and SIZES) are 0.90, 0.89, 0.38, and 0.90 respectively. In principle the results indicate that the concepts cannot 100% be substituted by one measure/variable. However, it appears that geographic diversification, business diversification, and firm size concepts can be represented by one measure and create only 10% chance of misrepresentation to the respective concept. On the other hand, when ROA or ROS is used by researchers to represent firms' level of profitability, there appear to be 62% of misrepresenting the profitability concept. In other words, when ROA or ROS is used to classify firms in a set of high profit making firms, then there is 62% chance of classifying a firm in a wrong set and only 38% chance of classifying a firm in a correct set. The questions here are: how to reduce this problem of misclassifying cases into a wrong profitability set? How the 10% misclassification of firms into wrong geographic diversification, business diversification, and firm size sets can be more reduce? Answer to these kind questions is suggested in Ragin, (2000, p.321-328), that is application of macrovariable as will be illustrated later in this section.

To summarise, table 5.2 indicates that when a single measure is used to proxy a multidimensional concept at the expense of others, it sometimes leads to conflicting correlations. Therefore, there is no enough evidence to reject the null hypothesis developed above. This result is consistent with Danbolt et al., (2011) who assessed eight proxies of growth opportunities and found that most of the measures were not good proxies of growth opportunities. This implies that application of a single measure of multidimensional concept to the exclusive of others is likely to lead to biased and conflicting results. Therefore application of macrovariables seems necessary to reduce the problem.

The next subsection uses linear regression models to examine the same supporting research question 1 as stated above.

5.2.1.3: Empirical Results from Linear Regression Models

Table 5.3 presents results of ten linear regression models. These models aim to explain if different proxies of geographic and business diversification and firm size have similar contributions across different measures of financial performance.

More specifically, the two proxies of geographic and business diversification (segmental assets and segmental sales), are regressed on different firm performance measures: Market to book value, firm profitability (ROA and ROS), and business risk (SDROA and SDROS). In order to understand if different proxies of geographic and business diversification lead to different impact on financial performance measures, all the ten models employ similar control variables.

The ten models shown in table 5.3 are grouped into two categories, category one comprises models where by the degree of geographic and business diversification is calculated by segmental assets, these include: models 1, 3, 5, 7, and 9. In category two, degree of geographic and business diversification is calculated using segmental sales. This category includes: models 2, 4, 6, 8, and 10.

Model 1 and model 2 show the results of linear regression of geographic and business diversification on market to book value of firms (MTB). It shows that different proxies of geographic and business diversification make similar contributions to MTB. Specifically, table 5.3 shows that geographic diversification makes a positive relationship on MTB regardless of different measures of diversification. Furthermore, the two business diversification proxies have a negative relationship on MTB but, none of them has shown significant relationship.

Table 5.3: Linear regression models

This table shows regression models of different proxies of corporate diversification on the three financial performance measures. All the variables were measured using three year or four year averages as discussed in section 4.3.2 of this thesis. The definitions of the variables are shown below.

MTB = Market to book – is calculated as total asset plus market value of equity minus book value of equity divided by total assets as in Denis et al., (2002).

ROA = Return on assets (DataStream code WC08326), that is net Income before Preferred Dividends - Preferred Dividend Requirement / Last year total assets x 100

ROS = Return on sales. Defined as (net income before Preferred Dividends - Preferred Dividend Requirement)/ total sales)x100

SDROA=Business risk is measured using standard deviation of ROA (Bettis and Hall, 1982; Kogut, 1985; Kim et al, 1993; Goldberg and Heflin, 1995).

SDROS=Business risks, calculated as standard deviation of ROS

DGA = Degree of geographic diversification is calculated using segmental asset, and entropy index of diversification D = $\sum_i \left[Pi\ X \ln \frac{1}{Pi}\right]$ as suggested in Jacquemin and Berry, (1979) and Palepu, (1985)

DGS = Degree of geographic diversification, is established using segmental sales as calculated by entropy index of diversification as for DGA above

DBA = Degree of business diversification is calculated by segmental assets using entropy index as for DGA above.

DBA = Degree of business diversification is established using segmental sales and calculated using entropy index as for DGA above

TDTA= Leverage is defined as a percentage of total debt on total assets (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008).

RETA= Retained earnings to total assets: percentage of after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve (Data Stream code WC03495) divide by total assets (DataStream code WC02999)

SIZEA= Firm size, defined as total assets in billions £ (DataStream code WC02999).

SIZES = Firm size (net sales in billions £) is defined as gross sales and other operating revenue less discounts, returns, and allowances (The DataStream code WC01001).

INTA = Asset intangibility is defined as percentage of total intangible (WC 02649) assets on total assets (WC 02999)

TANG = Asset tangibility is defined as percentage of net Property, Plant and Equipment (DataStream code WC02501) on total asset (code WC02999) (Rocca et al., 2009).

*, **, and *** represents 10%, 5% and 1% significant levels (two-tailed significance test). The definitions of the variables involved in this study are defined as follows

Independent variables	MTB		ROA		ROS		SDROA		SDROS	
	1	2	3	4	5	6	7	8	9	10
(Constant)	2.20*** (21.58)	2.16*** (21.14)	8.20*** (9.36)	8.06*** (9.21)	4.14*** (2.77)	3.01*** (2.02)	6.95*** (9.60)	6.98*** (9.66)	5.27*** (6.86)	5.23*** (6.82)
DGA	.01 (.11)		-.49 (-.82)		1.18 (1.15)		.17 (.33)		-.85 (-1.61)	
DGS		.051 (.77)		-.37 (-.64)		2.32** (2.39)		-.04 (-.08)		-.69 (-1.38)
DBA	-.10 (-1.49)		-.59 (-1.03)		-2.49** (-2.56)		-1.17** (-2.49)		-1.56*** (-3.13)	
DBS		-.079 (-1.18)		-.490 (-.86)		-1.86* (-1.91)		-.99** (-2.09)		-1.68*** (-3.34)
TDTA	.001 (.51)	.001 (.57)	.05** (2.48)	.05** (2.47)	.13*** (4.06)	.13*** (4.12)	-.001 (-.04)	.000 (.01)	-.005 (-.34)	-.004 (-.26)
RETA	-.001 (-.66)	-.001 (-.64)	.10*** (10.93)	.10*** (10.92)	.13*** (7.96)	.13*** (8.10)	-.05*** (-6.14)	-.05*** (-6.08)	-.04*** (-4.87)	-.04*** (-4.76)
SIZEA	-0.00 (-.28)		.00 (.06)		.00 (.76)		-.00 (-.25)		.00 (.79)	
SIZES		-.00 (-.24)		.00 (.03)		-.00 (-1.39)		-.00 (-.96)		-.00 (-.69)
INTA	-.01*** (-2.71)	-.01*** (-2.77)	-.06*** (-3.65)	-.06*** (-3.59)	.044 (1.50)	.039 (1.33)	-.02* (-1.71)	-.023 (-1.60)	-.021 (-1.39)	-.018 (-1.15)
TANG	-.01*** (-6.47)	-.01*** (-6.38)	-.06*** (-4.28)	-.06*** (-4.24)	.09*** (3.67)	.10*** (4.02)	-.003 (-.27)	-.003 (-.26)	.04** (3.31)	.04*** (3.53)
Number of cases	**836**	**836**	**836**	**836**	**836**	**836**	**836**	**836**	**836**	**836**
R-Sq	**0.063**	**0.062**	**0.146**	**0.146**	**0.126**	**0.128**	**0.058**	**0.058**	**0.084**	**0.086**

Model 1 and model 2 also show that when firm size is measured using total assets or volume of sales it makes a similar relationship on MTB which is negative but not significant. Generally, models 1 and 2 show that different proxies of geographic and business diversification and firm size ***do not usually*** have a differential effect on financial performance when MTB is used to measure financial performance.

Models: 3, 4, 5, and 6 show that when geographic and business diversifications are regressed on ROA and ROS, there are significantly different relationships. It shows that geographic diversification is negatively related to ROA, but positively related to ROS. Furthermore, table 5.3 shows that business diversification, is negatively related to ROA and ROS with only significant relationship on ROS. These results imply that the choice of profitability proxies can lead to conflicting results and conclusions.

In addition, model 3, 4, 5 and 6 show that there is no relationship between firm size and profitability across the different proxies of firm size and profitability. It appears also that level firm size have no impact on MTB and business risk reduction. This implies that any of the measures of firms (asset and sales) provide a better representation on firm size concept when it comes to examination of its impact on financial performance. However, a minor chance of misrepresentation appears in models ROS and SDROS models. Indeed, table 5.2 have shown that there is only 10% chance of firm's assets or sales to misrepresent the firm size concept.

Finally, models 7, 8, 9 and 10 show the impact of regressing different proxies of geographic and business diversification against different proxies of firms' business risks. As reported by previous researchers, business risk is calculated using standard deviations of firm profitability (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim at el., 1993). The results show that regardless of different geographic diversification proxies, geographic diversification has a positive relationship on business risk when standard deviation of ROA (SDROA) is used to proxy business risks (model 7 and 8). However when standard deviation of ROS (SDROS) is used to measure business risk, the relationship of geographic diversification (DGA and DGS) on SDROS becomes negative.

5.2.2: IMPLICATIONS OF THE EMPIRICAL RESULTS

Table 5.2 and table 5.3 present results on the supporting question 1 and provide empirical evidence for the argument that selection of a single measure to represent multi-dimensional concepts like geographic diversification, business diversification, profitability, and firm size would usually lead to different results. The evidence from the Pearson correlation (table 5.2) and linear regression models (table 5.3) show that while different proxies of geographic and business diversification and firm size typically leads to less conflicting results, different proxies of profitability (ROA and ROS), often result in conflicting conclusions. These provide answers to the three subsidiary supporting questions developed from the supporting research question 1, and the answer shows that there is no enough evidence to reject the null hypothesis for this supporting research question (see section 1.3.3). This implies that the variables selection bias is likely to lead to inconclusive results as suggested in previous research.

To avoid the problems of multidimensional misrepresentation, this research suggests application of macrovariable to represent multidimensional concept in order to minimise the associated problems such as concept misrepresentation. The next section discusses the calibration process and development of macrovariable.

5.3: CALIBRATION PROCESS AND MACROVARIABLE DEVELOPMENT

This section discusses in detail how FSA variables are developed. In particular, the section explains how the three benchmarks for variable calibrations were calculated and how macrovariables were developed. It has to be noted that in this thesis variables are treated as sets, and the original interval measures are transformed to fuzzy set values. Therefore, the FSA terminologies will now dominated the next sections and chapters of this thesis.

5.3.1: FINANCIAL PERFORMANCE SETS

As discussed previously, the desired outcome for this research is financial performance which can be represented as firm value, profitability, and risk-return performance. The thresholds for calibrating these measures to fuzzy set values are established and discussed in this section.

5.3.1.1: Market to Book value

Studies on corporate diversification and firm value usually measures firm value as market to book value ratio (Morck and Yeung, 1991; 1992; 1997; Denis et al., 2002; Campa and Kedia., 2002; Lu and Beamish., 2004; Barnes and Hardie-Brown., 2006). In line with previous researchers, this research uses market to book ratio as an original measure of firm value and it is defined as total asset plus market value of equity minus book value of equity divided by total assets (MTB) as in Denis et al., (2002). In order to assign a firm into a set of high MTB performing firms and in order to avoid a single year effect on MTB across the ten-year period (2001-2010), this research uses 3-4 year averages of MTB (Bodnar et al., 1999; Barnes and Hardie-Brown, 2006). However there is no much fluctuations of MTB cross the period, but for the purpose of creating MTB set, averaged MTB would be important as discussed in section 4.3.2.

It is generally accepted that when MTB of a particular firm is equal to one (1), then this firm is neither destroying nor creating value for shareholders. This implies that firms with MTB equal to one or less are classified as non-high value firms. Table 5.1 also shows that the 20^{th} percentile of MTB of the 3-4 year average groups is 1.07 while the 80^{th} percentile is 2.09. Furthermore table 5.1 shows that MTB data is highly skewed (skewness = 3.29) and in this context, the median of 1.45 (approximate to 1.5) which is used as a cross-over point. Based on these observations, the three thresholds for calibrating MTB value are calculated using MTB of 2.0, 1.5, and 1 for high-firm value, moderate firm value, and non-high firm respectively, these values correspond to fuzzy set values 0.95, 0.5, and 0.05 for full membership, cross-over point, and full nonmembership as shown on table 1.3 of this thesis, and I use them to create MTB set values.

5.3.1.2: Profitability measures and macrovariables.

Firm profitability is another desired outcome for this thesis; it is measured in a number of ways. However, as indicated in chapter 2 - table 2.3 of this thesis, .ROA and ROS are extensively used as proxies of profitability in corporate diversification-performance relationship studies (see table 2.3). This research uses ROA and ROS to proxy firm profitability. Furthermore, based on the agency costs theory, it is argued that managers may diversify firms for their own interest and at the expense of equityholders (Mueller, 1969, Amihud and Lev, 1981 Roll, 1986; Amit and Wernerfelt, 1990; Rajan et al., 2000; Aggarwal and Samwick, 2003; Laeven and Levine, 2007; Andreou et al., 2010; Ammann et al., 2012). This implies that if corporate diversification is for managers' interest then returns on assets will be lower in firms with a high degree of diversification and likewise profit per every pound of sales will be lower in high diversified firms. If diversification is in the interest of managers' then it would be expected that managers' efficiency in utilising company's assets to produce profitable sales would be low. ROA and ROS are here used to measure managers' efficiency in utilising the companies' assets for creating profitable sales. In addition, I argue that corporate diversification is calculated by using segmental assets and segmental sales and since ROA and ROS use assets and sales respectively, then, they might be directly influenced by corporate diversification.

In order to establish an objective criterion to determine the three thresholds for calibrating profitability measures, this research uses previous publications on firm performance studies that apply FSA. According to Greckhamer et al., (2008), Fiss, (2011) and Garcia-Castro et al., (2013), continuous variables like ROA are calibrated using percentiles of data distributions like 75th or 80th percentiles for benchmarking high profitable firms and medians (50th percentile) or means were used to represent cross-over point, and 25th or 20th percentiles were used to assign full nonmembership scores.

Table 5.1 shows that ROA and ROS data are not highly skewed. Therefore, a mean of 7% and 12% was used to determine cross-over points for ROA and ROS respectively. Furthermore, the 80th percentile of 12% and 20% of ROA and ROS respectively is used to determine full membership in highly profitable firms. The full nonmembership is calculated and established as 3% and 4% for ROA and ROS[64] respectively. Summary of the thresholds and their corresponding fuzzy values are found on table 1.3 and on table 5.5.

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[64] The cut-off for full nonmembership is calculated as the ***distance*** from cross-over point and full memberships is equal to the ***distance*** from the cross-over point to full non-memberships.

Profitability macrovariable (PROF)

Evidence from table 5.2 and table 5.3 of this chapter has clearly shown that when ROA or ROS are exclusively used to proxy firm profitability could lead to conflicting results. This is consistent with the argument that a single measure of a multidimensional concept "represents only a limited portion of the domain it intends to represent" (Sullivan, 1994, p.326). Indeed, table 5.2 has shown that the possibility that ROA and ROS to substitute one another for representing profitability concept is only 38%. This increases the possibility of rejecting or accepting a wrong null hypothesis in the case of hypothesis testing, which ruins the result validity (Bagozzi et al., 1991), and if the measure is not clean enough it will lead to contaminated results (Nunnally, 1978).

The correlation (0.38) between ROA and ROS presented in table 5.2 can be interpreted differently. One possible and common interpretation is that the two measures represent two different things! In principle, ROA indicates managers' ability to use firms' asset to generate return (profit) to their firms, in other words it show how much profit is created by a pound invested in assets. Higher ratio implies higher ability of assets to generate profit. This is to say a firm can be classified in a set of high ***profitable*** firms if ROA is high. On the other side ROS measures, how much profit is realised from one pound of sales. This means a firm can be classified in a set of high ***profitable*** firms if ROS is high. It appears therefore that determinants (especially denominator in their formulas) of ROA and ROS are quite different, and therefore there is good reason to believe that the two measures are different. However, they have one this in common, that is all they represent the concept of ***profitability.*** In other word ROA ***or*** ROS can equally be used by firms as "tickets" to entering a set of high profitable firms. This implies that members in this set (high profitability) will either be holding ROA or ROS ticket whichever brings better representation in this set (strongest link). In this context and in the context of set-theoretic framework, the differences between ROA and ROA are collapsed to create one set - profitability (macrovariable).

In net-effect framework, the profitability macrovariable would create interpretation problems because of possible differences between ROA and ROS but there is better chance (about 62%) of avoiding cases misclassification and variable misrepresentation as shown on table 5.2. When using ROA or ROS in the standalone basis to proxy profitability there is about 38% chance of one measure to correctly represent a case in high profitability set (see table 5.2). Contrary to net-effect framework, the set-theoretic framework adopted for this research requires to create a set of profitable firms by allowing the two tickets to be used in representing firms in the set of high profitable firms. This will reduce the problem of variable selection biases that would lead other firms been wrongly represented by their *weakest links*.

In order to avoid variables selection biased result, a macrovariable index has to be created as suggested in Ragin, (2000, p.321-328). Basically, macrovariable addresses the problem of too many variables measuring the same concept by using strongest link rule (see section 1.4). Therefore by using the substitutability principle, ROA or ROS can be used to create a macrovariable to represent profitability (here after PROF). Section 4.3.1.4 shows illustrates how macrovariables are developed (see table 4.9 and 4.10).

5.3.1.3: BUSINESS RISK-RETURN PERFORMANCE.

Risk-return performance (here after RRP) is another desired outcome for this research. The firm is considered to have favourable risk-return performance if its membership in *both* profitability and business risk-reduction sets is above average (fs > 0.5). Business risk is defined as volatility of firm profitability[65] while return is defined as a firm's profitability measured by ROA and ROS: and risk-return performance is the hybrid variable developed from a combination of both profitability and business-risk reduction. It is the intersection of these two measures that determines the membership of firms in favourable RRP set.

In order to establish a firm's favourable RRP membership, Literature on risk-return performance was consulted. This literature indicates that firms with average high profits *and* high level of risks-reduction (low profit volatility) were classified as having favourable risk-return performances (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993). In this case, in order to create an index to

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[65] Bettis and Hall, (1982, p.256), defined risk as "variability of returns"

represent a firm's membership in the set of favourable RRP), business risk and profitability were measured using 3-4 year averages, and fuzzy set operation "*and*" which dictates for selection of the lowest measure[66] was used. The whole process of creating RRP was done using fsQCA software.

Table 5.4 illustrates how fuzzy set operation *"and"* works to develop RRP index. Table 5.4 shows that RRP is obtained by taking the lower of PROF and risk-reduction, the logic behind this is to identify the intersection membership: the membership that is found in both sets. Logically, lower membership represents the intersection of the sets, for example, First Group Plc. has 0.52 memberships in profitability but 0.98 memberships in risk-reduction. This implies that the 0.52 membership is a subset of 0.98, thus 0.52 becomes an intersection. Therefore, RRP membership of First Group is 0.52, while that of William Hill Plc is 0.27. William Hill Plc on average had higher memberships in profitability (0.99), but its risk-reduction memberships were very low (0.27), which leads to William Hill Plc appearing to have 0.27 memberships in the RRP set.

Table 5.4: Illustration of RRP index development (2006 group)

This table illustrates the development of risk-return performance variable (RRP) of eight firms extracted from a sample for this research. PROF represents a macrovariable measure of profitability; RISKR represents a risk-reduction macrovariable, and RRP represents a firm's memberships in risk-return performance which is defined by lower of PROF *and* RISKR indexes. The bold figures are used to construct an RRP index.

COMPANY	INDUSTRY	PROF	RISKR	RRP
GREGGS PLC	Grocery Stores	**0.97**	**0.97**	0.97
MARKS & SPENCER	Department Stores	**0.91**	0.95	0.91
TESCO PLC	Grocery Stores	**0.61**	0.98	0.61
FIRSTGROUP PLC	Trucking	**0.52**	0.98	0.52
DEBENHAMS PLC	Department Stores	**0.51**	0.94	0.51
WILLIAM HILL PLC	Resorts & Casinos	0.99	**0.27**	0.27
888 HOLDINGS PLC	Resorts & Casinos	1	**0.08**	0.08
COSTAIN GROUP PLC	Engineering & Constructions	0.01	0.03	0.01

Generally, fuzzy set operation "*and"* uses the rule of "weakest link"; this rule is based on the argument that "a chain is only as strong as its weakest link" (Ragin,

[66] Fuzzy set logical "and" uses the same concept of intersection as in conventional set theory (see Ragin, 2000; 2008).

2000, p.322). Weakest link rule is the opposite of the substitutability principle which advocates for the strongest link. The weakest link rule can be used to determine firms that have simultaneously high profit and lower risk-return performance.

Table 5.5 summarise the three benchmarks for calibrating financial performance variables (MTB, PROF, and RRP).

Table 5.5: Thresholds for financial performance measures

The table presents thresholds that were used to calibrate financial performance measures. The variables were calculated using 3-4 year averages across the ten years (2001-2010). Definitions of the variables are given below.

MTB = Market to book – is calculated as total asset plus market value of equity minus book value of equity divided by total assets as in (Denis et al., 2002).

ROA = Return on assets: that is net Income before Preferred Dividends - Preferred Dividend Requirement / Last year total assets x 100

ROS = Return on sales. Defined as (net Income before Preferred Dividends - Preferred Dividend Requirement)/ total sales) x100

SDROA=Business risk is measured using the standard deviation of ROA as in (Bettis and Hall, 1982; Kogut, 1985; Kim et al, 1993; Goldberg and Heflin, 1995), the lower the better.

SDROS=Business risk, is calculated as standard deviation of ROS, the lower the better.

FS = Fuzzy set values used to transform the financial performance measures defined in the table: 0.95 represents full memberships which are equivalent to 2.0, 12%, 20%, 1.0, and 0.6 of MTB, ROA, ROS, SDROA, and SDROA respectively. 0.5 is a crossover point which is equal to 1.5, 7%, 12%, 2.8, and 1.7 of MTB, ROA, ROS, SDROA, and SDROA respectively. Finally, FS of 0.05 takes the original values of 1.0, 3%, 4%, 7.1, and 4.8 of MTB, ROA, ROS, SDROA, and SDROA respectively.

Thresholds	**Full memberships**	**Cross-over point**	**Full Non-memberships**
MTB	2.0–80th percentile	1.5 - Median	1.0 - 20th percentile
ROA	12%-80th percentile	7% - Mean	3% - 20th percentile
ROS	20%- 80th percentile	12th - Mean	4% - 20th percentile
SDROA	1.0–20th percentile	2.8 - Median	7 – 80th percentile
SDROS	0.6–20th percentile	1.7 - Median	5 – 80th percentile
Fuzzy Set (FS)	0.95	0.5	0.05

5.3.2: GEOGRAPHIC AND BUSINESS DIVERSIFICATION VARIABLE DEVELOPMENT

Corporate diversifications are growth strategies whereby companies opt to expand their operations beyond their normal geographic location and business specialisation (Berry, 1975; Andrews, 1980; Pandya and Rao, 1998; Johnson et al., 2005). Basically the concept of diversification covers two attributes and two dimensions; structural and performance attributes (Sullivan, 1994; Ramaswamy et al., 1996) and geographic and business dimensions. Therefore, the corporate diversification concept is always measured by the two attributes and the two dimensions (Sullivan, 1994).

According to Sullivan, (1994), structural attributes employ assets as a basis for measuring corporate diversification while performance attribute uses sales and profit measures. Since sales have been widely used to measure corporate diversification (Sullivan, 1994; Barnes and Hardie-Brown, 2006; Doaei et al., 2012), then this research also uses sales rather than profit measures to represent performance attributes and assets to cover structural attributes. Generally these two measures are widely used and acceptable proxies for corporate diversification (Rumelt, 1974; Rumelt, 1982; Palepu, 1985; Sullivan, 1994; Pandya and Rao, 1998; Afza et al., 2008; Qian et al., 2008).

In an accounting context, geographic and business diversification strategies are defined by geographic and business segmental information (Barnes and Hardie-Brown, 2006; Rocca et al., 2009). However, previous research measured geographic and business diversification differently using: segment counts (Lubatkin et al., 1993; Barnes and Hardie-Brown 2006), Specialization ratio (SR) (Rumelt, 1974; 1982; Pandya and Rao, 1998; Chkir and Cosset, 2001), Herfindahl index (Lang and Stulz, 1994), and Entropy index (Jacquemin and Berry 1979; Palepu, 1985; Hitt et al., 1997). Current researchers recognise the benefits of the entropy index over other measures of diversification because it addresses size, importance, and relatedness of diversification (Qian et al., 2008, Kahloul and Hallara, 2010; Park and Jang, 2011; Chiao and Ho, 2012; Doaei et al., 2012)[67].

The other measures focus either on diversification size *or* importance of diversification *or* relatedness of segments, and therefore appear less reliable measures of diversification (Fiss, 2007). For example Fiss, questioned the reliability of product count or SIC code counts as a measure of corporate diversification. He argued that diversification measures based on SIC counts make it difficult to classify firms as highly or not-highly diversified; this is because numbers of segments may show the size of diversification, but it explains nothing about the importance and

[67] Detail on these two measures (entropy and Herfindahl) is referred to Jacquemin and Berry, (1979)

relatedness of the segments. Likewise, specialisation ratio shows the relatedness of the segments, but it explains very little about the importance and size of diversification.

This research therefore uses the entropy index to determine the degrees of geographic and business diversification. The entropy indexes are then transformed to fuzzy set values using the direct method of calibration (Ragin, 2000; Fiss, 2011).

5.3.2.1. ENTROPY INDEX AND THE THREE THRESHOLDS FOR CALIBRATION PROCESS

Entropy index in this research is used not only because it is widely accepted but also because of its key properties as identified above (see also Jacquemin and Berry, 1979; Qian et al., 2008; Kahloul and Hallara., 2010; Park and Jang., 2011; Doaei et al., 2012; Chiao and Ho, 2012). These properties make the entropy index appear a universal set of other corporate diversification indexes.

Basically, entropy index was introduced in corporate diversification to measure business diversification (Jacquemin and Berry, 1979). It was also found to be a useful measure of geographic diversification (Hitt et al., 1997; Qian et al., 2008). The entropy measure of diversification is calculated as follows:

$$D = \sum_i \left[Pi \; X \ln \frac{1}{Pi} \right]$$

Where: D represents degrees of business/geographic diversification; P_i is the proportion of sales (assets) attributed to business/geographic segment$_i$, and $\ln \frac{1}{Pi}$ is the natural logarithm of the inverse of P_i or represents the weight given to each segment.

Table 4.5 in chapter 4 has shown that most firms disclose segments with less than 10% segmental assets, and table 2.2 in chapter 2 showed that firms with two or more segments whose largest segment accounts for 95% of total assets/sales are classified as focused firms. Based on these evidences, this research concludes that a firm with two segments one of which is 95% and the other 5% of total assets/sales, is unambiguously classified as out of the set of high diversified firms. This is equivalent to an entropy measure of 0.2 as calculated below.

$$[0.95 \times \ln (1/0.95) + 0.05 \times \ln(01/0.05)] = 0.2(\text{approximate})$$

Therefore, I use 0.2 entropy measure as a threshold for full nonmembership (fuzzy set value = 0.05) in high diversified-firms.

Furthermore, a specialisation ratio (SR) of 70% was classified as moderate diversification (Rumelt, 1974; 1982), so that below SR of 0.7 the firm was considered high diversified and above SR of 0.7 the firm was considered not-high diversified. The diversification scores of 0.3 (30%) marks the mid-point for high and non-high diversification (Hitt et al., 1997). Furthermore Riahi-Belkaoui, (1998), classified a moderately diversified firm as one with a geographic diversification ranging from 14% to 47% (i.e., mid-point of 30.5%). Based on this evidence, I argue that a firm with two segments is classified as moderately diversified if one of its larger segments has 70% of total segmental sales or assets while another segment has 30% of segmental sales or segmental assets. The equivalent entropy index of this diversification is 0.6 as calculated below.

$$[0.7 \times \ln (1/0.7) + 0.05 \times \ln(01/0.3)] = 0.6(\text{approximate})$$

In addition, table 5.1 indicates that an entropy index of around 0.6 defines mean and median of both geographic and business diversification. This implies that an entropy measure of 0.6 clearly shows the mid-point between high and not-high diversification. Therefore, I use an entropy measure of 0.6 to determine cross-over point (fuzzy set value = 0.5).

Finally, table 5.1 indicated that 80^{th} percentile geographic and business diversification entropy index is around 1.0, and table 4.7 and table 4.8 in chapter 4 have shown that many firms have three segments. I ague that a firm with three of more segments can be considered as high diversified. However, there is a need to avoid ***trivial segments***. Trivial segments are defined as segments that have a very low proportion in total segmental assets or sales. For example consider two firms (A and B) which both have three segments. One of the segments in firm A has 95% of total assets while the other two has 2% and 3% of total assets. In firm B, each of the three segments has 33% of total assets. The degree of diversification of firms A and

B would be the same if business count is used. However, since the two of the segments in firm A are ***trivial*** then the degree of diversification of firm B is relatively higher (entropy 1.0) compared to A (entropy = 0.2)[68]

In this context, three segment firms can only be classified as unambiguously high diversified if the three segments have equal weights. The equivalent entropy measure of diversification in this type of firm is approximately 1.0.

[0.33 x ln (1/0.33) + 0.033 x ln(01/0.33)+ 0.33 x ln(1/0.33)] = 1.0 (approximate)

Entropy index of 1.0 is also around 80th percentile of geographic and business diversification. Therefore, I use entropy index of 1.0 to determine a threshold for full membership (fuzzy set value = 0.95) in the set of high diversified firms.

5.3.2.2. Corporate Diversification and Macrovariable development

Table 5.2 showed that the correlation between geographic attributes (DGA and DGS) is 0.899 while that of business attributes (DBA and DBS) is 0.893 which are all significant at 1%. Cronbach's alpha is a measure of inter-correlation among variables believed to measure same concept, it is intended to understand internal reliability of different measures of concept. The higher value of alpha indicates higher internal reliability (George and Mallery, 2003), and higher chance of one variable to represent others in defining the concept (Ragin, 2000). Internal reliability of the geographic attributes is Cronbach's Alpha (α) 0.945, and 0.943 for the business diversification measures (table 5.6). According to George and Mallery, (2003), when $\alpha \geq 0.9$ the internal consistency is considered excellent, while $0.9 > \alpha \geq 0.8$ indicates good, and $0.8 > \alpha \geq 0.7$ indicates acceptable. This implies that DGA and DGS, and DBA and DBS have excellent internal consistency; they define the same concept and they are substitutable for the purpose of macrovariable development (Ragin, 2000) as discussed in section 1.5 and 4.3.1.4 of this thesis.

[68] Entropy formula is used to calculated these levels of diversification (see Jacquemin and Berry, 1979)

Table 5.6: Reliability statistic

DGA is degree of geographic diversification represented as an entropy index using geographic segmental assets; DGS is an entropy index of diversification using geographic segmental sales. DBA is degree of business diversification represented by an entropy measure using business segmental assets; DBS is an entropy index of diversification using business segmental sales.

Variables	Cronbach's Alpha
DGA vs. DGS	0.945
DBA vs. DBS	0.943

Since corporate diversification is usually calculated using segmental assets or segmental sales, then a firm's degree of diversification can be calculated using either segmental assets ***or*** segmental sales, as suggested by the substitutability principle[69]. In this context, fuzzy set logical "or" is used to determine geographic and business diversification macrovariable indexes (see table 1.2 in chapter 1).

5.3.3: Other Variables

Table 2.3 and table 2.4 of this thesis have shown that previous researchers on corporate diversification-performance relationships employ financing choice (e.g., leverage), asset structure (e.g., asset tangibility and intangibility), and firm size as control variables. In this research, these variables are not used as control variables but as important elements in the configurations that enable geographic and business diversification to sufficiently provide indicators of favourable financial performance. This subsection discusses how benchmarks for calibrating the ***other variables*** are established objectively.

5.3.3.1: Firm size variable

Section 2.3.4 defined firm size and indicated the cut-offs for large firm size set also showed how firm size influences diversification decisions. The definition of firm size has clearly showed that firm size is a multidimensional concept that usually defined by firm assets, sales, and number of employees. However for the purpose of this research I use assets and sales to define firm size (Canbäck et al., 2006)[70].

[69] Substitutability principle is defined in section 1.2.1 in chapter 1 of this thesis
[70] Details on the concept and measurements of firm size is also discussed in Kimberly, (1976)

Researchers usually choose one measure to represent the concept of firm size and examine it for its relationship on financial performance. The main argument given for ignoring other measures is that, the measures are highly correlated such that one measure can adequately represent firm size. However, it has been noted that measures of firm size have different implications (Kimberly, 1976) so that one measure cannot adequately represent others (Hitt et al., 2006) (see also section 5.2 of this thesis).

The consequences of using one measure to represent multidimensional concept has been argued to cause model misspecification (Diamantopoulos et al., 2008; Rodgers and Guiral, 2011), concept misrepresentation (Delmar et al., 2003)[71], variable selection bias, and in the outcome is misleading results (Nunnally, 1978; Sullivan, 1994). Indeed, empirical results presented in table 5.2 and table 5.3 have empirically shown presence of conflicting results associated with different proxies of firm size (see also table 4.15) which can be reduced through the application of macrovariables (Ragin, 2000; 2008). In this context, this research used firm size macrovariable to proxy firm size (SIZE).

Previous research defined firm size using total net asset (SIZEA) or total net sales (SIZES). Consistent with previous research, and similar to other scale measures I use SIZEA and SIZES and transform them to fuzzy set values using the direct method of calibration (Ragin, 2000). The three qualitative thresholds are determined using percentiles and the established definition of large firm size as discussed below.

Table 5.1 shows that SIZEA and SIZES are highly skewed (skewness measure is 8.74 and 11.42 respectively), thus the median of £0.66billions and £0.56billions are used to determine the cross-over point of SIZEA and SIZES respectively.

[71] Delmar et al (2003) when exploring for different measure of firm growth concluded that measures of growth like changes of net sales, and total assets convey different meanings in different firms, and the causes for these measures are different. They called for the use of a large number of reflectors or formative variables in order to capture multi-dimensional concepts.

Table 5.7: Thresholds for firm size calibrations

This table presents thresholds that were used to calibrate firm size variable. The variable is calculated using 3-4 year averages across the ten years (2001-2010). Definitions of the variables are given below.

SIZEA = Represents firm size defined by total asset and expressed in thousand pounds (£)

SIZES = Represents firm size defined by total net sales and expressed in thousand pounds (£)

FS = Fuzzy set values that are used to convert firm size measures defined in the table: 0.95 represents full memberships which are equivalent to 3,200,000 and 2,500,000 of SIZEA and SIZES respectively. 0.5 is a crossover point equal to 660,000 and 560,000 of SIZEA and SIZES respectively. Finally, FS of 0.05 takes the original values of 13,000 and 26,000 of SIZEA and SIZES respectively

Thresholds	Full memberships	Cross-over point	Full Non-memberships
Criteria	**80^{th} percentile**	**Median**	**Definition of size**
SIZEA	3,200,000	660,000	13,000
SIZES	2,500,000	560,000	26,000
FS	0.95	0.5	0.05

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The 80^{th} percentile of £3.2billions and £2.5billions are used to benchmark full memberships in very-large firm size set. In the UK, sections 465 of the Companies Act 2006 as amended in 2008 define a SME for the purpose of accounting requirements. According to this a medium-sized company has a turnover of not more than £25.9 million and asset not more than £12.9 million and not more than 250. This implies that a firm is defined as large if has net assets above £12.9million or net sales higher than £25.9million. Since this research use firms listed in London stock exchange then I use these firm cut-offs to define a set of large firms. However, it can be argued that although these thresholds for large firms have been precisely and objectively determined, the concept of largeness generally remain fuzzy because some are much larger than others. The definitions of large firm size are used to benchmark lower boundary of large firm size set (i.e., £0.026billion for sales and £0.013billion for assets). Table 5.7 summarises the benchmarks.

Firm size macrovariable

Correlation results in table 5.2 show that SIZEA and SIZES variables are highly and significantly correlated (Correlation = 0.90), and they have excellent internal consistency (α = 0.946) (George and Mallery, 2003) (see table 5.13). This implies that the variables agree to form a macrovariable (Ragin, 2000; 2008). According to Ragin, highly correlated variables can be "substitutable" to create a macrovariable

(SIZE) (2008, p. 142). Procedures for creating SIZE are similar to those illustrated in table 1.2.

Table 5.8: Internal consistency of firm size measures

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.946	.946	2

5.3.3.2: Financing choice

Financing choice variables are defined in section 2.3.3 (see also Loughran and Ritter, 1997). Based on the definition of financing choice; leverage and internal fund are used in this research as key financing choices for growth strategy in LSE-FASI-Firms.

It is argued that because of agency problems, debt and internal fund all have both a positive and a negative effect on financial performance as clearly discussed in section 2.3.3 (see also Jensen and Meckling, 1976; Amihud and Lev, B. , 1981; Jensen, 1986; Porter, 1987; Li and Li, 1996; Aggarwal and Samwick, 2003; Hillier at al., 2011). Section 2.3.3 has shown that levels of debt and internal funds have different influences on managers, shareholders, and debtholders for undertaking geographic and business diversification growth strategies. This leads researchers on corporate diversification and financial performance relationships to control for a standalone contribution of leverage and internal funds on the relationship results.

However, section 2.3.3 has shown theoretical and empirical evidences that firms with different levels of leverage and internal fund and different levels of other firm attributes exhibits different corporate diversification-financial performance relationships. This implies that the two financing choices synergistically combine with corporate diversification and other firm attributes to bring relationship on financial performance. This research uses debt (leverage) and internal funds not as the control variables but as ***sets*** in which ***cases*** are assigned membership, and I discuss below how the leverage and the internal fund sets were established.

Leverage

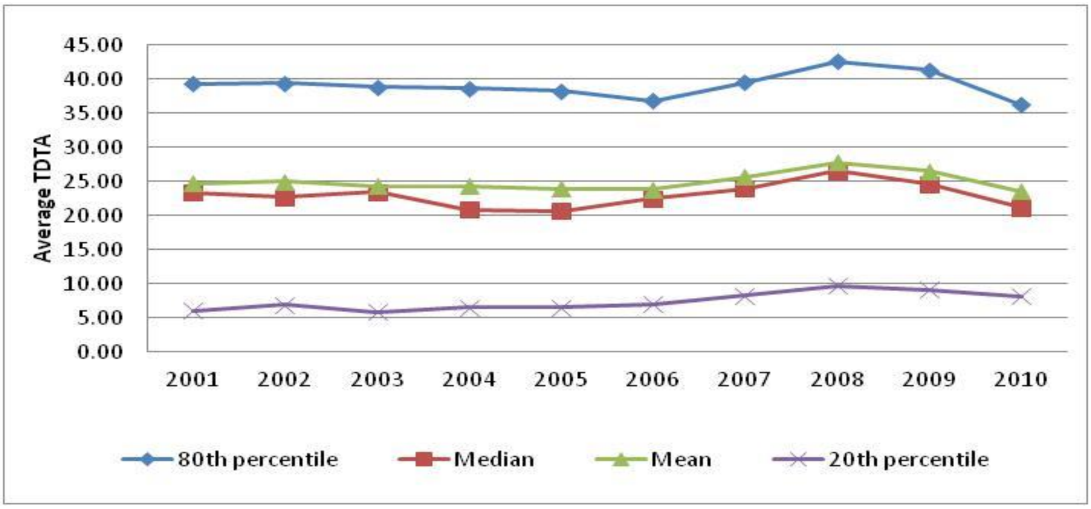
Researchers looking at corporate diversification usually measure leverage levels as a percentage of total debt to total assets (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008). Therefore, leverage in this research is primarily measured as a percentage of total debts on total assets (TDTA). The original measures are obtained from the DataStream (code WC 08236), and then calibrated to fuzzy sets. In order to establish the three thresholds for calibrating leverage; percentiles are used.

Figure 5.1 is developed from the sample of 3129 year firms, and it indicates a TDTA mean of LSE-FASI-Firms across the ten years is around 25%. This is similar a mean of TDTA in table 5.1 that is 24.85% and median of 22.71%. In addition table 5.1 has shown that TDTA skewness is less than 1.0 therefore the approximate mean of 25% of TDTA is used to benchmark cross-over point in this instance.

The 25% is consistent with Cheng, (2008), who found that on average, total debt to asset ratio of European firms for the period 1993-2005 ranges from 20.7% to 29.7%. Furthermore, table 5.1 and figure 5.1 show the 80th percentile and 20th percentile of leverage in LSE-FASI-Firms are about 38% and around 10% respectively. Therefore, I use 38% and 10% to benchmark full membership and full nonmembership in high leverage sets. Summary of the thresholds is indicated in table 1.3

Figure 5.1: Leverage levels in the LSE-FASI-Firms.

This figure shows leverage levels (TDTA) of LSE-FASI-firms across the ten-year periods



Retained Earnings (internal fund set)

Retained earnings represent accumulated after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve account. Traditionally, retained earnings can easily be considered as an output of firm's profitability rather than input for creating profit. This is because profit comes first before been accumulated to create retained earnings. However, retained earnings can best be described as shareholders' reinvestment or firm's reserves for paying out a debt or purchase a capital asset for future profits[72]. Retained earnings appear to be an internal source of funds for firm's investment (Myers, 1977; 1984; Myers and Majluf, 1984) that would create profit in future. Therefore, one can argue that retained earnings is an input for profit creations. In this context, this relationship appears to be a two ways rather than a one way relationship (i.e., egg and chicken story) when net-effect model are used. In principle, retained earnings is one of the two important source of funds (external source – debt and equity capital and internal

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[72] Business dictionary defines retained earnings as Profit generated by a company that are not distributed to shareholders as dividends but are either reinvested in the business or kept as a reserve for specific objectives such as to pay off a debt or purchase a capital assets. Available at: http://www.businessdictionary.com/definition/retained-earnings.html#ixzz2czpREfov. Visited on 22/08/2013

source – retained earnings and reserves), for financing growth such as diversification and other resources of firms for maximising financial performance including profit.

In principle, this research considers retained earnings as an input for creating profit, however since this research applies configuration approach (FSA), retained earnings is not considered as input in isolation of other firm attributes because, I believe that basing on pecking order theory and agency cost theory; retained earnings would appear a resource for favourable financial performance in presence or absence of other firm attributes. Besides, FSA is more about configurations rather than individual variable contribution in the outcome. Therefore, direct relationship is not the main concern but configuration.

According to pecking order theory (Myers, 1984; Myers and Majluf, 1984), firms with high level of internal funds can benefit more from financing their growth opportunities using cheap source of finance like internal funds. Since corporate diversification is a growth strategy, then it can logically be argued that diversification in firms with high retained earnings would increase their profitability because this source of finance is cheap and is likely to lower the cost of capital. Additionally internal funds allow flexibility of undertaking positive investment in the absence of high debt level, this can lead to better financial performance (Myers, 1977). Furthermore, internal fund can be the source of agency problems that can destroy financial performance through overinvestment associated problems (Jensen, 1986; 1993), therefore high level of leverage would be important to reduce overinvestment problems (Li and Li, 1996).

This research uses retained earnings as an equityholders' fund for financing geographic and business diversification growth that can lead to either favourable or unfavourable financial performance, depending on the presence or absence of other conditions like asset structure and firm size.

Retained earnings data is available in the DataStream (code WC 03495) and this variable is scaled by dividing the total assets (WC 02999) to create (RETA) as in Singh et al, (2003). Like other variables, the thresholds for calibrating the raw data to fuzzy set values are calculated using the 3-4 year averages. Table 5.1 shows that the

RETA variable is highly skewed (i.e., skewness value is -1.18), therefore, I calculate the cross-over point based on median.

Figure 5.2 is developed from a sample of 3129 year firms (see section 4.3.2). It shows that RETA's median is around 18%, and 80th percentile is about 36%. These values are similar to those calculated from the 836 cases as presented in table 5.1. Therefore, full membership and cross-over point will be 36% and 18% respectively, while full nonmembership is calculated as 3% (20th percentile) (see table 5.1).

Figure 5.2: 80th percentile, median and mean of RETA in LSE-FASI-Firms

This figure presents levels of internal funds (RETA) in LSE-FASI-Firms across the ten-year period. RETA: is defined as a percentage of accumulated after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve account of total assets

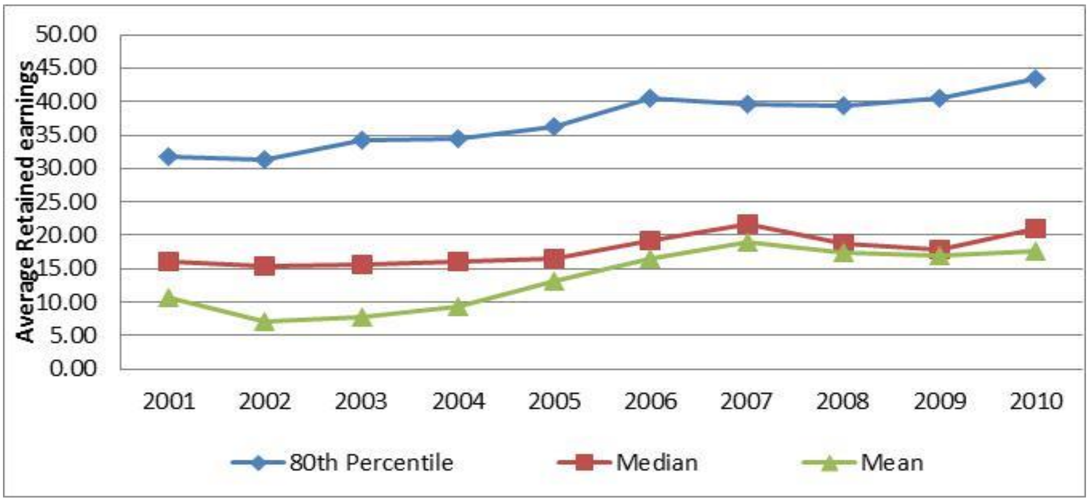


Table 5.9 indicates original variables with their corresponding fuzzy set qualitative threshold qualifiers for full membership, full nonmembership and cross-over point of financing choice variables of the LSE-FASI-Firms

Table 5.9: Thresholds for financing choices variables.

The table shows the thresholds that were used to calibrate financing choice variables. The variables were calculated based on the sample of 3129 year firms across the ten-year period (2001-2010). Definitions of the variables are given below.

TDTA= Leverage – is defined as a ratio of total debt to total assets (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008).

RETA = Retained earnings: represents the accumulated after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve (WC03495) divided by total assets (DataStream code WC02999)(see also Singh, et al., 2003)

FS = Fuzzy set values that are used as benchmarks for converting the financing choice measures defined in the table. 0.95 represents full membership which is equivalent to 38% and 36% for TDTA and RETA respectively. 0.5 is a crossover point which is equal to 25% and 18% for TDTA and RETA respectively. Finally, FS of 0.05 takes the original values of 10% and 3% for TDTA and RETA respectively.

VARIABLES	Full memberships	Cross-over point	Full Nonmembership
	80th	Mean	20th
TDTA	38%	25%	10
RETA	36%	18%	3
Fuzzy set (FS)	0.95	0.5	0.05

5.3.3.3: ASSET STRUCTURE

Section 2.3.4 of this thesis had defined asset structure to include tangible and intangible assets, and it has shown that asset tangibility and intangibility are the important factors in examining corporate diversification-performance relationships (see also Caves, 1996; Morck and Yeung, 1997; Contractor et al., 2003; Lu and Beamish, 2004; Hitt et al., 2006). In consistent with the previous researchers, this research also uses asset tangibility and intangibility as important sets where cases with different memberships are expected to have different memberships in financial performance (see for example Bettis and Mahajan, 1985; Williamson, 1988; Miller et al., 1990; Burgman, 1996; Palmer et al., 1999; Nickel and Rogriguez, 2002).

The processes and criteria for developing the asset tangibility and intangibility sets are discussed below.

Asset Tangibility

Asset tangibility refers to hard assets. Some firms have more hard assets (more tangible) than others. Hard assets are collateralised and so firms with high levels of tangible assets are capable of obtaining debt capital for financing growth at relatively lower costs, consistent with transaction cost theory. Asset tangibility is therefore an important variable for understanding corporate diversification-performance relationships (Hitt et al., 1997 see also section 2.3.2 of this thesis); therefore, it is included in this study.

Asset tangibility is commonly measured as the ratio of property, plant, and equipment (PPE) to total assets (here after TANG) (Morck and Yeung, 1991; Hitt et al., 1997; Rocca et al., 2009). PPE and total asset data were collected from the DataStream and were used to develop TANG original variable which was then transformed to fuzzy sets.

Figure 5.3 is developed from 3129 year firms' sample. It shows that skewness of TANG data is 0.76 which is not high, so a mean of 33% is used to determine cross-over point; this mean is similar to that reported in table 5.1 which is 33.33%. 80^{th} percentile in table 5.1 is 58%. However, I argue that above 50% level of asset tangibility can be regarded as high so I decided to use 75^{th} percentile that is 50% tangibility level to benchmark full membership in high TANG sets (see figure 5.3). 25^{th} percentile of 10% is used as the cut-off point for full nonmembership.

Figure 5.3: Tangibility in LSE-FASI-Firms (2001-2010)

This figure presents levels of asset tangibility (TANG) in LSE-FASI-Firms across the ten-year period. An original sample of 3129 was used to construct the figure as external criteria for enhancing robustness of the benchmarks. Asset tangibility is defined as a percentage of PPE on total assets. The 75^{th} and 25^{th} percentiles and means were used to create the three thresholds.

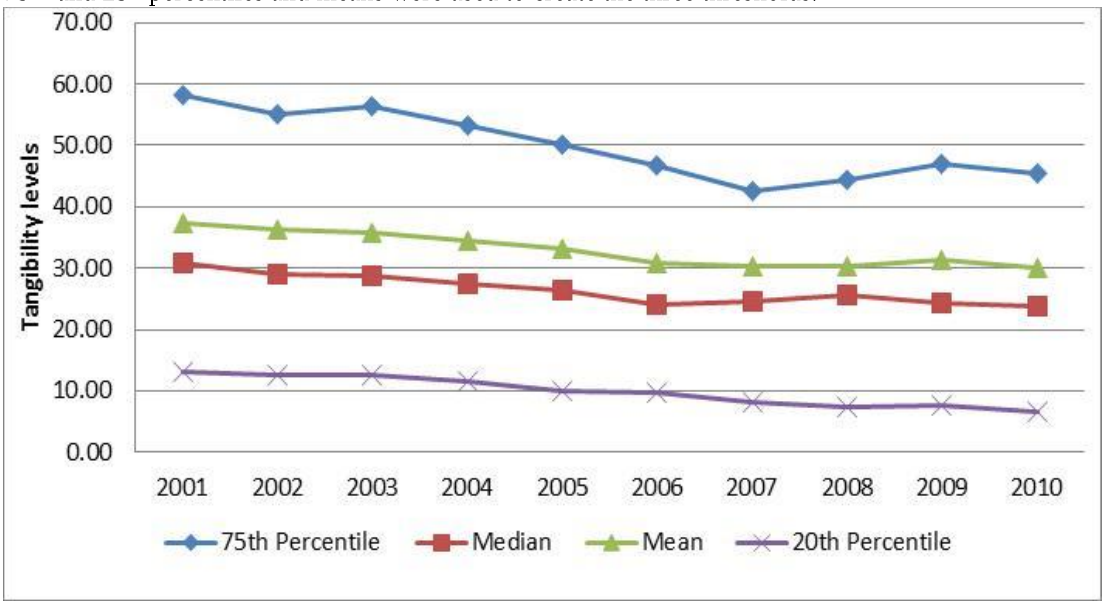


Figure 5.3 shows asset tangibility is declining over time which implies that firm are slowly shifting from possessing a high level of tangible assets and increasing the levels of intangibles, this is confirmed in figure 5.6 below.

Assets intangibility

Intangible assets include company specific assets like human capital assets, patents, brands, goodwill, marketing abilities, and research and development. These assets are shown in annual reports as intangibles, and they are firm-specific in nature. It is argued that firms with high levels of firm-specific asset benefit more from geographic diversification (Caves, 1996; Morck and Yeung., 1991; 1992; 1997; Hitt, 2006); the intangible asset variable is used in this research.

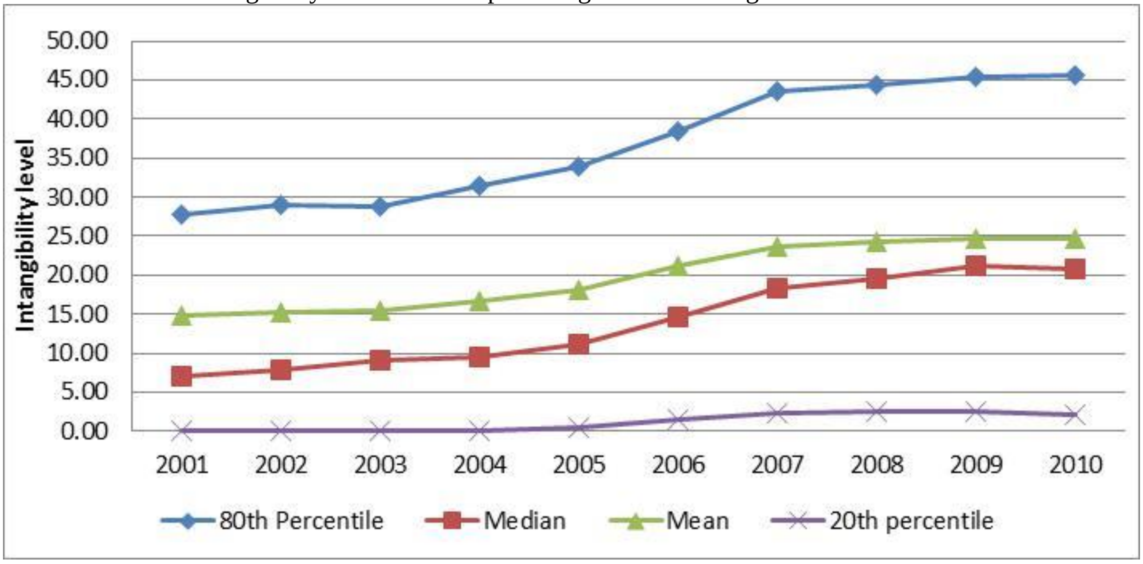
There are different ways to proxy firm's level of asset intangibility this includes: expenditure on R&D and advertisement and total intangible assets as disclosed in companies' annual reports. This research requires application of average levels of intangibility which includes not only current commitments of firms on intangible assets, but also the previously acquired intangible assets. In this context, asset intangibility in the current research is expressed as a fraction of intangible assets on total assets (INTA). The original intangible asset is obtained from the DataStream (WC 02649) and scaled by dividing to total assets (WC 02999) and before randomly checked to see if the values from the DataStream are different from those of the companies' annual reports[73]. INTA is then calibrated to fuzzy sets.

Table 5.1 indicates that INTA data is not highly skewed (skewness is 1.04), thus the mean value of 20% is used as the cross-over point, and 80th percentile (38%) is used to benchmark full membership in the set of high INTA. The 20th percentile of 2% is used to benchmark full non-memberships. The benchmark values above are similar to those presented in figure 5.4 which represent values of the original sample of 3129 year firms. This means, the benchmarks are robust.

[73] This process of reconciling measures collected from the DataStream with the annual report figures was done across all the variables collected and were found to have better reconciliations.

Figure 5.4: Asset intangibility in LSE-FASI-Firms (2001-2010)

This figure presents levels of asset intangibility (INTA) in LSE-FASI-Firms across the ten-year period. An original sample of 3129 was used to construct the figure as external criteria for enhancing robustness of the benchmarks. The 75th and 25th percentiles and means were used to create the three thresholds. Asset intangibility is defined as a percentage of total intangible assets on total assets.



Summary of the benchmarks for calibrating asset structure variables are presented in table 5.10 below

Table 5.10: Thresholds for calibrating asset structure variables.

The table presents thresholds that were used to calibrate asset structure variables. The variables were calculated using 3-4 year averages across the ten years (2001-2010). Definitions of the variables are given below.

TANG = Tangibility: represents Gross Property, Plant and Equipment less accumulated reserves for depreciation, depletion and amortization (WC02501) divided by total assets *100 as in(Morck and Yeung, 1991; Hitt et al., 1997; Rocca et al., 2009).

INTA = Intangibility percentage of intangible assets (WC 02649) on total assets (WC 02999)

FS = Fuzzy set values that are used to transform asset structure measures defined in the table: 0.95 represents full membership equivalent to 50% and 38% of TANG and INTA respectively. 0.5 is a crossover point which is equal to 33% and 20% of TANG and INTA respectively. Finally, FS of 0.05 takes the original values of 10% and 2% of TANG and INTA respectively

VARIABLE	Full memberships	Cross-over point	Full Non memberships
	Percentile	Mean	Percentile
TANG	50% - 75th	33%	10% - 25th
INTA	38% - 80th	20%	2% - 20th
FS	0.95	0.5	0.05

5.4: Conclusions and contributions of this chapter

One of the key objectives of this chapter was to provide evidence that when a multi-dimensional construct is represented by a single measure it often misleads results and conclusions. This problem has been noted by previous researchers, (Nunnally, 1978; Delmar, 1997; Sullivan, 1994; Bagozzi et al., 1991; Ramaswamy et al., 1996; Riahi-Belkaoui, 1998; 1999; Ragin, 2000; 2008; Delmar et al., 2003; Capar and Kotabe, 2003; Russell and Thomson, 2009; Achtenhagen et al., 2010; Danbolt, et al., 2011). However, little attention has been given to solve the problem (Sullivan, 1994). The empirical evidence presented in section 5.1 has confirmed that one measure of a multidimensional construct is not always sufficient to represent a multi-dimensional concept and leads to conflicting conclusions. It appears that the application of macrovariables reduces the problem.

Another objective was to discuss how the three benchmarks for calibrating original variable values to fuzzy set values are determined. In consistent with previous research, this chapter has shown that theoretical and empirical evidences from previous research were used to identify the three qualitative benchmarks. These benchmarks are summarised in table 5.11 below. Table 5.11 is the output of this chapter; it presents the original variable values and their corresponding fuzzy set value that were used to transform original variable measures to fuzzy set values. This table also shows how the variables presented in figure 4.6 in chapter 4 were reduced from thirteen to nine variables because of application of macrovariables.

Furthermore, this chapter have made a significant contribution to literature on how fuzzy set variables are developed and used to understand necessary and sufficient conditions for an outcome of interest. This chapter has also shown different process of create sets from scale variables which is important to future researchers interested in moving beyond net-effect type of thinking to configuration thinking. In specific, calibration process of scale variables has practically shown and justified to allow future researchers to replicate the process. Finally, this chapter brings a foundation for development of the empirical chapters of this thesis.

Table 5.11: Original variable and fuzzy set value thresholds

This table presents a list of all sets with their corresponding original variable values (OVV), fuzzy set values (FSV) which defines the three thresholds of membership of the cases in the sets: full membership, cross-over point, and full nonmembership. The last column represents the sets used in the analysis and their definitions are found in table 4.4 in chapter 4. ***or*** is a fuzzy set logical ***or*** which implies that the two sets joined by the ***or*** are used to creates a respective macrovariable-set, ***and*** is a fuzzy set logical and which shows that the two sets used to join the two sets creates a new set by considering a set with lowest memberships. * means the set was only used to create another set, and not used in the analysis.

Sets	**Full membership**		**Cross-over point**		**Full non membership**		**Sets used**
	OVV	**FSV**	**OVV**	**FSV**	**OVV**	**FSV**	
MTB-market to book	2	0.95	1.5	0.5	1	0.05	**MTB**
ROA-return on assets	12%	**0.95**	7%	**0.5**	3%	**0.05**	**PROF =** ROS ***or*** ROS
ROS-return on sales	20%		12%		4%		
SDROA-risk-reduction	1	**0.95**	2.8	**0.5**	7	**0.05**	*****RISKR = SDROA or SDROS
SDROS-risk reduction	0.6		1.7		5		
RRP risk-return performance	-	**-**	-	**-**	-	**-**	**RRP =** PROF *and* RISKR
DGA-segmental assets	1	**0.95**	0.6	**0.5**	0.2	**0.05**	**DG =** DGA ***or*** DGS
DGS-segmental sales	1		0.6		0.2		
DBA-segmental assets	1	**0.95**	0.6	**0.5**	0.2	**0.05**	**DB =** DBA ***or*** DBS
DBS-segmental sales	1		0.6		0.2		
TDTA-leverage	38%	**0.95**	25%	**0.5**	10%	**0.05**	**TDTA**
RETA-retained earning	36%		18%		3%		
SIZEA=Total assets in billions £	3.2	**0.95**	0.66	**0.5**	0.013	**0.05**	**SIZE =** SIZEA ***or*** SIZEB
SIZES = Total sales in billions £	2.5		0.56		0.026		
INTA-Intangibility	38%	0.95	20%	0.5	2%	0.05	**INTA**
TANG-Tangibility	50%	0.95	33%	0.5	10%	0.05	**TANG**

Chapter 6 EMPIRICAL RESULTS CORPORATE DIVERSIFICATION AND MTB: AN APPLICATION OF FSA.

6.1: INTRODUCTION

Chapter 2 has shown that the partial and fragmented results about corporate diversification and MTB relationship have been caused by methodological problems, and chapter 3 and chapter 4 have shown that fuzzy set analysis can solve these problems. Chapter 6 intends to present an analysis and discussion of the empirical evidences that reduce the previously noted partial and fragmented results by showing how the combinations of geographic and business diversification strategies and other firm attributes sufficiently lead to favourable MTB. In this chapter, favourable MTB was defined as performance above (median) 1.5 ratio of market to book value (here after MTB)[74] of firms listed in the London stock exchange FTSE Allshare index (hereafter LSE-FASI-Firms). This chapter, specifically addresses the first key research question and the hypothesis, both stated below.

> ***How does corporate diversification necessary and sufficiently lead to favourable MTB?***

The development of this chapter is mainly based on the internalisation theory of synergy (ITS) transaction cost theory (TCT), and agency theories (ACTs). These theories are used in selecting variables/fuzzy sets to be used in this research and in explaining configurations[75] for favourable MTB in LSE-FASI-Firms. Based on the hybridisation of these theories, ***hypothesis a*** below was used to examine question 1 above, and to construct a generic theoretical framework to be used in this chapter to provide theoretical and empirical evidences.

> ***A combination of high membership in geographic and not-high membership in business diversification sets, high membership in internal fund and intangible asset sets is a necessary but not sufficient indicator to achieve favourable MTB. The Sufficient configuration will depend on cases' membership in other attributes such as case size and leverage sets.***

[74] See chapter 5 for details on how this benchmark was determined

[75] The term configuration is used interchangeably with configuration and solution to mean connections or hybridisations of causal variables for a desired outcome of interest.

6.1.1: THE SET-THEORETIC FRAMEWORK

The set-theoretic framework developed to explore configurations for favourable MTB in this chapter is constructed mainly through the hybridisation of ITS and TCT, with ACTs been used as a supporting theory. The generic set-theoretic framework on figure 6.1 is based on ***necessary conditions*** as per the above hypothesis.

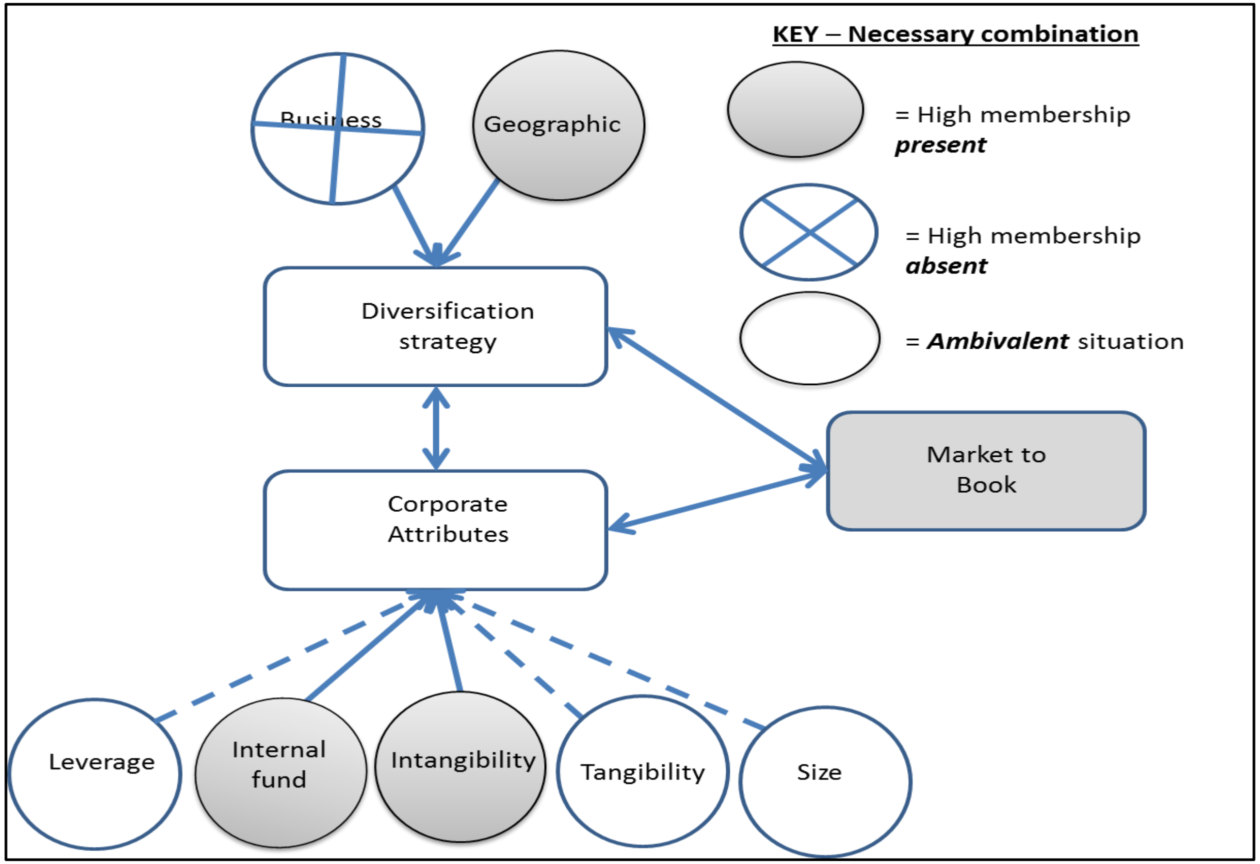
Theoretically, ITS contends that a high level of geographic diversification and not-high business diversification synergistically enables firms to create internal markets for their intangible assets (Morck and Yeung, 1991; 1992; 1997); to enhance benefits from economies of scope that stem from resource sharing (Bettis and Hall, 1982 Kaplan and Weisbach, 1992; Denis et al., 2002; Barnes and Hardie-Brown, 2006) and easy knowledge transfer across related business segments (Nickel and Rodriguez, 2002). In addition, related business signals low level operational complexity (Aggarwal and Samwick, 2003; Scott et al., 2007) and agency problems (Jensen, 1986).

The research literature on corporate diversification and firms' value has shown that most intangible assets are firm- specific in nature and specific to a certain line of business; thus they have less value to external markets. Consequently, a high level of these assets leads firms to have less capacity to access external finance. With this in mind, I argue that corporations with high membership in intangible asset sets can create better use of these assets by increasing their membership in geographic diversification while keeping low membership in business diversification sets as core conditions. This is consistent with ITS.

In addition, TCT contends that the presence of high levels of intangible assets would necessarily require relatively high levels of internal funds (absence of leverage) for investors to assign positive value. It should be noted that intangibles have less collateral value; consequently, internal funds become an important source of finance in firms with high levels of intangibles. In other words avoidance of high membership in leverage appears necessary to achieve favourable MTB in firms that have high levels of intangible assets. Figure 6.1 is a set-theoretical framework to explore configurations for favourable MTB as explained below.

Figure 6.1: Set-theoretic framework of configurations for favourable MTB

This figure is a ***generic*** set-theoretic framework adopted to explore ***configurations*** for favourable MTB. The dots represent firms' membership in different attributes that include: Geographic and business diversification sets, internal fund and leverage sets, intangibility and tangibility sets, and firm size set. The filled dots represent the presence of above 0.5 membership in the respective set; a dot with a cross indicates the presence of firms' membership of 0.5 or less in the respective set. The unfilled dot represents ambivalent situations where the impact of the presence of high or not-high membership in the ***necessary configuration*** is not clearly determined. The continuous arrows indicate that the condition is theoretically assumed present. While dotted arrows indicate the presence of a condition which is not theoretically determined but is important in the configuration



The filled circles in figure 6.1 indicate that it is necessary for a firm to possess high membership in the respective set, while the circles with a cross indicate that absence of high membership in a respective set is theoretically necessary for achieving favourable MTB. The unfilled circle represents ambivalent situations where a firm's possession of high or not-high membership in the respective sets is assumed to be not theoretically necessary, but might be important when it comes to determination of sufficient configurations for favourable/unfavourable MTB. The continuous arrows on figure 6.1 indicate that the presence of a corresponding membership in the respective condition is theoretically necessary; while dotted arrows indicate the presence of a condition which is assumed as not theoretically necessary but is important in the configuration.

Figure 6.1 indicates how conditions are connected to create ***necessary configurations for*** favourable MTB. It shows that a configuration of high membership in geographic and not-high membership in business diversification sets, and high membership in intangible asset and internal fund sets is theoretically ***necessary*** for achieving favourable MTB in LSE-FASI-Firms. A sufficient configuration will depend on the presence of characteristic of cases as hypothesised above.

It appears that hybridisation of ITS and TCT provides a sufficient explanation of the impact of corporate diversification strategies on MTB (see section 1.5). Hybridisation "allows a finer-grained understanding" of how causal conditions interact/hybridise in order to sufficiently explain outcomes of interest (Fiss, 2011, p.411). The hybridisation of ITS and TCT outlined above does not explain the effect of firm size and asset tangibility in understanding the impact of diversification on MTB. However, these attributes have been consistently used in other research. I have assumed that the presence, absence, or ambivalence of these attributes may provide important evidence when it comes to identification of configurations for favourable MTB.

As discussed in section 1.3 of this thesis, before presenting results of the key questions, supporting questions have to be addressed first. This chapter starts by providing empirical answers to the supporting questions listed below. These questions are addressed using traditional methods of analysis: independent sample means comparison and regression analysis (OLS). The supporting question helps provide justification for the use of this FSA in this research and to provide robust testing on FSA results.

- ***2i(A). Is there a diversification category that necessarily leads to favourable MTB?***
- ***2i(B). Do degrees of geographic and business diversification lead to differences in a firm's membership in MTB, financing choice, firm size, and asset structure sets?***
- ***2i(C) Given geographic and business diversification strategies, what are the impacts of geographic and business diversification membership on MTB?***

Answers to these questions are presented later on in section 6.3.

6.2: DATA, VARIABLES (SETS), AND DESCRIPTIVE STATISTICS

This research uses data from LSE-FASI-Firms for a period of ten year (2001-2010) broken down into three groups[76]. Original data/variables were available from the DataStream and have been presented in table 4.10 and in table 5.1 of chapter 4 and chapter 5 respectively. Since this research uses fuzzy sets then the original variables were calibrated to fuzzy sets. This allows determining memberships of cases in different variables/attributes; the term variable/attribute(s) in this thesis is usually replaced with set(s) [77].

The most common measures of MTB is usually defined as market to book value of total assets (MTB), see for example Morck and Yeung, (1991; 1992; 1997) and Denis et al., (2002), and in this chapter favourable MTB set is used as the desired outcome. A firm is classified as having high membership in favourable MTB when its 3-4 year average membership in MTB set is higher than 0.5 (i.e., MTB original

[76] See section 4.3.2 details about sample groups and data management

[77] Section 1.5 in chapter 1 of this thesis provides illustrations of how variables are considered as sets and cases are assigned memberships in the sets using fuzzy set values

value greater than 1.5), otherwise a firm is classified as having not-high membership in favourable MTB set (i.e., high membership in the unfavourable MTB set)[78].

Other sets of interest are geographic and business diversification as the main causal conditions (independent variables). The original geographic and business diversification variables were measured using entropy indexes and then calibrated to fuzzy sets[79]. This research includes also asset structure (tangibility - TANG and intangibility – INTA), financing choice (leverage – TDTA and retained earnings – RETA), and firm size (SIZE) sets. These sets were used because they were theoretically and empirically found to be important determinants of diversification decisions and MTB[80].

6.2.1: Descriptive statistics and Pearson correlations

Table 6.1 presents descriptive statistics and correlations of the calibrated values. It appears that the statistics and correlations presented in table 6.1 and those of original variables presented in table 5.2 are not significantly different. This implies that calibrated values are not significantly different from the uncalibrated variables, so the results from traditional approaches using calibrated measures would not significantly differ from the results of uncalibrated variables.

It appears that on average, membership of LSE-FASI-Firms in favourable MTB set is 0.49 which is around cross-over membership (that is 0.5). Table 6.1 also shows that most firms involved in this analysis have high membership in geographic diversification, business diversification and firm size sets. Consistent with the literature summarised in table 2.3, it shows that geographic diversification is positively and significantly correlated to MTB while business diversification membership appear to have no correlation with membership in MTB sets.

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[78] See section 5.3.1 for a discussion of how the MTB set was developed
[79] See section 5.3.2 on how geographic and business diversifications were calibrated
[80] See section 5.3.3 for details on why the other variables were included as an important part of creating a configuration for favourable MTB rather than being used as control variables, section 5.2 also provides a discussion on how the variables were calibrated.

Table 6.1: Descriptive statistics and correlations – calibrated variables.

This table presents sample statistics (mean and standard deviation) and Pearson correlations of the calibrated variables. The observed correlations in this table are similar to those of the uncalibrated measures in table 4.11. This implies that calibrated variables do not significantly change the quality of the original variables. Details of the definitions and calibration processes of the original variables are presented in chapter 5. However, this table provides a summary of the definitions. There are 836 cases involved in the analysis.

Market to book = Memberships of cases in MTB (MTB) set. The original measure of MTB was calculated as total asset plus market value of equity minus book value of equity divided by total assets as in Denis et al., (2002).

Geographic and (business) diversification = Memberships of cases in geographic (business) diversification sets. Original variables were measured using the entropy measure of diversification as defined in Jacquemin and Berry, (1979), Palepu, (1985) and Hitt et al., (1997)

Leverage (TDTA) = Memberships of cases in leverage set. The original measure of leverage was defined as a ratio of total debt to total assets as in Hitt et al., (1997), Wan and Hoskisson, (2003), Singh et al., (2003), and Cheng, (2008).

Retained earnings (RETA) = Memberships of cases in internal fund set. Internal fund variable was originally represented as a percentage of accumulated after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve, divided by total assets

Firm size (SIZE) = Memberships of cases in firm size set. The original measure of firm size is defined as amount of total firm assets of total sales in pounds

Intangibility (INTA) = Memberships of in cases in intangible asset set. The original variable is defined as a percentage of intangible assets on total assets.

Tangibility (TANG) = Memberships of cases in tangible asset set. The original variable is defined as a percentage of Property, Plant and Equipment on total assets as in (Morck and Yeung, 1991; Hitt et al., 1997; Rocca et al., 2009). * and ** represents 5% and 1% significant levels (two-tailed significance test).

Variables/sets(836 cases)	Mean	S.D	1	2	3	4	5	6	7	8
1. Market to book value (MTB)	0.49	0.38	1							
2. Geographic Diversification	0.59	0.43	.159**	1						
3. Business Diversification	0.53	0.42	-0.01	.226**	1					
4. Leverage - TDTA	0.47	0.39	-.149**	-.075*	0.046	1				
5. Retained Earnings to total assets (RETA)	0.50	0.39	.082*	-.071*	-.092**	-.311**	1			
6. Firm size (assets or sales) (SIZE)	0.56	0.35	-.101**	.150**	.204**	.212**	0.024	1		
7. Intangibles to total Assets (INTA)	0.43	0.39	.156**	.319**	.206**	0.054	-.162**	0.021	1	
8. Tangibles to total assets (TANG)	0.45	0.40	-.221**	-.259**	-.120**	.299**	.088*	.082*	-.569**	1

Table 6.1 also shows that memberships in leverage, firm size, and asset tangibility sets are all negatively correlated with membership in MTB set. Memberships in internal fund and intangible asset sets are positive and significantly correlated with membership in MTB set. This implies that geographic diversification, internal funds and intangibles assets are important to achieve favourable MTB. This is consistent with the results of previous researchers (see table 2.3).

6.3: EMPIRICAL RESULTS FROM TRADITIONAL METHODS

6.3.1: INDEPENDENT SAMPLE MEAN COMPARISON

The independent sample mean comparison is intended to provide empirical evidence of the supporting research question 2ii(B) which states that:

> ***Does degree of geographic and business diversification lead to differences in firm's membership in MTB, financing choice, firm size, and asset structure sets?***

Consistent with previous researchers such as Singh et al., (2003), I created four diversification strategy groups (HGHB, HGLB, LGHB, and LGLB) to define the independent samples. Cases with high membership in both geographic and business diversification, that is fuzzy set values higher than 0.5 (entropy index greater than 0.6) are classified as HGHB, otherwise the cases are classified as LGLB. The cases are classified in the HGLB (LGHB) sample when their membership in geographic diversification is greater (equal or less) than a fuzzy set value of 0.5 and their membership in business diversification is equal or less (greater) than a fuzzy set value of 0.5. This classification is used here because it has been found that less diversified firms have a similar financial performance to that of *focused* firms (Lee at al., 2006).

Table 6.2 presents results of the independent sample means comparison. It shows that **HG**HB and **HG**LB samples have relatively higher membership in MTB and intangible asset sets than **LG**HB and **LG**LB samples. Furthermore, the table shows that LGLB firms have the lowest membership in intangible asset and MTB sets. This may imply that on average, firms with high membership in geographic diversification and intangibility sets appear to be positively valued by investors.

Table 6.2: Membership means comparisons across diversification strategies

This table indicates the means differences across the four diversification strategy groups. Against every diversification strategy group the number of cases is indicated

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified firms and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

T = t-test (2-tailed) of which *, **, and *** represents 10%, 5% and 1% significant level respectively

Variables /Sets	HGHB(315) 1		HGLB(193) 2		LGHB(144) 3		LGLB(184) 4		1&2	1&3	1&4	2&3	2&4	3&4
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	T	T	T	T	T	T
Market to book value	0.51	0.37	0.56	0.39	0.44	0.39	0.42	0.38	-1.69*	1.70*	2.57***	2.84***	3.69***	0.58
Leverage	0.45	0.36	0.44	0.39	0.55	0.40	0.45	0.42	0.22	-2.50***	-0.02	-2.42**	-0.2	2.14**
Retained earnings	0.48	0.38	0.46	0.40	0.46	0.38	0.61	0.39	0.8	0.54	-3.40***	-0.17	-3.66***	-3.28***
Firm size	0.65	0.34	0.54	0.37	0.56	0.35	0.45	0.31	3.32***	2.33**	6.34***	-0.71	2.34**	3.01***
Asset Intangibility	0.55	0.37	0.48	0.38	0.38	0.39	0.22	0.32	2.07**	4.36***	10.64***	2.23**	7.26***	4.19***
Asset tangibility	0.35	0.35	0.42	0.41	0.54	0.42	0.60	0.41	-1.86*	-4.66***	-6.74***	-2.67***	-4.24***	-1.26

In addition, table 6.2 shows that average membership of **HG**LB (0.56) and **LG**LB (0.42) firms in MTB set are significantly different at 1% significant level (t = 3.69). These samples also show significant differences in membership in the intangible asset set (Z = 7.23) where the **HG**LB sample has higher membership than the **LG**LB sample. This is evidence that geographic diversification is important for enhancing MTB.

The results presented in table 6.2 demonstrated empirically that on average corporate diversification strategies are associated with significant differences in firms' membership in MTB, leverage, internal fund, intangibility, tangibility, and firm size sets. Specifically, it appears that HGHB and HGLB cases have relatively high memberships in intangible asset and in favourable MTB sets than the other diversification strategy groups.

Based, on these results, I would like to ***tentatively conclude*** that there is a positive synergistic-effect between high membership in geographic diversification and intangible asset sets in achieving favourable MTB. It appears that it is the presence of intangible assets that enable high geographic diversification to be positively valued by investors. This is consistent with ITS as used in Morck and Yeung, (1991; 1992; 1997), however, the results suggests that the impact of diversification on MTB is not a simple linear relationship but it seem to be complex and cannot adequately be explained using standalone theories as discussed in chapter 2.

This section was also aimed at a tentative explanation of key research 2i(A) which asked:

> ***Is there a diversification category that necessarily leads to favourable MTB?***

The tentative conclusion above, suggests that the presence of high membership in geographic diversification and intangible asset sets is necessary but not sufficient for favourable MTB. It appears that there are synergistic-effects between geographic diversification and intangible assets as suggested by ITS as noted above that cannot be understood using the independent sample mean comparison analysis.

Generally speaking, the results presented in table 6.2 require further analysis to help empirically identify configurations that sufficiently indicate favourable MTB. However, I will firstly examine the net-effect of geographic and business diversification on MTB using linear regression analysis.

6.3.2: EMPIRICAL RESULTS FROM REGRESSION (NET-EFFECT) ANALYSIS

The ordinary square regression analysis is used to provide empirical evidence on supporting research question 2i(C) which states that:

> ***Given geographic and business diversification strategies, what are the impacts of geographic and business diversification membership on MTB?***

Table 6.3 shows regression of geographic and business diversifications on MTB across the four diversification strategies and the whole sample. The results show that membership in geographic diversification set is positively related to membership in MTB set across all the five models.

It appears that on average high geographic diversification, internal funds and intangible assets are favourably valued by investors. This is consistent with previous researchers (Morck and Yeung, 1991; 1992; 1997; Jones et al., 2004; Jones and Danbolt, 2005; Barnes and Hardie-Brown, 2006; Hall and Lee, 2010). For example, Jones and Danbolt examined stock market reaction to business and geographic diversification announcements in the UK and found that firms that have low or zero dividend yield and those that *create future investment opportunity*[81] experienced higher abnormal returns (see also Jones et al., 2004). In addition, it appears that where firms are not-high business diversified (HGLB and LGLB) the geographic diversification appears to have no significant impact. This is consistent with Hitt et al., (1997), who found that geographic diversification has a positive impact on MTB in high business diversified firms but not in not-high business diversified firms

[81] *Create future investment opportunity* was defined as investment in research and development and business and geographic diversification

Table 6.3: Regression models for the four diversification strategies

This table shows ordinary least square regressions of geographic and business diversification and other firm characteristics on MTB. MTB is measured as a ratio of market to book value of firm assets (see chapter 5 for details). A firm is classified as having favourable MTB if its membership in MTB are higher than 0.5

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents firms with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified firms and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents firms with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales. *, **, and *** represent 10%, 5% and 1% significant level respectively.

Explanatory variables	**Linear Regression Models (OLS) – Dependent variable Market to Book value**				
	Full Sample	**HGHB**	**HGLB**	**LGHB**	**LGLB**
(Constant)	.51*** (10.97)	-.059 (-.28)	.48** (2.42)	.86*** (3.90)	.63*** (7.09)
Geographic diversification	.12*** (3.53)	.37** (2.03)	.19 (1.01)	.75*** (2.90)	.10 (.49)
Business diversification	-.034 (-1.06)	.30* (1.87)	-.208 (-1.05)	-.42* (-1.72)	-.15 (-.70)
Leverage	-.047 (-1.19)	.15** (2.25)	-.06 (-.76)	-.09 (-.94)	-.22*** (-2.86)
Retained earnings ratio	.10*** (2.72)	.16*** (2.69)	.17** (2.28)	.10 (1.11)	-.04 (-.50)
Firm size	-.10*** (-2.66)	-.05 (-.79)	-.08 (-1.05)	-.12 (-1.17)	-.28*** (-3.19)
Intangible assets	.060 (1.39)	-.13* (-1.74)	.02 (.23)	.07 (.72)	.25*** (2.78)
Tangible assets	-.138*** (-3.25)	-.25*** (-3.24)	-.19** (-2.05)	-.12 (-1.14)	-.027 (-.37)
Number of cases	**836**	**315**	**193**	**144**	**184**
R-Sq	**0.087**	**0.078**	**0.116**	**0.167**	**0.178**

Table 6.3 also shows that membership in business diversification sets has negative impact and significant on MTB sets in LGHB cases, but the impact is not significant in HGLB and LGLB cases. This confirms the presence of business diversification discounts on MTB that have been consistently documented by previous researchers (Berger and Ofek, 1995; Servaes, 1996; Lins and Servaes, 1999; Campa and Kedia., 2002; Barnes and Hardie-Brown, 2006; Hall and Lee, 2010; Munoz-Bullon and Sanchez-Bueno, 2011). Interestingly, it appears that on average, business diversification discounts do not exist in HGHB firms. This requires a further careful analysis on how combination of geographic and business diversification strategies enhance MTB is needed.

Table 6.3 also shows that high membership in internally generated fund and intangible asset sets are important indicators of favourable MTB. This provides an indication that there might be some synergistic-effects among the three variables (geographic diversification, intangible asset, and internal fund) that cannot be uncovered through regression analysis.

Generally speaking, the results presented in table 6.3, have shown that the impact of geographic and business diversification on MTB is different across the diversification strategies. This indicates how difficult it is for net-effect models like regression analysis to provide a clear-cut solution to explain the contribution of "standalone" geographic and business diversification on MTB. Basically the results presented on table 6.3 has indicated that conditional regression analysis may provide some improvement in understanding the standalone impact of corporate diversification on firm value. However, it does not clearly show how the other attribute synergistically combine with diversification strategies to influence the results. In this case FSA is crucial to this research.

As noted in previous chapters, one of the reasons for the observed differences might be that geographic and business diversification synergistically *hybridise* with other firm characteristics which is hard to address through linear regression models as discussed in chapter 4 of this thesis. Indeed, Thomson et al., (2012), noted that in any hybridisation process it is hard to pinpoint the contribution of one factor. Therefore, as noted above, this research employs configuration analysis (FSA) as the main research method and uses hybrid theories to explain the configurations. The results of the FSA are presented in the next subsections.

6.4: EMPIRICAL RESULTS: FUZZY SET ANALYSIS

6.4.1: INTRODUCTION

There is an old saying which goes "***Not all roads lead to Rome, but there are many roads leading to Rome***"

I have always believed in the value of the saying above as there are many configurations to achieve the same goal. If route 'A' does not lead one person to her destination it might be suitable for others who have the necessary "extra requirements" to use the route. This means that there are core and supporting conditions that can enable a certain route to lead to favourable achievements of goals. Therefore, it is important to understand the conditions that may lead to a desired goal.

The application of set-theoretic framework and FSA in this research has made a step forward in building a better understanding of how to choose a "road" out of the many and complex "roads" which lead to favourable MTB. Research has indicated that there are complex cause-effect relationships between corporate diversification and MTB that cannot be sufficiently discovered by net-effect models.

This chapter applies FSA to empirically identify specific configurations to favourable MTB through geographic and business diversification strategies by addressing the key question 1 below.

> ***How does corporate diversification necessarily and sufficiently lead to favourable MTB?***

The empirical evidence analysed in this chapter has shown that there are three robust configurations (roads) for favourable MTB. The perspectives employed in this thesis allow the analysis of *equifinality*, asymmetric causality, and identification of core and supporting conditions in financial performance and address the facts/issues that have been overlooked in linear regression models (Fiss, 2011)[82].

Consistent with previous research, I argue that the relationship between corporate diversification and MTB is complex and that there are many ways to favourable MTB that cannot be sufficiently examined through net-effect models or explained through standalone theories. To overcome these problems I propose application of a set-theoretic framework, fuzzy set analysis and hybridisation of theories. This helps identify core and supporting conditions and explain how corporate attributes are connected to understand favourable MTB. The research approach used in this thesis provides considerable promise to overcome the inconsistent relationships and identify necessary and sufficient configurations that are usually positively or negatively valued by investors.

This section presents, analyses, and discusses results of FSA. Features of FSA have been clearly described in chapter 3 showing that the truth table is essential when FSA is applied as a research method. Prior to presenting the truth table results, this subsection practically explains the three main steps of truth table analysis, theoretically discussed in chapter 3. In order to use the truth table, the fsQCA software which is provided free online by Ragin et al., (2003) is employed.

The first step of truth table analysis is construction of the truth table. The truth table is usually developed based on theories that would explain the connections of causal variables for an outcome of interest (Ragin, 2000). The main theories used to develop hypothesis a are ITS and TCT. Therefore, the truth table was developed based on hybridisation of the two theories as summarised in section 1.5 and 6.1 above.

The truth table displays all the logically possible combinations that show presence and absence of high membership of companies in different sets (conditions). “Yes” and “No” are used to represent the presence and absence of high membership as shown in table 6.4. Previous research into FSA represented the presence and absence of high membership in a condition by using 1s and 0s respectively. This may appear harder for readers to distinguish fuzzy set from crisp set analysis (CSA) because all

[82] Definitions of equifinality and asymmetric causality are found in appendix 1 of this thesis

the results are shown on similar way of presentation. To distinguish the results of the truth table of FSA results and those of CSA, I use "Yes" and "No" where "Yes" refers to fuzzy set values ranging from 0.5 to 1, while "No" means fuzzy set values ranging from 0 to 0.5. For the purpose of this research 0.5 is included in the "not-high" and is excluded in the "high" category.

As discussed in section 3.3.3.2, it was decided that around 85% consistency and frequency of seven cases cut-offs would allow to test for significance of at least more often than not sufficient configurations. The truth table 6.4 has indicated that a consistency of 84.8% meets the established criteria. The consistency cut-off of 84.8% is higher than the recommended level of 80% (Ragin, 2008) and is around 85% (the guide cut-off) therefore is used in this chapter. It should be noted that frequency and consistency cut-offs are usually decided after the truth table is produced but before producing the solutions/configurations. This is because, a truth table is intended to show how the cases are distributed across different rows, thus cut-offs are not needed. Cut-offs becomes important to obtain reasonable number of configurations and higher consistency for identifying and analysing sufficient or necessary configurations (after truth table results). Therefore, the pre-determined cut-offs were intended to provide bases for cut-offs rather than being used as cut-offs per se. Furthermore, since this research uses 836 cases, then the frequency cut-off of seven (7) cases is used as recommended in Von Eye, (1990) (see also section 3.3.3.2).

The cut-offs established above imply that some configurations have to be eliminated from the analysis so table 6.4 is the truth table that lists 47 of the 128 possible configurations that have at least seven cases. The 47 configurations constitute 76% of all cases involved in the analysis which is higher than the recommended level of 70% (Ragin, 2000; see also section 3.3.3.2).

The second step is to minimise the configurations and create simpler statements in order to exclude information which are not important and remain with important and theoretically justifiable information. This enables the understanding of the underpinning theories that are employed in the research (Ragin, 2008).

Table 6.4: Truth table of configurations for favourable MTB

This table presents a distribution of configurations with seven or more cases that achieved favourable MTB **(MTB)** at different levels of consistency. **Yes** = means the cases have high membership in their respective sets (membership higher than 0.5). **No** = means the cases have not-high membership in the respective sets (membership 0.5 or less). **YES** = means the cases that display favourable **MTB**, and **NO** = means cases within the respective configuration that do not display favourable **MTB**.

Diversification:

DG = Membership in geographic diversification set; **DB** represents membership in business diversification sets. Membership of corporate diversification is commonly calculated using segmental assets ***or*** segmental sales and usually represented by entropy measures of diversification (Palepu, 1985; Hitt et al., 1997; Qian et al., 2008, Chiao and Ho, 2012), which are then calibrated to fuzzy sets.

Financing choice:

TDTA = membership in leverage *sets* as defined by total debts to total assets. **RETA** = membership in internal funds *set* as defined by total retained earnings to total assets.

Asset structure and firm size:

TANG = membership in asset tangibility *set*, it is measured as the percentage of total property, plant, and equipment (PPE) on total assets. **INTA** = membership in asset intangibility *set* refers to as percentage of total intangible assets on total assets (Rocca et al., 2009). **SIZE** = membership in firm size set; firm size is usually reflected in a firm's structure (assets) ***or*** performance (sales) (Gooding and Wagner III., 1985). Thus assets and sales volumes are used to identify firm's membership in firm size as represented by macrovariable. All the sets are defined using fuzzy set values.

Number = numbers of cases in each configuration; **MTB** is membership in MTB calculated by the proportion of market to book value

Raw consist. = raw consistency is the proportion that the configurations agree in displaying favourable **MTB** performance.

Rows	Diversification		Financing Choice		Firm Size and Asset Structures			Cases	Outcome	Raw consist
	DG	DB	TDTA	RETA	SIZE	INTA	TANG	Number	MTB	Raw consist.
1	***Yes***	***No***	***Yes***	***Yes***	***Yes***	***Yes***	***No***	***8***	***YES***	***88.5%***
2	***Yes***	***No***	***No***	***Yes***	***No***	***Yes***	***No***	***10***	***YES***	***85.5%***
3	***Yes***	***No***	***Yes***	***No***	***Yes***	***Yes***	***No***	***7***	***YES***	***85.3%***
4	***Yes***	***Yes***	***Yes***	***No***	***Yes***	***No***	***No***	***7***	***YES***	***85.3%***
5	***Yes***	***No***	***No***	***Yes***	***No***	***No***	***Yes***	***8***	***YES***	***85.2%***
6	***Yes***	***No***	***No***	***Yes***	***No***	***No***	***No***	***12***	***YES***	***85.2%***
7	***Yes***	***No***	***No***	***No***	***No***	***No***	***No***	***8***	***YES***	***85.2%***
8	***Yes***	***No***	***No***	***Yes***	***Yes***	***Yes***	***No***	***12***	***YES***	***84.8%***
9	Yes	No	No	No	Yes	Yes	No	9	NO	82.9%
10	Yes	No	Yes	No	No	Yes	No	13	NO	82.8%
11	Yes	Yes	Yes	Yes	Yes	Yes	No	19	NO	82.7%
12	Yes	No	No	Yes	Yes	No	No	11	NO	81.2%
13	No	No	No	No	No	No	No	9	NO	80.7%
14	Yes	Yes	Yes	No	Yes	Yes	No	34	NO	80.6%
15	Yes	Yes	No	Yes	Yes	No	No	16	NO	80.2%
16	Yes	Yes	No	Yes	Yes	Yes	No	25	NO	80.1%
17	Yes	Yes	No	Yes	No	Yes	No	22	NO	79.8%
18	No	Yes	Yes	No	Yes	Yes	No	9	NO	79.7%
19	Yes	No	No	No	No	Yes	No	15	NO	79.6%

Rows	Diversification		Financing Choice		Firm Size and Asset Structures			Cases	Outcome	Raw consist
	DG	**DB**	**TDTA**	**RETA**	**SIZE**	**INTA**	**TANG**	**Number**	**MTB**	**Raw consist.**
20	No	Yes	No	Yes	No	Yes	No	9	NO	79.4%
21	Yes	Yes	No	Yes	No	No	No	18	NO	79.0%
22	Yes	Yes	No	No	Yes	No	No	18	NO	78.1%
23	No	No	No	No	No	No	Yes	7	NO	77.8%
24	Yes	Yes	Yes	No	No	Yes	No	16	NO	77.6%
25	No	No	No	Yes	No	No	No	11	NO	76.2%
26	Yes	Yes	No	No	Yes	Yes	No	15	NO	76.1%
27	No	No	Yes	Yes	Yes	No	No	7	NO	75.0%
28	No	Yes	No	Yes	No	No	Yes	8	NO	74.9%
29	Yes	Yes	Yes	Yes	Yes	No	Yes	11	NO	74.1%
30	Yes	Yes	No	No	Yes	No	Yes	9	NO	73.9%
31	Yes	Yes	No	Yes	Yes	No	Yes	25	NO	73.8%
32	Yes	Yes	No	No	No	Yes	No	15	NO	73.8%
33	Yes	No	Yes	Yes	Yes	No	Yes	9	NO	73.6%
34	No	No	No	Yes	Yes	No	Yes	15	NO	73.0%
35	Yes	Yes	Yes	No	Yes	No	Yes	14	NO	71.8%
36	No	Yes	No	No	Yes	No	No	8	NO	70.3%
37	No	No	No	Yes	No	No	Yes	19	NO	70.1%
38	Yes	No	Yes	No	No	No	Yes	10	NO	69.5%
39	No	Yes	Yes	Yes	No	No	Yes	7	NO	68.3%
40	Yes	No	Yes	No	Yes	No	Yes	11	NO	66.0%
41	No	No	No	Yes	Yes	No	No	16	NO	63.0%
42	No	No	Yes	No	No	No	Yes	13	NO	61.0%
43	No	No	Yes	Yes	Yes	No	Yes	12	NO	60.4%
44	No	Yes	Yes	No	Yes	No	Yes	16	NO	60.1%
45	No	Yes	Yes	Yes	Yes	No	Yes	20	NO	59.5%
46	No	No	Yes	No	Yes	No	Yes	16	NO	57.8%
47	No	No	Yes	Yes	No	No	Yes	11	NO	57.7%

Minimisation process is done using fsQCA2.0 software. This software uses Quine-McCluskey algorithms (QMA) to create simpler statements (Ragin, 2000; 2008). QMA is used to determine simpler set-theoretic connection amongst causal elements that form a configuration for an outcome of interest to occur. In order to do this, fsQCA produces two important solutions: parsimonious and intermediate solutions. Parsimonious and intermediate are usually used in the analysis of FSA results (Ragin, 2008; Crilly, 2011; Fiss, 2011; Meuer, 2011). Therefore, this research uses the parsimonious and intermediate solutions (see section 3.3.3.3).

The third step is to present the results of parsimonious and intermediate solutions in a combined form (Meuer, 2011). Consistent with Ragin and Fiss, (2008), Crilly, (2011), Fiss, (2011), and Meuer, (2011), the truth table results are presented using configuration tables, in which core and supporting conditions are represented by using dots. Large dots represent core conditions and small dots represent supporting conditions. Unfilled dots (○) indicate an ambivalent situation where the presence or absence of a condition has no impact on the outcome of interest (Fiss, 2011)[83]. Filled dots (●) show the presence of high membership (fs > 0.5) in a certain causal condition (set), while dots with a cross (⊕) indicate absence of high membership of a case (fs ≤ 0.5) in the respective set. The next subsection presents, analyses, and discusses configurations that lead to favourable MTB.

6.4.2: CONFIGURATIONS FOR FAVOURABLE MTB

Table 6.5 present configurations of geographic and business diversification, financing choice, firm size, and asset structure that sufficiently indicate favourable value of LSE-FASI-Firms. There are five different configurations that lead to favourable MTB of which two configurations share same core conditions, this leads to four equally effective configurations that lead to favourable MTB.

[83] The term ambivalent situation used in this research was previously referred to as don't care situation (Ragin and Fiss, 2008; Fiss, 2011), which means the absence or presence of a condition that does not make impact on an outcome of interest

Table 6.5: Configurations for favourable MTB

This table presents results of the truth tables which show configurations that lead to favourable MTB. The consistencies of the configurations were further tested for significance using Z-test one-tailed, as suggested in Ragin, (2000). *, **, and *** represents 10%, 5%, and 1% significant level (one tailed z-test). ***Definitions***: **Consistency** measures how well the solution corresponds to the data and theory. **Coverage** measures empirical importance of a solution: raw coverage is the proportion that the solution covers in the favourable MTB set which does not exclude shared coverage. Unique coverage is the proportion uniquely covered by a solution in favourable MTB set. ⬤ = presence of core causal condition; ⨁ = Core condition absent; ● = Supporting causal condition present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions (Sets)	Configurations for favourable firm value (MTB)					Robust configuration – sensitivity analysis		
	MTB-1A	MTB-1B	MTB-2	MTB-3	MTB-4	MTB-1	MTB-2	MTB-3
Diversifications:								
Geographic	⬤	⬤	●	●	●	⬤	●	●
Business	⨁	⨁	⨁	⨁	⬤	⊕	⨁	⨁
Financing Choices:								
leverage	⨁	⨁	⬤	⊕	⬤	⊕	⬤	⊕
Retained Earnings	○	●	○	⬤	○	⬤	○	⬤
Asset Structure & Size:								
Intangibility	⨁	⨁	⬤	⬤	⨁	⊕	●	⬤
Tangibility	⊕	●	⊕	⊕	⨁	⬤	⨁	⊕
Size	⨁	⨁	⬤	○	●	⨁	⬤	○
Consistent cases	20	20	15	22	7			
Z-test: Usually sufficient (0.65)	1.63*	1.63*	1.47*	1.72**	0.93			
Z-test: More often than not sufficient (0.5)					1.74**			
Raw coverage	0.09	0.09	0.10	0.10	0.10	0.20	0.12	0.14
Unique Coverage	0.02	0.03	0.03	0.03	0.05	0.05	0.00	0.03
Consistency	0.83	0.83	0.85	0.83	0.87	0.86	0.85	0.83
Solution Coverage			0.26					
Solution Consistency			0.81					

According to Fiss, (2011), the four configurations show evidence of first order equifinality[84] of which three are robust as indicated on the right side of the table 6.5. Table 6.5 shows that all five configurations exhibit consistency higher than the recommended level of 80% and coverage of about 10%. Solution consistency and coverage are 81% and 26% respectively which are good (Ragin, 2006). All the configurations were tested for significance and it was found that the configurations were ***usually*** or ***more often than not, sufficient*** to achieve favourable MTB. In order to have objective results and conclusions, I only use robust configurations to analyse and explain my results as follows.

6.4.2.1: CONFIGURATION MTB-1

Table 6.5 shows that relatively not-very large HGLB cases can sufficiently create favourable MTB through possession of high membership in internal fund and tangible asset sets as core conditions, and avoidance of high membership of external finance (debt) and intangible asset sets as supporting conditions.

This configuration provides supports for previous researchers' findings (see for example Jones et al., (2004) and Jones and Danbolt, (2005), who find that not-very large firms that are diversified and do not pay dividend[85] are favourably valued by the market because these attributes indicate a high level of growth opportunity which is usually favourable to investors (Fama and French, 2001; Barnes and Hardie-Brown, 2006; Hall and Lee, 2010).

I tested the significance of this configuration and found that the configuration is a "*usually sufficient*" indicator of favourable MTB at 10% significant level (Z = 1.63).

This configuration is well explained through hybridisation of transaction cost theory (TCT) and agency cost theory (ACT). TCT explains that transaction costs of obtaining external funds (debt) for financing growth like corporate diversification are relatively high in cases with not-high membership in size set because of scarce resources. Therefore, avoidance of high membership in leverage and intangible asset sets is important to ensure better return to investors. It is therefore not surprising to

[84] See section 3.2.3.1 for definition of equifinality.

[85] Firms that have lower dividend yield are here classified as firms that have high retained earnings (high retention ratio)

see that these cases are favourably valued by investors when their membership in leverage and intangible asset sets are not-high.

In addition, it has been noted that relatively not-very large firms enable managers to make better allocation of scarce resources and better choice of projects which add value (Stein, 1997, Canbäck et al., 2006). This implies that not-large firm size has lower level of managers-shareholders agency problems which make investors believe that managers are working for the best interest of shareholders.

Furthermore, not-high leverage reduces shareholders appetite for the asset substitution that leads to underinvestment problems (Jensen and Meckling, 1976). It has also noted that high level of internal funds (low or not paying dividends) signals company's positive growth opportunities that investors assign positive value (Jones and Danbolt, 2005). Therefore, this combination doesn't only suggest the presence of the lowest level of agency problems and transaction costs but also presence of positive growth opportunities.

Based on coinsurance effect (CET), it can also be suggested that the absence of a high level of business diversification makes external (debt) financing expensive (Lewellen, 1971), this is because business risk associated with cash flow from related or single business is high and might lead to high bankruptcy costs. Therefore, avoidance of high level of debt capital in HGLB firms leads to high value. Indeed, table 6.2 in section 6.3.2.1 shows that HGLB firms have the lowest membership in leverage, high membership in retained earnings and have the highest membership in MTB.

To summarise, one of the answers to the question of how ***HGLB*** diversification strategy sufficiently leads to favourable MTB is presented by configuration MTB-1 in table 6.5. It shows that HGLB diversification strategy requires the presence of high membership in internal fund and tangible asset sets, and not-high membership in firm size sets as core conditions; and not high membership in leverage and asset intangibility sets as supporting conditions. This configuration is sufficiently explained through the hybridisation of TCT and ACT as dominant theories and CET as a supporting theory.

6.4.2.2: Configuration MTB-2

Configuration MTB-2 shows four core conditions for achieving favourable MTB. This configuration shows that relatively very-large HGLB cases are positively valued by investors when levels of leverage and intangible assets are all high and ambivalent about internal fund level. The sensitivity analysis showed that configuration MTB-2 is robust (see table 6.5 – robustness model). This configuration appears to be "***usually***" a sufficient indicator of favourable MTB at 10% significant level (Z = 1.47 one-tail test).

Contrary to configuration MTB-1, configuration MTB-2 shows that in relatively very-large HGLB cases, high membership of leverage, and intangible asset sets are core for achieving favourable MTB. Not-high membership in the tangibility set as a supporting condition and ambivalent about membership in internal fund set can sufficiently enable these cases to achieve favourable MTB.

There are at least two possible reasons for this configuration to lead to favourable MTB: firstly, relatively very-large firms are capable of accessing cheap debt capital because it is argued that relatively very-large firms are more oriented towards meeting debtholders' needs (Su and Vo, 2010), and are considered to have lower levels of default. This enables these firms to use debt capital to finance growth and intangibles and let internally generated funds become available for distribution to investors. This is good news to the investor. Secondly, very-large firms have a high level of agency problem between managers and shareholders. The presence of high leverage would reduce some of the agency problems that relate to misuse of internally generated funds (Li and Li, 1996), so high leverage provides a signal of low agency problems which is good news to investors

It appears therefore that a configuration for achieving favourable MTB in very large HGLB cases is significantly different from that of relatively not-very large HGLB firms. This confirms the saying quoted above that there are "***many roads leading to Rome***". The best configuration for achieving favourable MTB in very large HGLB cases requires different conditions from those of relatively not-very large firms. This implies that the set-theoretic framework and FSA applied in this research allows for the analysis of asymmetric causality and equifinality so, configurations leading to favourable MTB in relatively not-very large firms are often different from those of relatively very large firms.

This result is important because it shows that the combination of geographic diversification and asset intangibility per se is not a sufficient indicator of high MTB. Indeed, Morck and Yeung, (1992, p.45) noted that although "geographic diversification is viewed by investors as value adding in the presence of intangible assets", still there are evidence which show that some geographic diversified firms with high level of intangible assets had relatively lower value. This research's findings have empirically shown that in order for a combination of high geographic diversification and intangible assets to be positively valued by investors, firm size plays a big role. This is consistent with Morck and Yeung, (1997).

To summarise, configuration MTB-2 provides another answer to the question ***how HGLB*** diversification strategy sufficiently leads to favourable MTB by showing, this diversification strategy requires high membership of leverage, intangible asset, and firm size sets as core conditions and not-high membership in tangible asset set as supporting conditions in order to enable LSE-FASI-Firms to be positively valued by investors.

6.4.2.3: Configuration MTB-3

The empirical evidence analysed above have shown that possession of high membership in internal fund and intangible asset ***sets*** is core for favourable value in both very large and relatively not-very large HGLB cases; this mean firm size in HGLB cases doesn't matter in this combination. Configuration MTB-3 is consistent with the ***hypothesis a*** and the resultant set-theoretic framework presented on figure 6.2 in section 6.6.

This configuration becomes sufficient indicator of favourable MTB when memberships in leverage and asset tangibility sets are not-high. The configuration MTB-3 is robust and ***usually sufficient*** for favourable MTB at 5% significant level (Z = 1.72).

This configuration supports the idea of hybridisation of ITS and TCT as dominant theories and ACTd as supporting theory. It appears that efficiency in utilising intangibles in high geographic diversified firms would require not-high membership in business diversification and high membership in internal fund sets. In fact, intangible assets are the results of human capital. This means efficiency of intangible assets depends on the capacity for human capital transferability and sharing across business segments. Not-high business diversified firms enhance knowledge transfer across geographic segments because of business relatedness (Fang et al, 2007).

Theoretically, HGLB firms can effectively create internal markets for their intangible assets because high geographic diversification allows sellers and buyers of intangible assets to meet and trade within the firm's environments Morck and Yeung, (1992, 1997) and not-high business diversification enhances scope economies by allowing the sharing of experience and knowledge (Fang et al, 2007) and other resources across related segments (Kaplan and Weisbach, 1992; Kim et al., 1993; Whitley, 1994; Hitt et al., 1997; Denis et al., 2002). Indeed Kaplan and Weisbach, (1992) and Whitley, (1994) documented that unrelated diversification limits the scope of synergies because their operations are typically run on a standalone basis which hinders the positive synergy resulting from scope economics.

In addition, Fang et al, (2007), examined how geographic diversified firms succeed in achieving better performance and found that the success of geographic diversified firms "depends on a firm's capability to transfer knowledge to its subsidiaries", they added that "as the knowledge resources are imperfectly mobile, a firm finds it difficult to transfer knowledge to its subsidiaries" (p. 1053). This implies that not-high business diversification leads to easier mobility of knowledge across geographic subsidiaries. This result also supports Morck and Yeung's, (1997) findings which show that a combination of geographic diversification, sheer firm size, and intangibles is necessary for high MTB.

The configuration also implies that since intangible assets have less collateral value and are firm specific in nature, the presence of high membership of internal fund becomes important as this will be used to finance growth at lower costs in firms that have high level of intangibles as per TCT perspectives (Williamson, 1988).

Furthermore, the agency cost theory of debt (ACTd), could be used to add that a combination of high level of equityholders' funds and not-high level of debtholders' funds reduces underinvestment behaviour (Jensen and Meckling, 1976; Hillier et al., 2011) which eventually leads to high MTB. However, it has been argued that high levels of internal funds (e.g., free cash flow) may lead to agency problems of overinvestment through diversification (Jensen, 1986; 1993; Li and Li, 1996). It is also argued that business diversification leads to agency problems of overinvestment (Jensen, 1993). Based on the FSA results, it appears that overinvestment is the result of combining high business diversification and a high level of internally generated funds. This means, overinvestment rarely happens in not-high business diversified firms.

Based on the results discussed above, it appears that theories that were previously used on a standalone basis to explain the impact of corporate diversification on financial performance cannot sufficiently explain it. The results have shown that ***hybridisation*** of the three theories (ITS, TCT, and ACTd) provide an adequate explanation of the impact of geographic and business diversification on MTB.

To summarise, configuration MTB-3 provides another empirical answer to the question ***how HGLB*** diversification strategy leads to favourable MTB. It shows that possession of high membership in internal fund and intangible asset ***sets*** as core conditions, and not-high membership in leverage and asset tangibility sets as supporting conditions could sufficiently lead to favourable MTB in both very large and not-very large cases. This configuration is consistent with hypothesis a.

Generally, the results presented in table 6.5 are consistent with previous researchers who found that a combination of information-based assets and geographic diversification per se does not necessarily or sufficiently lead to favourable MTB (Morck and Yeung, 1991; 1992), but other firm attributes (Morck and Yeung, 1997; Bodnar et al., 1999; Martin and Sayrak, 2003; Barnes and Hardie-Brown, 2006), which make firms appear heterogeneous (Lu and Beamish, 2004) are important components to support the combination of geographic diversification and information-based assets for high MTB. This is an important observation because, it clarifies Riahi-Belkaoui's, (1999, p. 195) idea that investors sees geographic diversification as an “unbooked intangible asset”, and Morck and Yeung’s, (1992, p. 45) conclusion which states that geographic diversified firms are “viewed by the investor as value adding in the presence of intangible assets”. Fletcher and Marshall, (2005, p 467), also conclued that “diversification benefits for a UK investor are significant in developed equity markets”.

Configuration MTB-1; MTB-2, and MTB-3 have clearly answered the key question 1 by showing ***how*** high geographic and not-high business diversification can sufficiently lead to favourable MTB as summarised in table 6.8. The configurations also indicate that standalone theory is not ***usually sufficient*** to explain the impact of geographic and business diversification on MTB. The empirical evidence has shown that hybridisation of two or more of ITS, TCT and ACTs provides sufficient explanation for key question 1.

6.4.3: Configuration for unfavourable MTB

I was also interested to determine configurations for unfavourable MTB (UMTB). In order to do this, I established a UMTB set by recalibrating the original MTB measures: MTB of 1 is taken as a cut-off for full membership (0.95), MTB of 1.5 as a cross-over point and MTB of 2.0 as a cut-off for full nonmembership. Then I used the same procedures to determine the configurations that lead to an outcome of interest (UMTB).

I find three configurations sufficiently lead to unfavourable MTB (see table 6.6). It appears that a combination of a high level of leverage and not-high level of intangibles is usually necessary for unfavourable MTB. Furthermore, the results show that not-high membership in geographic diversification and internally generated funds lead investors to assign negative value. This is consistent with the argument that “markets react negatively” to business and geographic diversification for firms with high dividend yield” (firms with low retained earnings) (Jones and Danbolt, 2005, p.628), perhaps because it was argued that high dividend paying firms have lower growth opportunities (Fama and French, 2001).

Table 6.6: Configuration for unfavourable MTB.

This table presents results of the truth tables which show configurations that lead to unfavourable MTB in LSE-FASI-Firms. UMTB-2, UMTB-2, and UMTB-3 imply configurations leading to unfavourable MTB (UMTB). ***Definitions***: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures the empirical importance of a solution: raw coverage is the percentage that the solution covers in the unfavourable MTB set, not excluding shared coverage. Unique coverage is the percentage that is uniquely covered by a solution in an unfavourable MTB set. ● = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal condition present; ⊕ = Supporting condition absent; a space ○ = Ambivalent situation

Conditions (Sets)	Configurations to unfavourable firm value (UMTB)		
	UMMTB-1	UMMTB-2	UMMTB-3
Diversifications:			
Geographic	⨁	○	⨁
Business	○	⨁	⨁
Financing Choices:			
leverage	●	•	●
Retained Earnings	⨁	⨁	●
Asset Structure & Size:			
Intangibility	⨁	⨁	⊕
Tangibility	•	•	●
Size	●	●	○
Raw coverage	0.13	0.13	0.14
Unique Coverage	0.04	0.04	0.03
Consistency	0.87	0.88	0.83
Solution Coverage	0.21		
Solution Consistency	0.85		

Theoretically, a relatively high level of leverage implies a high level of bankruptcy risks that lead to higher costs of equity capital that reduces MTB. In other words, any rational equity investor would not favourably value firms that are near bankruptcy point even if the level of tangible assets is high, as these would be used to cover debtholders' claims at the time of the firm's dissolution. Investors would negatively value firms with lower growth opportunities (Jones et al., 2004). The configurations in table 6.6 are consistent with previous researchers' findings and therefore are not surprising.

Table 6.6 has added answers to key question 1 by showing ***how*** not-high diversifications can lead to unfavourable MTB. It appears that not-high diversified firms are usually negatively valued by investors if there is also the presence of high level of leverage and tangible assets and the absence of high levels of intangible assets. Theoretically, this combination is expected to reduce the cost of capital because of the high level of asset tangibility that enables firms to access cheap leverage (transaction cost theory perspectives). However, it appears that this does not make investors assign positive value to firms. This requires further investigation on the ability of a standalone transaction cost theory to explain the impact of asset structure on investors' decisions. Or, as I argue a single theory is not sufficient to explain the causes of UMTB.

6.5: ROBUST TESTS

6.5.1: INTRODUCTION

Variables-oriented researchers are sceptical of results from FSA methodology. They argue that FSA solutions are highly biased to researchers' decisions (Lieberson, 2004; Seawright, 2005; Skaaning, 2011). On the other hand, proponents of FSA methodology do not agree with variable-oriented researchers' claims. They argue that FSA hybridises the strength of both quantitative and qualitative approaches, this makes FSA a compromise between the two (Ragin, 1987; 2000; 2008; Fiss, 2011). Whatever the case, the facts remain that regardless of FSA's ability to combine the strengths and eliminate most of the weaknesses of quantitative and qualitative research methods, FSA procedures depend on researcher's decisions (see section 3.3 of this thesis) so the robustness test is essential (Skaaning, 2011).

This section provides different robust checks of this research. Skaaning, (2011), identified a numbers of ways to test the robustness of FSA results, these include: application of method triangulation; sensitivity analysis like adjustments of thresholds used in the calibration process (see also Fiss, 2011) and adjustments for frequency and consistency cut-offs (see also Crilly, 2011); and post hoc analysis (see also Greckhamer et al., 2008). Consistent with Fiss, (2011), this chapter uses the first two robustness tests.

6.5.2: ROBUST TEST - METHOD TRIANGULATION

Consistent with Fiss, (2011), I first used traditional approaches like independent sample means comparison and regression analysis as presented in section 6.3.1 and 6.3.2 respectively. This enables the understanding of the diversification strategies that appears to have relatively high MTB and to identify other firm characteristics associated with diversification strategies that have favourable MTB. The results of FSA and those of the traditional approaches were then compared.

It appears that FSA results are well supported by the results of more traditional approaches. However, as noted in Fiss (2011), the results from more traditional approaches provide limited insight regarding to the connections and neutral permutations among causal variables. So although traditional approaches support the FSA results, they fail to pinpoint the configurations for favourable and unfavourable MTB indicators. In specific for example, table 6.1 (correlations) indicated that geographic diversification is positively and significantly correlated to MTB, and although business diversification appear to have no correction with MTB, there is indication of negative correlations. Also table 6.3 (conditional regression analysis), full sample model have shown that high geographic diversification brings positive results while business diversification destroys MTB, this is consistent with previous research (see table 2.3). The FSA results (robust configurations) presented in table 6.5 confirms also showed that a combination of high geographic and not high business diversification appears important for achieving favourable MTB. This implies that FSA results provide additional insights into the relationships between corporate diversifications and MTB by examining sufficiency and necessity of geographic and business diversification strategies in connection with other corporate attributes (configurations) for favourable and unfavourable MTB. This can hardly be done through the traditional approaches.

6.5.3: ROBUST TEST – SENSITIVITY ANALYSIS

Previous researchers have noted that one of the possible sources of doubtful results from FSA is the process of establishing the benchmarks for calibrating original variables to fuzzy sets. Although the benchmarks are theoretically or substantively justified (Ragin, 2000; 2008; Fiss, 2007; 2011), human error in data processing is inevitable (Ragin, 2000). Hence it is important to examine similarities of the solutions across different reasonably established thresholds (Fiss, 2011; Skaaning, 2011). Fiss, (2011) made adjustments to his original established thresholds for calibrating causal variables by adding and reducing similar percentages, and reran the analysis to compare the results. I followed the same sensitivity analysis as in Fiss, (2011) to test the robustness of my FSA results.

Particularly, I adjusted the causal variables by adding and reducing 20% on the crossover points and recalibrating the variables and then reran the analysis in order to test for sensitivity of the results. Table 6.7 compares the configurations of adjusted thresholds of causal variables. It shows that there are basically three robust configurations supported when adding 20% and only two configurations when the thresholds were reduced by 20%, and all are found in HGLB firms. These configurations are graphically presented later in figure 6.2 in section 6.6 (see also appendix 2). The redundant configurations from reduced thresholds result is difficult to explain, however, basing on prime implicants (see section 3.3.3.2) this result is not surprising because, by reducing thresholds more configurations with implied and simplified intermediate solutions or parsimonious solutions would be expected. This would lead some differences. I considered the three configuration for analysis purpose as the configurations are can be theoretically supported as discussed above,

Table 6.7: Robust configurations for favourable MTB – sensitivity analysis

This table presents robust configurations determined using sensitivity analysis. It compares the original results presented in table 6.5 with the results of adjusted causal variables. This enables the identification of consistent configurations for favourable MTB (MTB-2, MTB-2, and MTB-3) in LSE-FASI-Firms. Specifically, the results from original, +20%, and -20% thresholds are compared, and the similar configurations are presented in this table for further analysis and discussion.

Definitions: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures empirical importance of a solution: raw coverage is the percentage that the solution covers in the favourable MTB set, not excluding shared coverage. Unique coverage is the percentage uniquely covered by a solution in favourable MTB set. ● = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal condition present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions	Thresholds - Original			Thresholds – Added by 20%			Thresholds – Reduce 20%	
	MTB-IB	MTB-2	MTB-3	MTB-1	MTB-2	MTB-3	MTB-1	MTB-2
Diversifications								
Geographic	●	•	•	●	•	•	●	•
Business	⨁	⨁	⨁	⊕	⨁	⨁	⨁	⨁
Financing Choices								
leverage	⨁	●	⊕	⊕	⊕	●	⨁	●
Retained Earnings	•	○	●	●	●	○	●	○
Asset Structure & Size								
Intangibility	⨁	●	●	⊕	●	•	○	●
Tangibility	•	⊕	⊕	●	⊕	⨁	•	⊕
Size	⨁	●	○	⨁	○	●	⨁	●
Raw coverage	0.09	0.10	0.10	0.20	0.12	0.14	0.06	0.08
Unique Coverage	0.03	0.03	0.03	0.05	0.00	0.03	0.02	0.06
Consistency	0.83	0.83	0.85	0.86	0.85	0.83	0.86	0.82

Furthermore, I also did sensitivity analysis by adjusting consistency cut-offs as in Crilly, (2011). I adjusted the consistency cut-off by adding 3% and reducing 3% from the established level of around 85%. This means, 88% and 82% consistency cut-offs were applied. It shows that there are some changes to the number of configurations, while the interpretation of the results remains the same.

6.6: SUMMARY AND CONCLUSION OF THIS CHAPTER

The main objective of this chapter was to apply set-theoretic framework and FSA configuration approach to understand how degrees of geographic and business diversification combine with other firm characteristics for necessary and sufficient indicators of favourable and unfavourable MTB. In addition, traditional approaches like independent sample mean comparison and linear regression analysis were also used to provide support for FSA results. In order to achieve this objective this research provided answers to key question 1:

> ***How does corporate diversification necessarily and sufficiently lead to favourable MTB?***

This question was first indirectly approached using traditional approaches and a set of supporting questions (see section 6.1). The results have been presented and analysed in section 6.3. These results showed partial, fragmented, and conflicting conclusions as observed in prior literature as analytically reviewed in chapter 2. Following, the results analysed in section 6.3, the question was then directly approached using FSA and the results have been discussed in section 6.4.

It showed that the impact of geographic and business diversification on MTB depends on the presence or absence of a certain degree of leverage, internal funds, firm size, asset intangibility and tangibility. This implies that there are synergistic-effects among degrees of geographic and business diversifications and other characteristics for favourable MTB. This cannot be discovered through net-effect models. Therefore, the application of FSA was necessary, and table 6.8 and figure 6.2 summarise answers to key question 1.

Table 6.8: Robust configurations/configurations to favourable MTB

This table summarises the three robust configurations/configurations to favourable MTB (MTB-1, MTB-2, and MTB-3) and also shows common conditions or configurations that appear necessary to achieve favourable MTB. The table indicates firms' membership in core, supporting, and ambivalent conditions that sufficiently create configurations to favourable MTB. The configurations are shown in the first column. The Core column shows attributes where their presence or absence is important for the configuration for indicate favourable MTB. The Supporting column shows attributes that appear to support the core condition when they are present or absent. The Ambivalent column includes attributes that their presence or absence does not make a difference to the configurations. The last rows represented by the word Common represent conditions that appear common across the three configurations. * implies that the condition is ambivalent but it is considered as present rather than absent in this table.

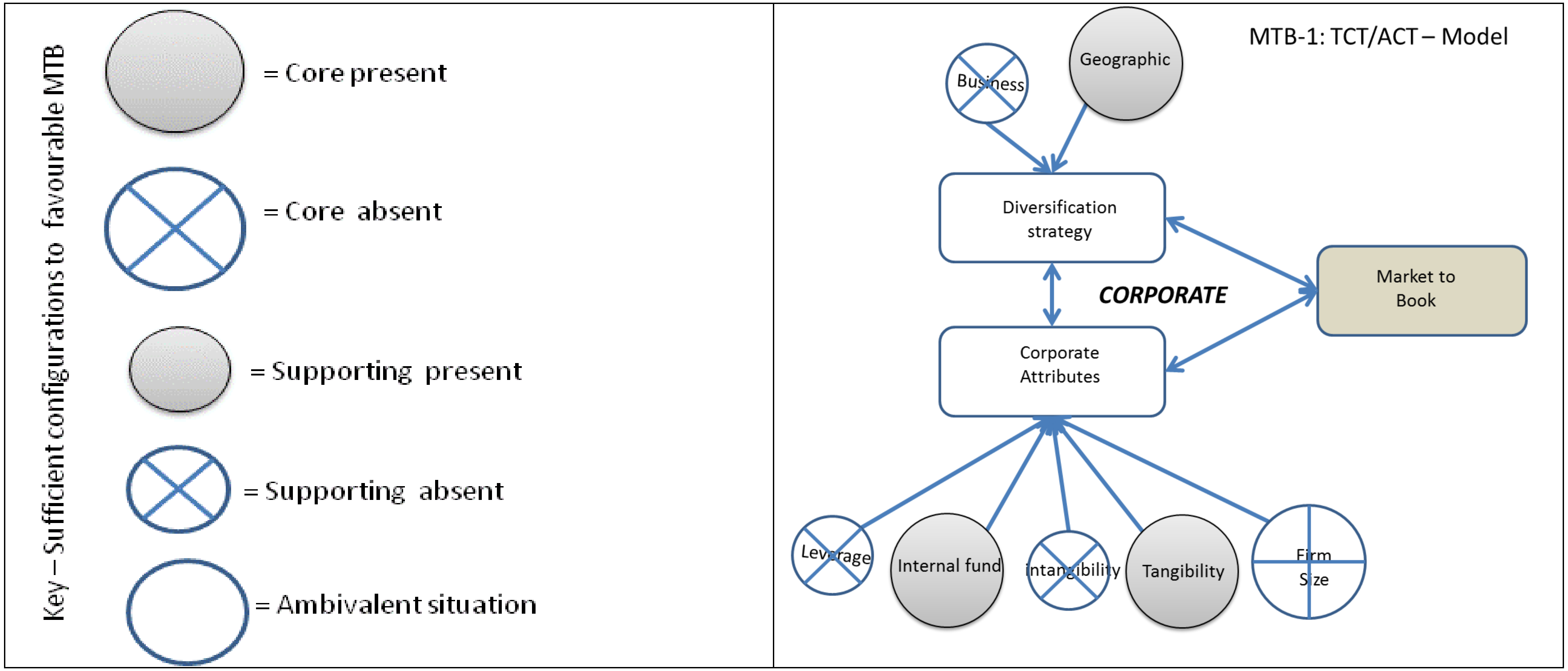
Configurations	**Core**		**Supporting**		**Ambivalent**
	Presence of high membership	**Absence of high membership**	**Presence of high membership**	**Absence of high membership**	
MTB-1	Geographic diversification Retained earnings Tangibility	Firm size	None	Leverage Intangibility Business diversification	None
MTB-2	Leverage Firm size Intangibility	Business diversification	*Geographic diversification*	Tangibility	Retained earnings*
MTB-3	Retained earnings Intangibility	Business diversification	*Geographic diversification*	Leverage Tangibility	Firm size
Common	None	***Business diversification***	None	None	
Identification of necessary condition(s) or configurations					

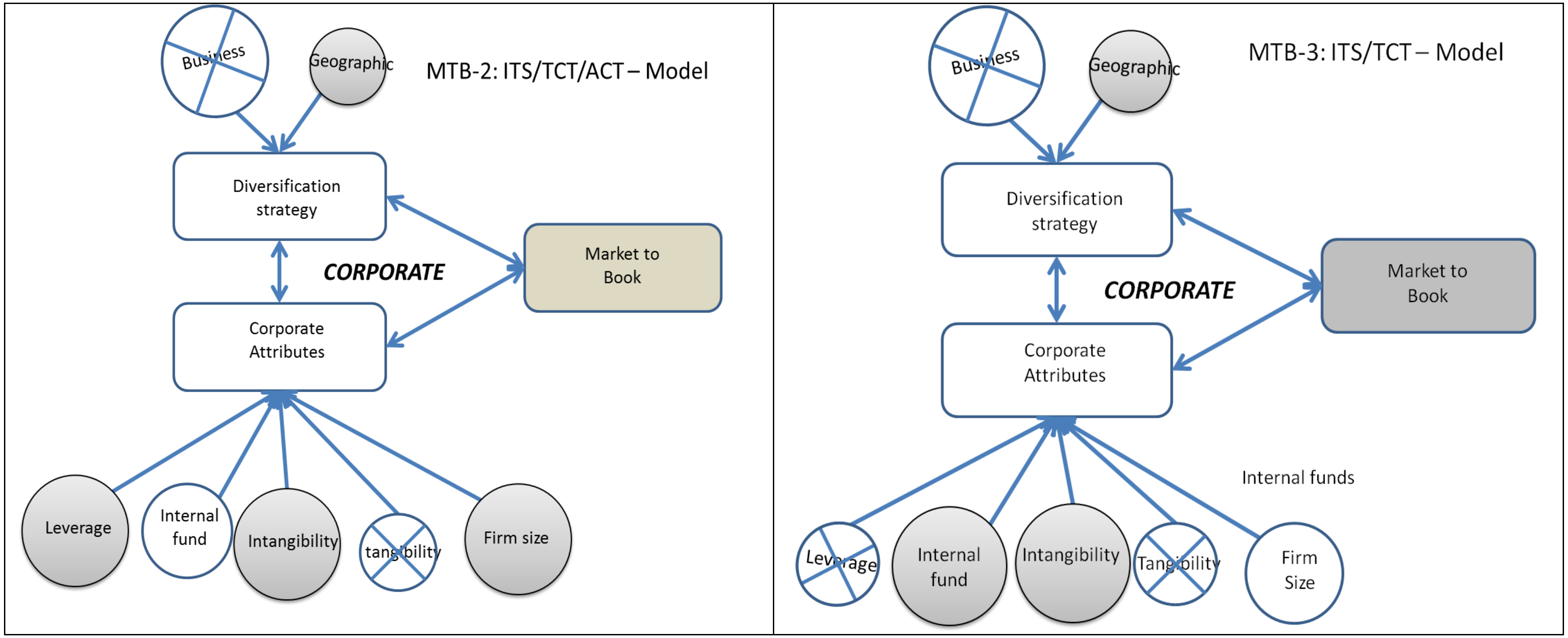
	Presence of high membership	**Absence of high membership**	**Ambivalent**
Common	Geographic diversification set Retained earnings*	Business diversification	None

Source: Constructed from table 6.

Figure 6.2: Summary set-theoretic frameworks for favourable MTB

This figure summarises the three robust configurations for favourable MTB (MTB-1, MTB-2, and MTB-3). It shows the three set-theoretic frameworks that can be used to understand sufficient indicators of favourable MTB. The figure indicates firms' membership in core, supporting, and ambivalent conditions that sufficiently create configurations to favourable MTB.





Business
Geographic
MTB-2: ITS/TCT/ACT – Model
Diversification strategy
CORPORATE
Market to Book
Corporate Attributes
Leverage
Internal fund
Intangibility
tangibility
Firm size
Business
Geographic
MTB-3: ITS/TCT – Model
Diversification strategy
CORPORATE
Market to Book
Corporate Attributes
Internal funds
Leverage
Internal fund
Intangibility
Tangibility
Firm Size

Table 6.5 shows three robust configurations for favourable MTB which require high geographic and not-high business diversification strategies (HGLB). This implies that LSE-FASI-Firms can sufficiently create favourable MTB through ***HGLB*** diversification strategies rather than any other diversification strategies. This means the question ***how HGLB*** diversification strategy is usually sufficiently associated to favourable MTB is clearly answered in table 6.5 and summarised in table 6.8 and in figure 6.2.

Table 6.8 and figure 6.2 clearly show that ***HGLB*** diversification strategy usually requires retained earnings as a necessary condition for achieving favourable MTB. In addition to this necessary condition; ***HGLB*** diversification strategy can sufficiently achieve favourable MTB through firstly possessing high membership in asset tangibility and not-high membership in firm size sets as core conditions, and avoidance of high membership in leverage and asset tangibility sets as supporting conditions (MTB-1). Secondly, possession of high membership in leverage, firm size, and not-high membership in asset tangibility sets as core conditions and high membership in intangibility sets as a supporting condition (MTB-2). Thirdly, possession of high membership in intangible assets as a core condition and having not-high membership in leverage and tangibility sets as a supporting condition, and being ambivalent in firm size membership (MTB-3).

The results and the theoretical framework used in this chapter have a numbers of implications to researchers, corporate managers, and investors. *Firstly* the results have shown how configurations of geographic and business diversification and other firm characteristics are "usually sufficiently" associated with favourable MTB (table 6.5). This is expected to help managers in identify a diversification strategy that would bring better chance (usually sufficient) for enhancing MTB. It is true that most the firm attributes are beyond managers' control; however managers have greater decisions on diversification decisions. Therefore given the current firm characteristics and the configurations presented in table 6.5, managers are equipped with the knowledge that HGLB diversification strategy have significantly higher than 65% chance to enhance MTB, however managers need to understand other core and supporting firm characteristics (see table 6.8 for summary).

Secondly, the set-theoretic framework developed here allows investors, analysts, and other decision makers to identify core and supporting conditions for understanding how diversification strategies and other firm characteristics can be used together as a bundle to make investment decisions. This is an additional insight to investors and financial analysts beyond the traditional standalone variable based decisions which analyse ability of a standalone variable to predict favourable or unfavourable MTB. This is important because reliance on individual factors' ability to predict outcomes may not lead to the identification of necessary or sufficient conditions for an outcome (Fiss, 2011).

Thirdly, the chapter enormously contributes to research literature and methodology by providing additional theoretical frameworks that allow hybridisation of theories to provide sufficient explanations of complex relationship studies. This provides evidence of the existence of asymmetric causality, complex causality, and equifinality in financial performance studies. These facts cannot easily uncovered using net-effect technique (Fiss, 2011). I considered uncovering of these facts as important methodological and theoretical contributions of FSA configuration above net-effect models.

To conclude, the results summarised in table 6.8 and in figure 6.2 clarifies the Riahi-Belkaoui's, (1999, p. 195) idea that investors see geographic diversification as an "unbooked intangible asset", Morck and Yeung's, (1992, p.45) conclusion that geographic diversification is "viewed by the investor as value adding in the presence of intangible assets", and the results presented in Jones et al., (2004) and Jones and Danbolt, (2005) which shows that not large firms are favourably valued by investors. The results of this thesis have clearly shown that asset structure, sheer size, and financing choice are important elements that combine with diversification strategies for sufficient indicators of favourable and unfavourable MTB. This supports hybridisation of ITS, TCT, and ACTd theories in explaining how corporate diversification are favourably valued by investors.

Chapter 7 : EMPIRICAL RESULTS CORPORATE DIVERSIFICATION AND PROFITABILITY: AN APPLICATION OF FSA

7.1: INTRODUCTION

Chapter 6 confirmed that there are "***many roads leading to Rome***". This saying has been confirmed by the identification of different configurations through the same diversification strategy (HGLB) that leads to favourable and unfavourable MTB. This implies that there may be different configurations that lead to favourable profitability. Thus the current chapter presents, analyses, and discusses empirical findings on the second key research question:

> ***How does corporate diversification necessarily and sufficiently lead to favourable profitability?***

Favourable profitability occurs when firms have above the cross-over point (mean) *membership* in the set of profitable firms listed in the London Stock Exchange FTSE Allshare index. The cross-over membership was determined using the higher of the mean of return on assets (ROA = 7%) "***or***" the mean of return on sales (ROS = 12%) for each case across sample[86]. Therefore, in this research cases with ROA higher than 7% or ROS higher than 12% are classified as having favourable profitability. In other words profitability is used as macrovariable as discussed in section 5.3.1 above.

7.1.1: HYPOTHESIS AND THE SET-THEORETIC FRAMEWORK

Section 1.3.2 of this thesis developed the hypotheses for examining key research question 2.

Hypothesis b

> ***A combination of not-high membership in business diversification and high membership in internal fund sets is a necessary but insufficient indicator of favourable profitability. Sufficient configuration will depend on firm's membership in other attributes like firm size, geographic diversification, asset tangibility and intangibility.***

[86] See section 5.3.1 for discussion on how the cases' memberships in profitability set were developed.

This hypothesis was developed from the analytical review of the literature which showed that not-high business diversification and intangible assets hybridise to allow firms to achieve favourable profitability through market power (Montgomery, 1985), low agency problems (Jensen, 1986), synergistic benefits stemming from information-based assets across related business (Bettis and Hull, 1982), and easier knowledge transfer across the segments (Nickel and Rodriguez, 2002; Fang et al., 2007; Rocca et al., 2009). However theoretically, not-high business diversification may lead to high cash flow risks that increase the cost of external finance such as debt, and intangible assets with less collateral value which reduces the borrowing capacity of firms that possess high levels of intangible assets. I ague that high levels of internal funds are a necessary indicator of favourable profitability in not-high business diversified-firm especialy when the level of intangible assets is high. This draws on TCT perspectives.

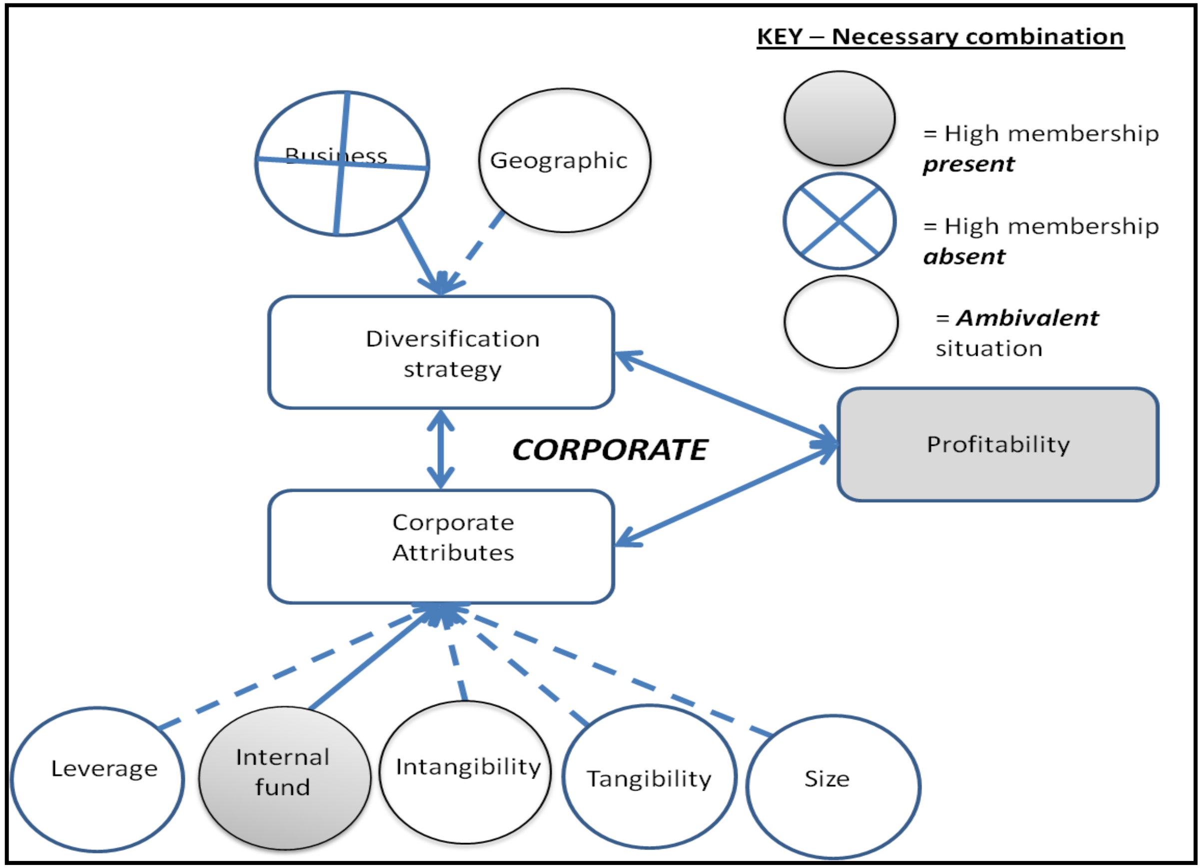
The set-theoretic framework

It appears that the business diversification-profitability relationships documented in other research is complex and can be explained through hybridisation of the three theories TCT, ACTs, and ITS. It shows that TCT and ACTs, can create a sufficient hybrid theory to explain the diversification-profitability relationship. ITS provide support for TCT and ACTs, and in the light of this and based on TCT and ACTs, I develop a generic set-theoretic framework in figure 7.1.

Rocca et al., (2009, p.801), noted that not-high business (related) diversification allows “operational synergies related to resource sharing in the value chains among businesses and the transfer of skills and knowledge from one value chain to the other”. These factors reduce transaction costs relating to the acquisition of knowledge and skills in using firms’ tangible assets such as plant and equipment and intangible assets such as brand names, innovative capabilities, and know-how resources. The TCT approach contends that since not-high business diversified-firms usually possess high levels of firm specific assets they can use equity funds (such as internal funds) to finance their assets and reduce transaction costs (Williamson, 1988).

Figure 7.1: Set-theoretic framework of configurations for favourable profitability

This figure is a set-theoretic framework adopted to examine configurations that lead to favourable profitability. The dots represent cases' memberships in different sets that include: Geographic and business diversification sets, internally generated fund (internal) set, leverage set, intangibility set, tangibility set, and firm size set. The filled dots represent the presence of above 0.5 memberships in the respective set and a dot with a cross represents firms' membership of 0.5 or less. The unfilled dot represents ambivalent memberships which mean a high or not-high membership of a case in an attribute does not matter. Large and small dots represent core and supporting conditions respectively in the configuration for favourable profitability.



In addition, ACTs are used to argue that not-high business diversification can be associated with relatively lower agency problems. The literature has shown that high diversification in unrelated businesses usually destroy financial performance because of agency problems (Jensen, 1993; Li and Li, 1996), which means that avoidance of high memberships in unrelated diversification lowers agency problems. Specifically, agency cost theory of debt (ACTd) contends that a high level of equityholders' fund in capital structure reduces managers' and equityholders' tendency to embrace asset substitutability actions that are associated with underinvestment problems (Jensen and Meckling, 1976).

Figure 7.1 has been used to examine key research question 2 alongside ***hypothesis b*** and it appears therefore, that the combination of TCT and ACTs would sufficiently explain the configurations to favourable profitability. The figure shows that a combination of not-high membership in business diversification and high membership in internal funds (or not-high membership in leverage) sets are necessary but not sufficient for LSE-FASI-Firms to achieve favourable profitability.

The figure 7.1 was used to develop a truth table that identifies configurations of geographic and business diversification, leverage, internal funds, firm size, asset intangibility and tangibility that sufficiently leads to favourable profitability.

As discussed in chapter 1, before presenting results of the key question above, a number of supporting questions have to be addressed first. Therefore, this chapter starts by addressing supporting questions which are examined using traditional methods: cluster analysis, independent sample means comparison, and regression analysis (OLS). These questions are mentioned below.

2ii(A). Is there a diversification strategy that necessarily leads to favourable profitability?

2ii(B). Does degree of geographic and business diversification lead to differences in firms' memberships in profitability?

2ii(C). Given geographic and business diversification strategies, what are the impacts of geographic and business diversification membership on profitability?

Answers to these questions are presented later in section 7.3. The next section summarises information on data source, samples, and variable used in this chapter.

7.2: DATA, VARIABLE (SETS) AND DESCRIPTIVE STATISTICS

Original data/variables were obtained from the DataStream and their characteristics were presented in table 5.1 of this thesis. In addition, the characteristics of the calibrated variables are presented in table 7.1.

The dependent variable for this chapter is profitability which is normally measured using returns on assets (ROA) or returns on sales (ROS) (see table 2.3). In this research profitability is represented by macrovariable (PROF)[87] which is used to determine memberships of firms in a profitability set (see section 5.3.1)

As in chapter 6 the other variables used in this chapter include geographic and business diversification which were originally measured using entropy indexes[88], asset structure (tangibility - TANG and intangibility – INTA), financing choice (leverage – TDTA and retained earnings – RETA), and firm size (SIZE). Further discussions on these variables were presented in section 5.3.3 of this thesis. As noted in the preceding chapters, this research is based on set-theoretic framework and fuzzy set analysis (FSA). Consequently, all variables were measured using fuzzy set values and are considered to be sets in which cases were assigned membership as discussed in chapter 5.

[87] See section 5.3.1.2 for discussion of how macrovariable PROF is developed.
[88] see section 5.3.2 for discussion of entropy index and its development

Table 7.1: Descriptive statistics and correlations.

This table presents descriptive statistics (mean and standard deviation) and Pearson correlations of the calibrated variables. The observed correlations in this table are similar to those of the uncalibrated measures in table 4.15. This implies that calibrated variables do not significantly change the value of the original variables. Details of the definitions and calibration processes of the original variables are presented in chapter 5. However, this table provides a summary of the definitions. 836 cases are analysed

Profitability = Profitability set. The original measures of profitability were calculated as return on assets (ROA) or return on sales (ROS) whichever shows the higher membership.

Geographic and business diversification = Geographic and business diversification sets. Original variables were measured using the entropy measure of diversification as defined in Jacquemin and Berry, (1979), Palepu, (1985), and Hitt et al., (1997)

Leverage (TDTA) = Leverage set. The original measure of leverage was defined as a ratio of total debt to total assets (Hitt et al., 1997; Wan and Hoskisson, 2003; Singh et al., 2003; Cheng, 2008).

Retained earnings (RETA) = Internal fund set. This was originally represented as a percentage of accumulated after tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve divided by total assets

Firm size (SIZE) = Firm size set. The original measure of firm size was defined as total firm assets of total sales in pounds sterling.

Intangibility (INTA) = Intangible asset set. The original variable was defined as the percentage of intangible assets of total assets.

Tangibility (TANG) = Tangibility asset set. The original variable was defined as a percentage of Property, Plant and Equipment of total assets as in Morck and Yeung, (1991), Hitt et al., (1997), and Rocca et al., (2009). * and ** stands for 5% and 1% significant levels (two-tailed significance test).

Variables (836 cases)	Mean	S.D	1	2	3	4	5	6	7	8
1. Profitability (ROA or ROS)	0.61	0.37	1							
2. Geographic Diversification	0.59	0.43	-.101**	1						
3. Business Diversification	0.53	0.42	-.167**	.226**	1					
4. Leverage - TDTA	0.47	0.39	0.039	-.075*	0.046	1				
5. Retained Earnings to total assets	0.50	0.39	.314**	-.071*	-.092**	-.311**	1			
6. Firm size (assets or sales)	0.56	0.35	-0	.150**	.204**	.212**	0.024	1		
7. Intangibles to total Assets	0.43	0.39	-.129**	.319**	.206**	0.054	-.162**	0.021	1	
8. Tangibles to total assets	0.45	0.40	.102**	-.259**	-.120**	.299**	.088*	.082*	-.569**	1

Table 7.1 presents descriptive statistics and correlations of the calibrated variables. It shows that most firms involved in this study have above average membership of profitability sets (0.61). The Pearson correlation shows that membership in geographic and business diversification is negatively and significantly correlated with membership profitability at 1% significant level. Furthermore, retained earnings are positively and significantly related to profitability. Finally it appears that while asset intangibility is negatively related to firm profitability, asset tangibility is positively correlated with profitability and there is no correlation between firm size and profitability. The correlations presented here are not significantly different to those of the original variables presented in table 5.2. This implies that the calibration of variables are only the reduction of large numbers to smaller and more manageable figures while enhancing the quality of analysis through avoidance of conflicting results as shown on table 5.2.

7.3: EMPIRICAL RESULTS FROM TRADITIONAL APPROACHES

7.3.1: EMPIRICAL RESULTS FROM CLUSTER ANALYSIS

The K-mean cluster analysis requires a researcher to specify the number of clusters to be involved in the analysis. This approach was intended to provide empirical answers to supporting research question 2ii(A)

> ***Is there a diversification strategy that necessarily leads to favourable profitability?***

In order to answer this question, I created four clusters based on firms' memberships in profitability and MTB sets (hereafter profit-value clusters). I argue that firms possessing high membership[89] in both MTB and profitability sets are classified as ***Winners*** (cluster 4). Those firms that have high membership in a MTB set but not-high membership in a profitability set are defined as ***value-seekers*** (cluster 2). Companies that have not-high membership in MTB sets but high membership in profitability sets are classified as ***profit-seekers*** (cluster 3). Finally, companies that

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[89] A Case is classified as having high membership in profitability or MTB when it corresponds to fuzzy set value higher than 0.5 in both profitability and MTB sets otherwise; it is classified as having not-high membership.

have both not-high memberships in MTB and profitability sets are classified as ***losers*** (cluster 1). These clusters are presented in figure 7.2.

Figure 7.2 present the four clusters with their corresponding numbers of firms indicated and the centroids (mean memberships) of every cluster are also indicated for both profitability and MTB memberships. The horizontal axis indicates memberships of LSE-FASI-Firms in profitability sets, while the vertical axis indicates memberships in MTB.

Figure 7.2: X-Y plot of cluster centroids – profitability and MTB

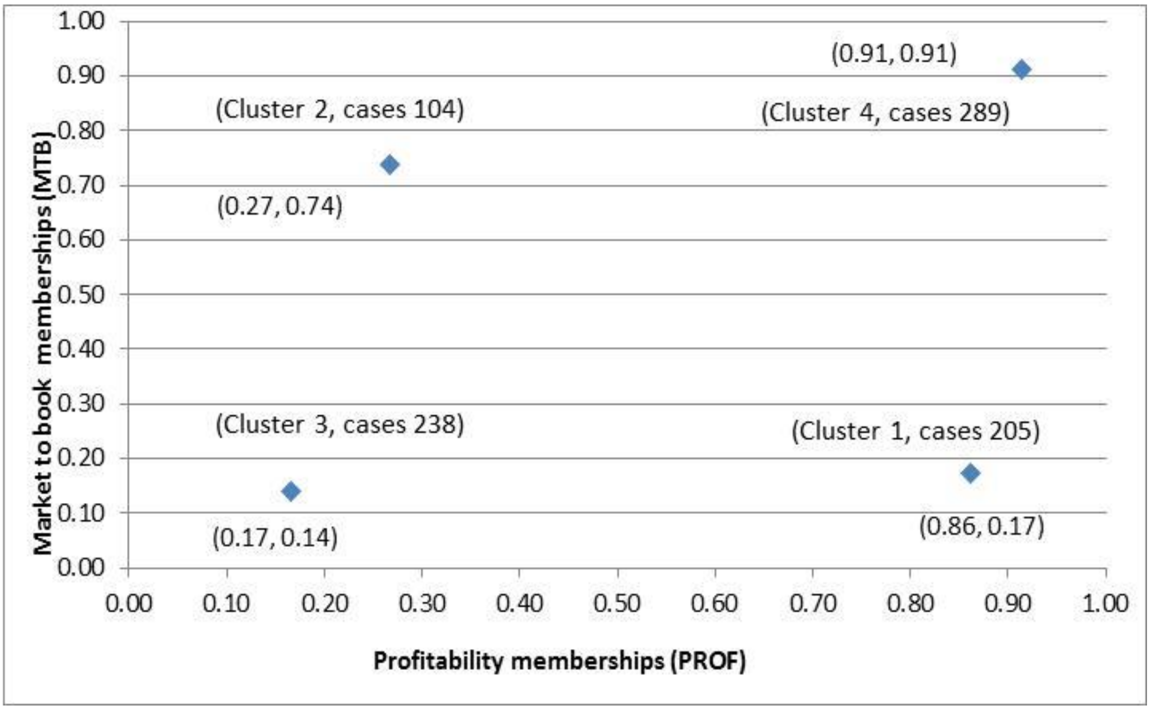


Figure 7.2 indicates that four clusters do in fact exist. However, it appears that the number of cases in the ***Winners*** cluster and ***the Losers*** cluster is relatively high. The result also shows that there are few cases in the ***value-seekers*** cluster but relatively many cases in ***profit-seekers*** cluster. These implies that on average firms that have high membership in MTB sets are also profitable, however many firms that are profitable are not always assigned positive value by investors. This highlights that indicators of firm profitability are likely to be different from those of MTB. This is consistent with the asymmetric causality assumption which has been overlooked in previous research.

In order to clearly understand if a certain diversification strategy has influenced the profit-value clusters. I used the four diversification strategies to identify the percentage of cases across the profit-value clusters as shown in table 7.2.

Table 7.2: Clusters across diversification categories

This table present clusters of MTB and profitability across the four diversification strategies. The clusters and the diversification strategies are defined below. The table indicates the percentages of cases that are found in every profit-value cluster across the four diversification strategies. Higher percentage implies relatively higher consistency of the cases in the respective cluster.

Winners = Companies with high memberships in both MTB and profitability (fs > 0.5) where fs stand for fuzzy set value

Value-seekers = Cluster of cases with above average membership in MTB (fs > 0.5) but not-high membership in profitability (fs ≤ 0.5)

Profit-seekers = Stands for not-high MTB achievers (fs ≤ 0.5) but high achievers in profitability (fs > 0.5)

Losers = Cases with not-high membership in both MTB and profitability (fs ≤ 0.5).

HGHB = Cases with high memberships in both geographic and business diversification (fs > 0.5).

HGLB = Cases with high membership in geographic diversification (fs > 0.5) and not-high membership in business diversification (fs < 0.5) .

LGHB = Cases with not-high membership in geographic diversified-firm sets and high membership in business diversification sets.

LGLB = Cases with not-high membership in both geographic and business diversified-sets

Clusters	No of cases	Diversification categories				Means - Memberships	
		HGHB	HGLB	LGHB	LGLB	MTB	PROF
1. Profit-seekers	205	15.2%	19.2%	29.9%	***38.0%***	0.17	0.86
2. Value-seekers	104	***9.8%***	8.3%	7.6%	5.4%	0.74	0.27
3. Losers	238	***36.2%***	25.9%	28.5%	24.5%	0.14	0.17
4. Winners	289	38.7%	***46.6%***	34.0%	32.1%	0.91	0.91
Total Cases	836	315	193	144	184		

Table 7.2 shows the percentage of every profit-value cluster across the four corporate diversification strategies. It appears that LGLB cases have a relatively greater chance of creating profits but they have also a higher chance of destroying MTB. At the other end, HGHB cases have the highest chance of destroying profitability but have a relatively higher chance of creating favourable MTB. Finally, HGLB cases appear to have the greatest chance of creating both high MTB and profitability. Indeed, chapter 6 indicates that all configurations that lead to favourable MTB are found in HGLB cases.

The first implication of these results is that high geographic diversified firms have a higher chance of creating favourable MTB and not-high business diversified firms have a higher chance of enhancing profitability. This is consistent with previous research findings which show that value discounts exist in high business diversification companies and value premium exists in not-high business diversified-firms (Rumelt, 1982; Varadarajan and Ramanujam, 1987; Berger and Ofek, 1995; Lins and Servaes, 1999; Lins and Servaes, 2002; Barnes and Hardie-Brown, 2006; Hall, and Lee, 2010), and in high geographic diversified-firms (Lang and Stulz, 1994; Mocrk and Yeung, 1997; Hall, and Lee, 2010).

To summarise it appears that there is no diversification strategy that appears sufficient for achieving favourable profitability. However, not-high geographic diversification seems to be an important condition for achieving favourable profitability but destroys MTB. The results of the cluster analysis raise the question as to whether other firm characteristics have influenced the results. This is consistent with the analytical review on previous studies discussed in section 2.4.3. I use an independent sample mean comparisons approach to understand if cases with different memberships in geographic and business diversifications exhibits different memberships in profitability and other firm attributes as shown below.

7.3.2: EMPIRICAL RESULTS FROM INDEPENDENT SAMPLE MEAN COMPARISONS

This subsection presents and analyses results of the independent sample mean comparison across the four diversification categories. The section is specifically intended to provide answer(s) to supporting question 2ii (B):

> ***Do degrees of geographic and business diversification lead to differences in a firm's membership in profitability?***

Table 7.3 compares mean memberships of LSE-FASI-Firms in different sets across the four diversification strategies. It shows that on average HGLB companies have significantly higher memberships (0.56) in MTB sets and relatively higher memberships (0.64) in profitability sets.

Table 7.3: Mean comparisons across diversification strategies

This table indicates independent sample mean differences across the four diversification strategies as defined below. Against every diversification strategy the number of cases is indicated

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

T = t-test (2-tailed) of which *, **, and *** represents 10%, 5% and 1% significant level respectively

Variables /Sets	HGHB-315 1		HGLB-193 2		LGHB-144 3		LGLB-184 4		1&2	1&3	1&4	2&3	2&4	3&4
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	T	T	T	T	T	T
Market to book value	0.51	0.37	***0.56***	0.39	0.44	0.39	***0.42***	0.38	-1.69*	1.70*	2.57***	2.84***	3.69***	0.58
Profitability	0.53	0.37	***0.64***	0.38	0.61	0.37	***0.70***	0.36	-3.15***	-2.07**	-4.93***	0.73	-1.56	-2.22**
Leverage	0.45	0.36	0.44	0.39	0.55	0.40	0.45	0.42	0.22	-2.50***	-0.02	-2.42**	-0.2	2.14**
Retained earnings	0.48	0.38	0.46	0.40	0.46	0.38	***0.61***	0.39	0.8	0.54	-3.40***	-0.17	-3.66***	-3.28***
Firm size	***0.65***	0.34	0.54	0.37	0.56	0.35	0.45	0.31	3.32***	2.33**	6.34***	-0.71	2.34**	3.01***
Asset Intangibility	***0.55***	0.37	***0.48***	0.38	0.38	0.39	0.22	0.32	2.07**	4.36***	10.64***	2.23**	7.26***	4.19***
Asset tangibility	0.35	0.35	0.42	0.41	0.54	0.42	***0.60***	0.41	-1.86*	-4.66***	-6.74***	-2.67***	-4.24***	-1.26

.

The table also shows that cases with LGLB diversification strategy have the lowest memberships in MTB sets (0.42), but have the highest memberships (0.70) in profitability sets. Furthermore, cases with HGHB strategy have the lowest membership in profitability (0.53). It appears that although geographic diversification is positively valued by investors (see ***HG***HB and ***HG***LB), this doesn't guarantee favourable profitability because high business diversification strategy seems to be a profit damaging strategy (see HG***HB*** and LG***HB***).

As in table 7.2, table 7.3 has shown that not-high business diversification provides a better chance of creating high profits as indicated by cases with LG***LB*** and HG***LB*** diversification strategy. Indeed, membership of LGLB (0.70) and HGLB (0.64) firms in profitability *sets* are not significantly different (t = 1.56) but the average membership of HGLB (0.56) and LGLB (0.42) cases in MTB set are significantly different at 1% significant level (t = 3.69).

In addition, table 7.3 shows that LGLB firms have significantly the highest memberships in internal fund sets (0.61) but the lowest in asset intangibility sets (0.22). This signals that LGLB companies can achieve favourable profitability membership through avoidance of high membership in intangible asset and leverage sets. In other words a combination of high levels of internal funds and not-high levels of intangibles is important for LGLB companies to create favourable profitability.

Furthermore, it appears that HGLB companies have high membership in both MTB and profitability and relatively high membership in intangible asset sets and relatively lower memberships in leverage sets. This signals a positive synergistic-effect of high membership in internal fund sets and intangible asset sets in HGLB companies (Morck and Yeung, 1991; 1992; 1997; Bettis and Hall, 1982).

Table 7.3 has shown that membership in profitability is significantly different across most diversification categories. Therefore, I can tentatively conclude that one of the causes for this difference is diversification strategy.

Based on the results presented in table 7.2 and table 7.3, I am confident in concluding that while high geographic diversification is important for achieving favourable MTB in the presence of high levels of intangible assets and internal funds, not-high business diversification is important to achieve favourable profitability in the presence of high levels of internal funds. Indeed, table 5.2 of this thesis supports this conclusion by using original (uncalibrated) variables. This enhances the answer to the supporting question 2ii(A) by confirming that there is no diversification strategy that is necessary or sufficient for favourable profitability.

In the next section, I examine the net-effect of geographic and business diversification on profitability in order to understand if diversification strategies influence the relationships between corporate diversification and profitability.

7.3.3: Empirical results from regression analysis

Regression analysis in this research was primary intended to support question 2ii(C):

> ***Given geographic and business diversification strategies, what are the impacts of geographic and business diversification membership on profitability?***

Table 7.4 presents the results. The table shows five models that regress geographic and business diversification on profitability across the five samples: full sample, HGHB, HGLB, LGHB, and LGLB. Generally, the results are consistent with the results from the cluster analysis and the independent sample mean comparison presented in table 7.3 above. It shows that geographic diversification has a negative impact on profitability except for firms with high membership in business diversification. This is consistent with Hitt et al., (1997), who found that geographic diversification has a positive impact on financial performance in high business-diversified firms. The results also show that business diversification has a negative impact on profitability. This means that not-high business diversification brings a positive impact on profitability.

Table 7.4: Regression models for the four diversification categories

This table shows ordinary least square regressions of geographic and business diversification and other firm characteristics on profitability (PROF). PROF is measured using macrovariables developed from return on assets (ROA) and return on sales (ROS) (see chapter 5 for details). A firm is classified as having favourable profitability if its membership in firm profitability sets is higher than 0.5. *, **, and *** stands for 10%, 5% and 1% significant level respectively.

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These cases show an entropy index above 0.6 (fs > 0.5) in geographic diversification and 0.6 (fs ≤ 0.5) or below in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

Explanatory variables	**Linear Regression Models (OLS) – Dependent variable is Profitability**				
	Full Sample	**HGHB**	**HGLB**	**LGHB**	**LGLB**
(Constant)	.49*** (11.24)	.074 (.36)	.51*** (2.73)	.66*** (3.29)	.61*** (7.19)
Geographic diversification	-.018 (-.57)	.170 (.96)	-.01 (-.06)	.48** (2.02)	-.08 (-.42)
Business diversification	-.11*** (-3.69)	.154 (.99)	-.27 (-1.40)	-.50** (-2.24)	-.12 (-.57)
Leverage	.16*** (4.42)	.17** (2.57)	.13* (1.67)	.29*** (3.35)	.11 (1.52)
Retained earnings ratio	.33*** (9.93)	.30*** (5.13)	.37*** (5.14)	.36*** (4.58)	.32*** (4.54)
Firm size	-.014 (-.38)	.014 (.23)	-.03 (-.34)	.04 (.40)	-.19** (-2.32)
Intangible assets	-.070* (-1.73)	-.13* (-1.79)	-.02 (-.24)	.05 (.58)	-.16* (-1.80)
Tangible assets	-.037 (-.92)	.007 (.10)	-.08 (-.89)	-.03 (-.26)	-.03 (-.44)
Number of cases	**836**	**315**	**193**	**144**	**184**
R-Sq	**0.144**	**0.144**	**0.150**	**0.234**	**0.149**

This confirms the presence of business diversification discounts that were empirically found by previous researchers (see for example Hall and Lee, 2010; Munoz-Bullon and Sanchez-Bueno, 2011). However, it shows that on average business diversification discounts do not exist in HGHB firms. This implies the need for a further careful analysis on how business diversification strategies enhance or destroy company profitability.

Table 7.4 also shows that a high level of internally generated funds is an important indicator of favourable profitability. It shows that there is a positive and significant relationship between retained earnings and profitability across the five models. This is consistent with the argument that firms with profitable growth opportunities are less likely to pay dividends (Fama and French, 2001; Jones and Danbolt, 2005). This implies that a high level of retained earnings is a good indicator of profitable investment opportunities.

Generally speaking, the results presented in table 7.4 have shown that the impact of geographic and business diversification on profitability is significantly different across companies. This indicates that the relationship between corporate diversification and profitability is complex and cannot adequately be explained by net-effect models as clearly discussed in chapter 4 of this thesis. The next section employs configuration analysis (FSA) to understand the configurations that lead to favourable profitability

7 .4: EMPIRICAL RESULTS FROM FUZZY SET ANALYSIS

7.4.1: CONFIGURATIONS FOR FAVOURABLE FIRM PROFITABILITY

This chapter follows similar steps of FSA application as discussed in section 6.4. And the chapter is intended to provide answers to key question 2:

> ***How does corporate diversification necessarily and sufficiently lead to favourable profitability?***

In order to understand how corporate diversification leads to favourable profitability, I used fuzzy set analysis based on the truth table presented in table 7.5. Table 7.5 presents 47 out of 128 possible configurations (that is 2^7 possible configurations) that lead to favourable profitability. These configurations constitute 76% of all cases involved in the analysis. I use consistency and frequency cut-offs of 85% and seven cases respectively. These cut-offs are used in order to obtain a reasonable number of configurations to be used in the analysis (Ragin, 2000).

As discussed in chapter 6, creation of simpler statements is important when FSA is used as this enables the understanding of the underpinning theories that are employed in the research (Ragin, 2008). I use fsQCA software to construct truth tables that produces two important solutions: parsimonious and intermediate solutions which are usually applied in FSA (Crilly, 2011; Fiss, 2011; Meuer, 2011)[90], so the current chapter also uses parsimonious and intermediate solutions to present and analyse the results.

Table 7.6 presents the results of the truth table 7.5 using notations that were used by previous researchers such as Ragin and Fiss, (2008) and Fiss, (2011). This notation uses large dots to represent core conditions and small dots to represent supporting conditions. The filled dot (●) shows the presence of high membership (fs > 0.5) in a certain causal condition (set), and a dot with a cross (⊕) indicates the absence of high membership (fs ≤ 0.5) in the respective set. And, the unfilled dot (O) indicates an ambivalent situation (Fiss, 2011)[91].

Table 7.6 confirms that there is no diversification strategy that is sufficient for favourable profitability. However, not-high business diversification appears to be a necessary condition for achieving favourable profitability. The results provide additional answers to the supporting research question 2ii (A) by indicating that a configuration of a high degree of internal funds and not-high business diversification is necessary for favourable profitability. This is consistent with the set-theoretic framework presented in figure 7.1 and ***hypothesis b*** of this thesis.

[90] See also section 3.3.3 and section 6.4 for discussion about parsimonious and intermediate solutions.

[91] The term ambivalent situation used in this research was previously used as a “don’t care situation” (Ragin and Fiss, 2008; Fiss, 2011), which means the absence or presence of a condition does not make any impact on an outcome of interest

Table 7.5: Truth table of configurations for favourable profitability

This table presents a distribution of configurations with seven or more cases that achieved favourable profitability **(PROF)** at different levels of consistency. **Yes** = means the cases have high membership in their respective sets (membership higher than 0.5). **No** = means the cases have not-high membership in the respective sets (membership 0.5 or less). **YES** = means the cases that display favourable **PROF**, and **NO** = means cases within the respective configuration that do not display favourable **PROF**.

Diversification:

DG = Membership in geographic diversification set; **DB** represents membership in business diversification sets. Membership of corporate diversification is commonly calculated using segmental assets ***or*** segmental sales and usually represented by entropy measures of diversification (Palepu, 1985; Hitt et al., 1997; Qian et al., 2008, Chiao and Ho, 2012), which are then calibrated to fuzzy sets.

Financing choice:

TDTA = membership in leverage *sets* as defined by total debts to total assets. **RETA** = membership in internal funds *set* as defined by total retained earnings to total assets.

Asset structure and firm size:

TANG = membership in asset tangibility *set*, it is measured as the percentage of total property, plant, and equipment (PPE) on total assets. **INTA** = membership in asset intangibility *set* refers to as percentage of total intangible assets on total assets (Rocca et al., 2009). **SIZE** = membership in firm size set; firm size is usually reflected in a firm's structure (assets) ***or*** performance (sales) (Gooding and Wagner III., 1985). Thus assets and sales volumes are used to identify firm's membership in firm size as represented by macrovariable. All the sets are defined using fuzzy set values.

Number = numbers of cases in each configuration.

Raw consist. = raw consistency is the proportion that the configurations agree in displaying favourable profitability.

Row	Diversification		Financing Choice		Firm Size and Asset Structures			Cases	Profitability	Raw consist
	DG	DB	TDTA	RETA	SIZE	INTA	TANG	Number	PROF	Raw consist.
1	***No***	***No***	***No***	***Yes***	***No***	***No***	***Yes***	***19***	***YES***	***92.2%***
2	***No***	***No***	***No***	***Yes***	***No***	***No***	***No***	***11***	***YES***	***92.1%***
3	***Yes***	***No***	***No***	***Yes***	***No***	***No***	***Yes***	***8***	***YES***	***91.0%***
4	***No***	***Yes***	***Yes***	***Yes***	***Yes***	***No***	***Yes***	***20***	***YES***	***89.8%***
5	***No***	***No***	***Yes***	***Yes***	***Yes***	***No***	***Yes***	***12***	***YES***	***89.6%***
6	***Yes***	***No***	***No***	***Yes***	***No***	***No***	***No***	***12***	***YES***	***89.5%***
7	***No***	***No***	***Yes***	***Yes***	***No***	***No***	***Yes***	***11***	***YES***	***89.5%***
8	***Yes***	***No***	***No***	***Yes***	***No***	***Yes***	***No***	***10***	***YES***	***89.2%***
9	***No***	***No***	***Yes***	***Yes***	***Yes***	***No***	***No***	***7***	***YES***	***88.9%***
10	***Yes***	***No***	***Yes***	***Yes***	***Yes***	***No***	***Yes***	***9***	***YES***	***88.3%***
11	***No***	***No***	***No***	***Yes***	***Yes***	***No***	***No***	***16***	***YES***	***88.2%***
12	***No***	***Yes***	***No***	***Yes***	***No***	***No***	***Yes***	***8***	***YES***	***87.7%***
13	***Yes***	***No***	***No***	***Yes***	***Yes***	***Yes***	***No***	***12***	***YES***	***87.4%***
14	***Yes***	***Yes***	***Yes***	***Yes***	***Yes***	***No***	***Yes***	***11***	***YES***	***86.5%***
15	***Yes***	***No***	***Yes***	***Yes***	***Yes***	***Yes***	***No***	***8***	***YES***	***86.2%***
16	***No***	***Yes***	***No***	***Yes***	***No***	***Yes***	***No***	***9***	***YES***	***86.1%***
17	***No***	***No***	***No***	***Yes***	***Yes***	***No***	***Yes***	***15***	***YES***	***85.7%***
18	***Yes***	***No***	***No***	***Yes***	***Yes***	***No***	***No***	***11***	***YES***	***85.3%***
19	No	Yes	Yes	Yes	No	No	Yes	7	NO	84.6%
20	Yes	Yes	No	Yes	Yes	No	Yes	25	NO	84.4%
21	Yes	Yes	Yes	Yes	Yes	Yes	No	19	NO	84.3%

Row	Diversification		Financing Choice		Firm Size and Asset Structures			Cases	Profitability	Raw consist
	DG	DB	TDTA	RETA	SIZE	INTA	TANG	Number	PROF	Raw consist.
22	No	No	Yes	No	Yes	No	Yes	16	NO	84.3%
23	Yes	Yes	No	Yes	Yes	No	No	16	NO	83.8%
24	Yes	No	Yes	No	Yes	Yes	No	7	NO	83.6%
25	Yes	No	Yes	No	No	Yes	No	13	NO	83.3%
26	No	Yes	Yes	No	Yes	Yes	No	9	NO	82.4%
27	Yes	Yes	Yes	No	Yes	No	Yes	14	NO	82.4%
28	Yes	Yes	No	Yes	No	No	No	18	NO	81.9%
29	No	No	No	No	No	No	Yes	7	NO	81.7%
30	Yes	Yes	No	Yes	No	Yes	No	22	NO	81.5%
31	Yes	Yes	No	Yes	Yes	Yes	No	25	NO	81.3%
32	No	No	Yes	No	No	No	Yes	13	NO	81.2%
33	Yes	Yes	Yes	No	Yes	No	No	7	NO	80.5%
34	Yes	No	Yes	No	Yes	No	Yes	11	NO	80.4%
35	No	Yes	Yes	No	Yes	No	Yes	16	NO	80.1%
36	Yes	No	Yes	No	No	No	Yes	10	NO	79.4%
37	Yes	No	No	No	Yes	Yes	No	9	NO	79.1%
38	Yes	Yes	No	No	Yes	No	Yes	9	NO	78.9%
39	Yes	Yes	Yes	No	Yes	Yes	No	34	NO	77.2%
40	No	No	No	No	No	No	No	9	NO	75.8%
41	Yes	Yes	Yes	No	No	Yes	No	16	NO	75.4%
42	Yes	No	No	No	No	Yes	No	15	NO	74.4%
43	Yes	Yes	No	No	Yes	Yes	No	15	NO	74.2%
44	Yes	No	No	No	No	No	No	8	NO	73.2%
45	Yes	Yes	No	No	Yes	No	No	18	NO	72.1%
46	No	Yes	No	No	Yes	No	No	8	NO	68.9%
47	Yes	Yes	No	No	No	Yes	No	15	NO	65.9%
Total cases - accumulative percentage – (76%)										

Table 7.6: Configurations for favourable profitability

This table presents results of the truth tables. It shows configurations that lead to favourable profitability (PROF). The consistencies of the configurations were further tested for significance using Z-test one-tailed as suggested in Ragin, (2000). *, **, and *** represents 10%, 5%, and 1% significant level.

Definitions: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures the empirical importance of a solution**:** **raw coverage** is the proportion that the solution covers in the profitability set which does not exclude shared coverage. **Unique coverage** is the proportion that is uniquely covered by a solution in profitability set.. ⬤ = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal condition present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions	All-Configurations								Robust configurations - Sensitivity analysis		
	PROF-1A	PROF-1B	PROF-1C	PROF-1D	PROF-1E	PROF-2	PROF-3A	PROF-3B	PROF-1	PROF-2	PROF-3
Diversifications											
Geographic	⊕	○	○	•	•	○	⨁	⨁	⊕	•	⨁
Business	⨁	⨁	⨁	⨁	⨁	○	○	○	⨁	⨁	○
Financing Choices											
leverage	○	⊕	⊕	○	⊕	⬤	⨁	⨁	○	⊕	⨁
Retained Earnings	⬤	⬤	⬤	⬤	⬤	⬤	⬤	⬤	⬤	⬤	⬤
Asset Structure & Size											
Intangibility	⊕	⊕	○	○	•	⨁	⊕	○	⊕	⬤	○
Tangibility	○	○	⊕	⊕	⊕	○	○	⊕	○	⊕	⊕
Size	○	⊕	⊕	•	○	⬤	⊕	⊕	○	○	⊕
Consistent cases	91	60	33	38	22	59	38	20			
Z-test: Usually sufficient (0.65)	4.43***	4.15***	2.89***	2.52***	1.93**	3.67***	3.18***	1.99**			
Raw coverage	0.20	0.15	0.13	0.09	0.11	0.19	0.13	0.10	0.24	0.10	0.14
Unique Coverage	0.05	0.01	0.00	0.01	0.00	0.08	0.01	0.01	0.02	0.02	0.02
Consistency	0.86	0.90	0.89	0.84	0.85	0.87	0.89	0.87	0.87	0.86	0.87
Solution Coverage	0.43										
Solution Consistency	0.84										

Basically, TCT and ACTs are the key theories that led to the development of ***hypothesis b*** which is used to construct the truth table presented in table 7.5 and summarised in table 7.6.

The truth table has shown that all of the eight configurations indicated in table 7.6 (All-configuration model) require the presence of retained earnings as a core condition and most of them indicate that not-high business diversification is a core condition for favourable profitability. Furthermore, the eight configurations have a consistency of 84% or higher and the overall coverage of 43% means that these results are reliable (Ragin, 2006). I tested if the configurations observed on table 7.6 are significant and the results have shown that all of the eight configurations are ***usually sufficient*** for achieving favourable profitability at 5% or better conventional significant levels. However, after conducting a sensitivity analysis, I found that there are only three configurations which are robust (see table 7.6 – robust models).

It appears that a high level of internal funds do not always lead to managers' interest diverge from that of shareholders. The configurations presented in table 7.6 have clearly shown that agency problems suggested in Jensen and Meckling, (1976), Jensen, (1986), and Stulz, (1990), do not always exist in not-high business diversified firms. This is consistent with Harris and Raviv, (1991) who noted that high levels of internally generated funds in the capital structure reduces underinvestment and overinvestment problems as this prohibits new investment in "unrelated lines of business" (p.301). Indeed, high levels of internal fund (zero dividend yields) have been empirically associated with favourable investment opportunities (Fama and French, 2001; Jones at al., 2004; Jones and Danbolt, 2005).

It appears also that high membership in internal fund sets and not-high membership in business diversification sets can hybridise to produce a condition that prohibits overinvestment and underinvestment problems and this would usually lead to favourable profitability. This is consistent with Thomson et al., (2012) argument that hybridisation is achieved in the presence of mutual acceptance of common mediating instruments (see also Kurunmaki, 2004; Jacobs, 2005).

The eight configurations are grouped by their core conditions to produce three equally effectively configurations for favourable profitability. This indicates the presence of first-order equifinality which has been overlooked in previous studies (Fiss, 2011). In addition, the robustness tests have shown that there are three robust configurations (PROF-1A (PROF-1), configuration PROF-1E (PROF-2), PROF-3B (PROF-3)) to favourable profitability. In order to avoid researcher's biased results, I only use the solutions that appear to be robust to analyse and discuss my FSA results as follows.

7.4.1.1: Configuration PROF-1 in LGLB cases

The empirical evidence presented in table 7.6 and further summarised in table 7.8 and figure 7.3 has shown that in addition to the core and necessary conditions (high membership in retained earnings) discussed above, not-high business and geographic diversification strategies (LGLB), can sufficiently enable LSE-FASI-Firms to achieve favourable profitability in the absence of high membership in intangible asset sets and be ambivalent about membership in asset tangibility, size, and leverage sets as indicated by PROF-1. This configuration is usually sufficient for favourable profitability at 1% conventional significant level (Z = 4.43).

Theoretically, LGLB firms have the advantage of accumulating expertise and experience in core businesses which increases profitability (Bettis and Hall, 1982; Battis and Mahajan, 1985). They have the disadvantages of accessing debt capital (Rocca et al.,2009) which implies that internally generated funds are an important source of finance. It appears therefore that not-high business diversified firms would avoid external sources of finance because they are relatively expensive and they prohibit flexibility to undertake positive growth opportunities. As internally generated funds are the cheapest source of finance (Myers and Majiluf, 1984), and prohibit asset substitutability problems (Harris and Raviv, 1991), then it is not surprising that configuration PROF-1 would usually lead LGLB firms to favourable profitability.

To summarise, the question of ***how LGLB*** diversification strategy enables LSE-FASI-Firms to achieve favourable profitability has been empirically answered by configuration PROF-1 (see table 7.8 and figure 7.3) by showing that profitable diversification needs only two conditions: the presence of high membership in internal funds set as a core condition and the absence of high memberships in intangible asset sets as a supporting condition and being ambivalent about firm size, leverage and tangible asset memberships.

7.4.1.2: Configuration PROF- 2 in HGLB cases

Configuration PROF-2 shows that in addition to the presence of high levels of internal funds as a core and necessary condition, HGLB strategy can sufficiently enable the firms to create favourable profitability in the presence of high membership in intangible asset sets as a core condition, and not-high membership in leverage and asset tangibility sets as a supporting condition and being ambivalent about membership in firm size set. This is consistent with the results presented in table 7.3 which show that on average HGLB firms has higher membership in profitability and intangible asset sets. In addition, this configuration was also found to lead to favourable MTB (see configuration MTB-3 in table 6.5) and so it implies that it is possible to identify hybrid configurations that enable firms to achieve both favourable MTB and profitability.

It appears that high geographic and not-high business diversification membership synergistically allows resource sharing among related businesses and accumulation of business experiences which enhances product quality and customer loyalty leading to favourable profitability. Furthermore, it appears that knowledge-based assets in not-high business diversified firms work better when their memberships in geographic diversification is high and level of leverage is not high as discussed in section 6.4.2. This is consistent with ITS as discussed in Morck and Yeung, (1992) who noted that information-based assets are like “public good” and that their value increases with geographic coverage, and as discussed in Bettis and Hall, (1982) on how not-high business diversified-firms enhance returns.

To summarise, configuration PROF-2 shows that HGLB diversification strategy can enable LSE-FASI-Firms to achieve favourable profitability through possession of high memberships in retained earnings and intangible asset sets as core conditions, avoidance of high membership in leverage and asset tangibility sets as supporting conditions, and be ambivalent about memberships in firm size. Further discussion is in section 7.6.

7.4.1.3: Configuration PROF-3 in relatively not-large cases

Table 7.6 also shows that regardless of the degree of business diversification, a combination of not-high membership in geographic diversification and leverage sets, and high membership in internal fund sets is a core condition for achieving favourable profitability. It appears also that when these core conditions are hybridised with not-high membership in firm size and asset tangibility it usually creates a sufficient configuration for favourable profitability. This configuration is consistent with the argument that relatively not-large firms have less capacity to access external funds, thus they have disadvantage of using debt capital. So a combination of low level of leverage and high level of retained earnings is core for these firms to sufficiently create favourable profitability.

Indeed Munoz-Bullon and Sanchez-Bueno, (2011), examined the standalone impact of geographic and business diversification on the profitability of not-large firms (i.e., small and medium firms). They found evidence of a negative relationship between geographic expansion and profitability. This implies that not-high geographic diversification is important in relatively not-very large firms to create favourable profitability. Further discussion in section 7.6

To summarise, the empirical answer to the question: ***how*** not-high geographic diversification can lead to favourable profitability in LSE-FASI-firms, is clearly presented by configuration PROF-3 which is summarised later in table 7.8 and in figure 7.3. It appears that high membership in internal funds and not-high membership in leverage sets as core conditions require the support of not-high membership in firm size and asset tangibility sets to sufficiently achieve favourable profitability. This configuration is sufficiently explained through hybridisation of TCT, ACTd, and ITS as indicated in figure 7.3

7.4.2: Configurations to unfavourable profitability

The results of cluster analysis presented in section 7.3.1 indicate that there are many cases with unfavourable profitability, so I also calibrated the original variable measures to fuzzy set values to reflect firms' memberships in unfavourable profitability set. In this set, cases with fuzzy set memberships equal or less than 0.5 were considered as possessing high membership in unfavourable profitability otherwise they were classified as possessing not-high membership.

The truth table results on the configuration to unfavourable profitability are presented in appendix 5 and show that all configurations leading to unfavourable profitability have lower than the minimum recommended level of 75% consistency. This means there is no specific configuration that sufficiently leads to unfavourable firm profitability which is consistent with the results presented in Fiss, (2011), which showed the absence of a clear set-theoretic relationship when unfavourable profitability is used as an outcome of interest. This implies that there are many but no consistent ***roads*** to unfavourable profitability. As expected, this is evidence of asymmetric causality which was highly ignored in previous research (ibid).

7.5: Robust Tests

7.5.1: Introduction

This section provides robust tests. I applied method triangulation and sensitivity analysis as in Fiss, (2011), and sensitivity analysis by adjusting the frequency and consistency cut-offs as in Crilly, (2011) to test the robustness of the FSA results.

7.5.2: Robust test based on method triangulations

Consistent with Fiss, (2011), I used traditional approaches like cluster analysis, independent sample mean comparison, and regression analysis as shown in sections 7.3.1, 7.3.2, and 7.3.3 respectively. This enables a comparison of the results of net-effect and those of synergistic-effect models. When the results of FSA and those of the traditional approaches were compared, I found that the FSA results were well supported by the results of traditional approaches, as shown in section 7.3 above. However, the results of traditional approaches provide limited insight regarding the identification of configurations that sufficiently lead to favourable profitability.

Traditional models failed to pinpoint the core and supporting conditions which enable firms to achieve favourable profitability. Therefore, FSA was particularly important for overcoming the shortcomings of the traditional models.

7.5.3: ROBUST TEST BASED ON SENSITIVITY ANALYSIS

As discussed in chapter 3, FSA procedures are usually determined by the researcher. As such, FSA results are likely to be biased to the researcher's decisions and errors in data processing (Ragin, 2000). This implies that configurations created under a similar theoretical background may appear different across researchers who process the data differently (Fiss, 2011; Skaaning, 2011) so sensitivity analysis is a better way of identifying robust configurations (Crilly, 2011; Fiss, 2011).

As in Fiss, (2011), I adjusted the original thresholds that were used in the calibration process and reran the analysis. Specifically, the three established thresholds of causal variables[92] were adjusted by adding and reducing 20% and recalibrating the causal variable and rerunning the analysis. The results are summarised in configuration table 7.7 and compared with the results in table 7.6 (see also appendix 3).

Table 7.7 shows that there are three robust configurations that sufficiently leads to favourable profitability. It appears that the configurations are mainly found in HGLB and LGLB firms as tentatively concluded using traditional models discussed in section 7.3. In order to avoid the possibility of the researcher's biased results, the current research only considered robust configurations in analysis and discussion. This means the results discussed here are robust and can be generalised.

[92] See section 5.2 for discussion and identification of the three thresholds used in the calibration process

Table 7.7: Configurations to favourable profitability – sensitivity analysis

This table presents configurations to favourable profitability after adjusting the original thresholds by +20%, and -20%. This enables the examination of consistent configurations for favourable profitability (PROF). The configurations of the original thresholds are compared with those of sensitivity analysis to identify the common configurations. ***Definitions***: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures empirical importance of a solution: raw coverage is the percentage that the solution covers in the risk-return performance set; this does not exclude shared coverage. Unique coverage is the percentage that is uniquely covered by a solution in a risk-return performance set. ⬤ = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal on present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions	Original Thresholds			Thresholds added by 20%			3.Thresholds reduced by 20%		
	PROF1A	PROF-1E	PROF-3B	PROF-1	PROF-2	PROF-3	PROF-2	PROF-3	PROF
Diversifications									
Geographic	⊕	•	⨁	⊕	•	⨁	⬤	⨁	○
Business	⨁	⨁	○	⨁	⨁	○	⨁	○	⨁
Financing Choices									
leverage	○	⊕	⨁	○	⊕	⨁	⊕	⨁	⊕
Retained Earnings	⬤	⬤	⬤	⬤	⬤	⬤	⬤	⬤	⬤
Asset Structure & Size									
Intangibility	⊕	•	○	⊕	•	○	•	○	○
Tangibility	○	⊕	⊕	○	⊕	⊕	⊕	⊕	⨁
Size	○	○	⊕	○	○	⊕	○	⨁	○
Raw coverage	0.20	0.11	0.10	0.24	0.10	0.14	0.08	0.06	0.08
Unique Coverage	0.05	0.00	0.01	0.02	0.02	0.02	0.00	0.01	0.00
Consistency	0.86	0.85	0.87	0.87	0.86	0.87	0.87	0.87	0.88

I also did sensitivity analysis by adjusting the consistency cut-offs as in Crilly, (2011 by adding 3% and reducing 3% from the established level of around 85%. This means that I used 88% and 82% consistency cut-offs. It shows that whilst there are minor changes in the number of configurations, the results remain the same in terms of interpretation.

7.6: DISCUSSION OF THE RESULTS

7.6.1: GENERAL DISCUSSION OF THE RESULTS

I argue that firms usually possess different membership in geographic and business diversification sets, and this difference leads firms to obtain different memberships in other characteristics sets like leverage, internal funds, firm size, asset intangibility and tangibility sets. However, regardless of different firms' memberships in other attributes, their memberships in the profitability set may appear similar. In addition, consistent with Fiss, (2011), I assumed that the relationship between memberships in corporate diversification and profitability is complex as it is characterised by complex and asymmetric causality and equifinality. Consequently, this relationship cannot adequately be examined through net-effect models.

Based on the assumptions of this thesis, a set-theoretic framework was proposed within which the configuration approach (FSA) was applied and hybridisation of theories in order to identify and explain configurations that are sufficient or necessary for achieving favourable or unfavourable profitability. I clearly identified the core and supporting conditions that would enable researchers, managers, and shareholders to clearly understand elements in a configuration that are superior or subordinate to achieving favourable profitability.

The sample of LSE-FASI-Firms examined in this research has shown that there are three robust configurations that lead to favourable profitability. This demonstrates the existence of equifinality, that is different configurations achieve similar results (favourable profitability), and these equifinal configurations consist of core and supporting conditions. These observations are hard to identify through net-effect models.

The set-theoretic framework and the associated FSA used here are particularly important to overcome the challenges of complex relationships and allow a shift from examination of simple cause-outcome relationship studies to the examination of necessity and sufficiency of a cause for an outcome of interest. This theme is important in accounting and finance as it will help to explain sufficient or necessary indicators of favourable financial performance.

In addition, it is shown that although there are many configurations that lead to favourable profitability, the evidence has shown that there are no consistent configurations that lead to unfavourable profitability. This is clear evidence of the existence of asymmetric causality; configurations leading to favourable profitability are frequently different to those leading to unfavourable profitability (Fiss, 2011). This fact is also overlooked in cause-effect studies; consequently, this led to the partial, fragmented, and conflicting results and conclusions.

The configurations presented in this chapter show that firms that hybridise not-high membership in business diversification and high membership in internal fund sets were necessarily able to achieve favourable profitability as clearly indicated in table 7.6. As such it is usually necessary for LGLB and HGLB firms to have high memberships in internal fund sets in order to create favourable profitability.

Basically, cases with LGLB and HGLB diversification strategies have the great advantage of sharing knowledge and other resources across the related business segments. This enables to lower their operation and production costs which consequently lead to high profits. However these firms have disadvantages in accessing external capital because of risks of cash flow from related business segments. This leads firms to avoid debt financing as this increases costs of capital. Based on transaction cost theory (TCT), it is argued that not-high business diversified firms are subject to high cash flow risk[93], which makes debt capital expensive. Therefore, it is not surprising to find that avoidance of high leverage and

[93] Table 5.2 in chapter 5 of this thesis indicates that business diversification is negatively related to business risk measures. This implies that at lower levels of business diversification firms are expected to experience high business risks

use of internal funds is a necessary indicator of favourable profitability in LGLB and HGLB firms.

7.6.2: ASYMMETRIC CAUSALITY IN ACCOUNTING AND FINANCE

The results presented in this chapter have shown the existence of asymmetric causality, that is configurations leading to favourable profitability are different from those leading to unfavourable profitability. This result carries significant implications for the cause-effect relationship studies in accounting and finance which embrace symmetric causality that may not always exists. For example, based on symmetric causality, it is common in net-effect studies to conclude that since business diversification is negatively and significantly related to profitability, then it must be true that not-high business diversified firms would always outperform high business diversified firms in terms of profitability. In reality, this might not always be the case because when not-high business diversified firms are highly leveraged, they would perform poorly as compared to those whose level of debt is not-high and have high levels of internal funds as clearly indicated in the results of the set-theoretic framework (see table 7.6).

It is therefore important for both academia and practitioners in accounting and finance and related fields to understand that the configurations that lead to favourable profitability are usually different from those that lead to unfavourable profitability or favourable MTB. However, it is possible to have a hybrid configuration that leads to both favourable profitability and MTB as shown in table 6.5 and 7.6 (see configuration MTB-3 and PROF-2 in the respective tables)

7.6.3: EQUIFINALITY IN AN ACCOUNTING AND FINANCE CONTEXT

As I argued in chapter 6 that there are “many roads lead to Rome”, in this chapter, this saying means that there are many configurations for achieving favourable profitability. The results have shown three robust configurations that imply many “roads” to favourable profitability. This notion is important to managers and other decisions makers who use financial information as a reference for their decisions. It appears that diversification per se is not sufficient for favourable profitability, in other words it appears that there are many different ways of hybridising diversification with other firm characteristics for sufficient indicators of profitability.

This implies that managers can achieve favourable profitability for their firms by choosing the right mix of financing choice, asset structure, firm size and diversification levels as proposed in table 7.6

7.6.4: CORE AND SUPPORTING CONDITIONS IN ACCOUNTING AND FINANCE

The results have shown that there are core and supporting conditions within configurations that lead to favourable profitability. This is an important observation as academia and practicing managers can use the idea of core and supporting condition to analyse the conditions or configurations that are the most relevant for creating favourable profitability in certain types of firms. For example, evidence presented in this chapter and in chapter 6 has shown that internal funds and intangible assets play a major role in highly geographic and not-highly business diversified firms in achieving favourable MTB.

7.7: SUMMARY AND CONCLUSION OF THIS CHAPTER

The main objective of this chapter was to apply set-theoretic framework and FSA to explain ***how*** geographic and business diversification strategies combine with other firm characteristics for necessary and sufficient indicators of favourable and unfavourable profitability. To achieve this objective, I also used traditions approached such as cluster analysis, independent sample mean comparison, and linear regression models to provide the "green light" to apply FSA and to provide empirical support of FSA answers on the key research question 2 stated below.

> ***How does corporate diversification necessarily and sufficiently lead to favourable profitability?***

As noted above, this question was first indirectly approached using the traditional approaches and a set of supporting questions. The results are presented and discussed in sections 7.3.1, 7.3.2, and 7.3.2. These results have confirmed the presence of partial and fragmented results showed by prior research as discussed in chapter 2. Therefore, the traditional approaches gave a "green light" to application of FSA as expected. The FSA answers to the question above have been presented and analysed in section 7.4 and discussed in section 7.6 and finally summarised in table 7.8 and figure 7.3.

It appears that there is no simple answer to this question. However, it is clear that high membership in internal funds is a core and necessary condition to favourable profitability across the three robust configurations which is consistent with ***hypothesis b.***

Table 7.6 and table 7.8 also show that there are three diversification strategies that sufficiently lead to favourable profitability in LSE-FASI-Firms: LGLB, HGLB, and not-high geographic and ambivalent business diversification.

The question now was ***how*** the identified diversification strategies ***sufficiently*** enabled LSE-FASI-Firms to achieve favourable profitability? Table 7.8 and figure 7.3 have presented answers to this question. It shows that in addition to high level of internal fund as a core and a necessary indicator of favourable profitability; cases with ***LGLB*** diversification strategy require a not-high membership in intangible asset sets as a supporting condition to achieve favourable profitability and ambivalence towards memberships in leverage, tangibility, and firm size sets. Cases with ***HGLB*** diversification strategy require high membership in intangible asset sets as a core condition, not-high memberships in leverage and tangibility sets as supporting conditions and ambivalence towards firm size membership in order to achieve favourable profitability. Finally, cases with not-high memberships in business diversification sufficiently leads to favourable profitability through the possession of not-high memberships in leverage sets as a core condition, and possession of not-high memberships in asset tangibility and firm size sets as a supporting condition and ambivalence towards intangibility and geographic diversification memberships.

Table 7.8: Summary of configurations to favourable profitability

This table summarises the three robust configurations to favourable profitability (PROF-1, PROF-2, and PROF-3) and also shows common conditions or configurations that appears necessary to achieve favourable profitability. The table indicates firms' memberships in core, supporting, and ambivalent conditions that sufficiently create configurations to favourable profitability. The configurations are shows in the first column of the table. Core column shows attributes where their presence of absence is important for the configuration for indicate favourable profitability. Supporting column shows attributes that appear to support the core attributes when their presence or absent is recorded. The ambivalent column shows attributes where their presence or absence does not make a difference to the outcome. The last rows represented by PROF-common show conditions that appear common across the three configurations. * implies that the ambivalent situation is considered as the absence of high membership.

Configurations	Core		Supporting		Ambivalent
	Presence of high membership	Absence of high membership	Presence of high memberships	Absence of high membership	
PROF-1	Retained earnings	Business diversification	None	Geographic diversification Intangibility	Leverage Tangibility Firm size
PROF-2	Retained earnings Intangibility	Business diversification	Geographic diversification	Leverage Tangibility	Firm size
PROF-3	Retained earnings	Geographic diversification Leverage	None	Tangibility Firm Size	Business diversification Intangibility
PROF-Common	Retained earnings	**none**	None	None	None

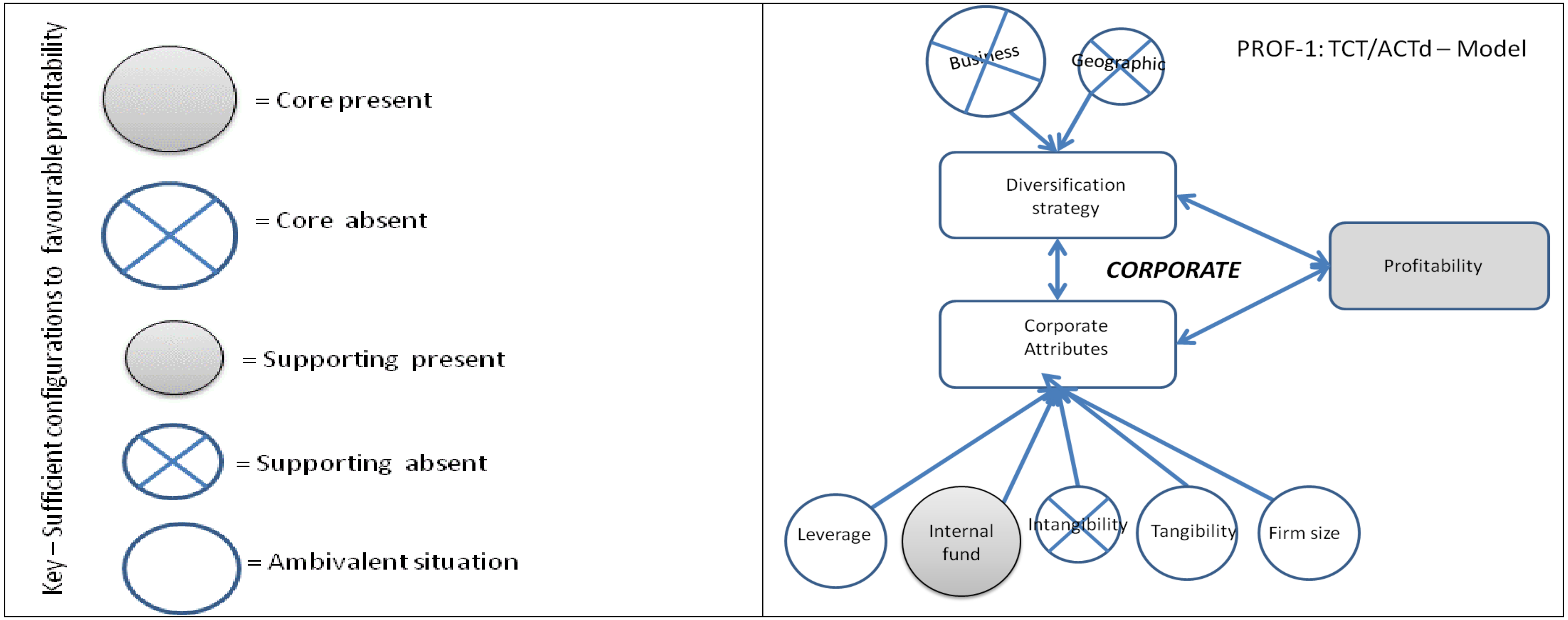
Identification of necessary condition(s) or configurations

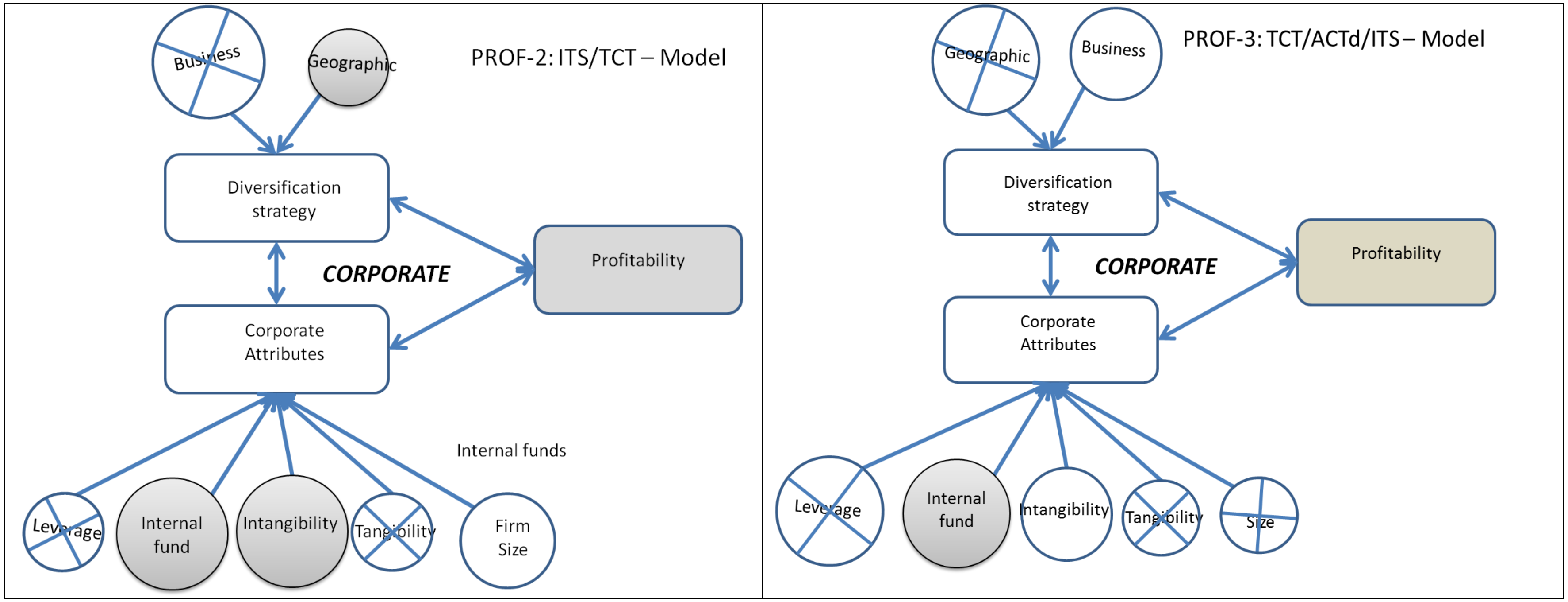
	Presence of high membership	Absence of high membership	Ambivalent
PROF- Common	Retained earnings	Business diversification* Firm Size*, Leverage*	None

Source: Constructed from table 7.6

Figure 7.3: Summary of set-theoretic frameworks for favourable profitability

This figure summarises the three robust configurations for favourable profitability (PROF-1, PROF-2, and PROF-3). It shows three set-theoretic frameworks that can be used to understand sufficient indicators of favourable profitability. The figure indicates firms' memberships in core, supporting, and ambivalent conditions that sufficiently create configurations to favourable profitability.





PROF-2: ITS/TCT – Model
Business
Geographic
Diversification strategy
CORPORATE
Profitability
Corporate Attributes
Internal funds
Leverage
Internal fund
Intangibility
Tangibility
Firm Size
PROF-3: TCT/ACTd/ITS – Model
Geographic
Business
Diversification strategy
CORPORATE
Profitability
Corporate Attributes
Leverage
Internal fund
Intangibility
Tangibility
Size

To conclude, the results have shown that LSE-FASI-Firms can easily create profit through LGLB diversification strategy as this requires only two conditions: high membership in internal fund sets as a core condition and not-high membership in intangible asset sets as a supporting condition. Whilst HGLB diversification strategy requires more conditions in order to sufficiently achieve favourable profitability.

The results have indicated that the business diversification-profitability relationships is complex and can be adequately explained through hybridisation of the three theories TCT, ACTs, and ITS as suggested in chapter 2. This hybridisation of theories has been performed using set-theoretic framework that uses FSA.

The empirical results have shown that FSA is a particularly a useful tool to explain the necessary and sufficient configurations that lead to favourable profitability in LSE-FASI-Firms. Subsequently, FSA appears to complement net-effect and other standard methods of analysis in corporate diversification-performance relationship studies as this relationship is too complex to examine through simple symmetric causality models. This means that FSA is particular important for future development not only in corporate diversification-performance relationship studies, but also in other cause-effect studies and in hybridisation studies in accounting and finance especially when causal variables are highly interactive.

Finally, the results and the set-theoretic framework developed here is important to researchers because it reduces the problems of insufficient explanations and conclusions about the impact of geographic and business diversification on profitability. Consequently, practical contributions of the results include enabling investors to make decisions about firm profitability based on configurations rather than on standalone profitability indicators. The results will also help managers to understand the optimal mix of degree and type of corporate diversification, financing choice, asset structure and firm size that would sufficiently lead to favourable profitability in their firms. More discussion on implication and contribution are in section 9.2 and 9.4 respectively.

Chapter 8 : EMPIRICAL RESULTS CORPORATE DIVERSIFICATION AND THE BALANCE OF RISK-RETURN PERFORMANCE: AN APPLICATION OF FSA

8.1: INTRODUCTION

> *"The objective of diversification is to produce the best portfolio-the one with the most favourable combination of risk and expected return" (Lintner, 1965, p. 589)*

The above quotation implies that firms diversify across geographic locations and business lines in order to achieve a favourable balance of business risk-reduction and return (hereafter favourable risk-return performance – RRP)[94]. Evidence shows that firms can simultaneously increase their profitability and reduce business risks through corporate diversification strategies in the presence or absence of other characteristics (Lintner, 1965; Bowman, 1980; Bettis and Hall, 1982; Bettis and Mahajan, 1985; Amit and Livnat, 1988; Kim et al., 1993; Lee et al., 2006). Indeed, Lintner, (1965,p. 589) noted that unless diversification is connected to other firm attributes there is "no possible degree or manner of diversification which will be sufficient to eliminate all the risks"

This means that the long lived notion of "the absence of a free lunch" for "profit-maximisers" or "risk-minimisers" proposed by finance theories (French et al., 1987; Fletcher, 2000; Ghysels et al., 2005) which shows that risk-return trade-off is "the fundamental law of finance" (Ghysels et al., 2005, p. 510) is refutable through a combination of corporate diversification strategies and other firm attributes[95]. However, to date it is not clearly know how the corporate diversification strategies combine with other firm attributes to achieve favourable RRP (Aggarwal and Samwick, 2003; Laeven and Levine, 2007; Andreou et al., 2010). Research literature has shown that methodological issues lead to an inability of explaining how corporate diversification would enhance RRP.

[94] Favourable RRP in this thesis is defined as simultaneous achievement of above cross-over membership in both profitability and risk-reduction sets (see chapter 5).
[95] The term other firm attributes in this thesis means other firm characteristics which include: leverage, internal fund, firm size, asset tangibility and intangibility.

This chapter aims to apply a set-theoretic framework, fuzzy set analysis (FSA), and hybridisation of theories to identify configurations of geographic and business diversification, level of leverage, internal fund, case size, asset intangibility and tangibility for favourable RRP in firms listed in the London stock exchange FTSE Allshare index (LSE-FASI-firms). Specifically, this chapter presents, analyses, and discusses empirical results of key research question 3 of this thesis:

> ***How does corporate diversification necessarily and sufficiently lead to favourable risk-return performance?***

Hypothesis d is used to explore answers to key question 3 as discussed in chapter 1. This hypothesis creates a truth table which is then used to identify the configurations[96] to favourable RRP in LSE-FASI-Firms.

Hypothesis d

> ***A combination of not-high membership in a business diversification set and high membership in internal fund and case size sets is a necessary but insufficient indicator of favourable RRP. Other attributes like assets tangibility and intangibility and geographic diversification are important for determining sufficient configurations***

As noted in the previous chapters, before embarking on a search for empirical answers to the key question above, I first addressed the supporting questions using independent sample mean comparisons, cluster analysis, and linear regression analysis models. These models provide supporting explanation as to why FSA is used to investigate the relationship between of corporate diversification strategies on RRP, and allows comparisons of this current result with previous research, and provides robustness checks.

[96] The term configuration in this research is used interchangeably with solution to mean connection (combination) of causal variables that sufficiently lead to favourable RRP.

The supporting questions indicated below are used as stepping stones towards answering the key research question of this chapter.

3A. ***Is there a specific diversification strategy that is necessary for favourable RRP?***

3B ***Are diversification strategies lead to differences in firm's membership of profitability, risk-reduction, and RRP?***

3C ***Do cases with similar membership in favourable RRP have significant differences in diversification strategies and other firm characteristics?***

3D ***What is the contribution geographic and business diversification on RRP across the corporate diversification strategies?***

8.2: RELATED LITERATURE

Previous researchers have found that it is possible for firms to simultaneously increase profits and reduce business risks (Bowman, 1980; Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1993; Lee et al., 2006). This idea challenges the long-lived notion of the absence of a "free lunch" for profit seekers or risk-averse investors. This paradox is commonly known as Bowman's risk-return paradox.

Following Bowman's risk-return paradox, researchers have applied different theories to explain how corporate diversification and other attributes can support Bowman's paradox (see table 2.5). It is argued that the corporate diversification strategies are important to understand RRP (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993; Lee et al., 2006)[97]. However, other firm characteristics have been found to impact on the relationship between corporate diversification strategies and RRP which requires further attention (Bettis and Mahajan, 1985; Kim et al., 1993).

It has been found that business "related diversification is a necessary but not sufficient condition to achieve favourable risk/return performances" [98] (Bettis and Mahajan, 1985, p.793). It appears that clusters which show favourable RRP in Bettis and Mahajan have higher levels of R&D and advertisement spending and the lowest

[97] There are four diversification strategies used in this research and they are defined in table 4.16

[98] A condition or a configuration is considered necessary if it must be present for an outcome to occur, while a cause is defined as sufficient if, by itself, it can produce an outcome (see section 3.3.3 of this thesis for further discussion of these concepts).

level of debt capital. This is consistent with the argument advanced by Bettis and Hall, (1982) that related diversification enables better RRP through shared R&D and marketing costs, expertise, and business experience across related segments.

Bettis and Mahajan, (1985) recommended that future researchers should consider the study of synergistic-effect in order to explain the effects of product and geographic diversification and other corporate characteristics.

Kim et al., (1989; 1993) examined the impact of diversification strategies on RRP. They found that the impact of geographical diversification on risk-reduction performance is positive and significant in related business diversified firms but not in unrelated business diversified firms. However, Kim et al., (1989) were unable to empirically "uncover diversification strategies in which firms achieve both favourable profit growth and stability" (p.54). Kim et al., (1993) examined further the role of geographic diversification on RRP and found that geographic diversification is capable of enhancing RRP, and unrelated diversification can only reduce risk by trading-off returns.

Furthermore, Kim et al., (1989; 1993) noted that different business environments across countries overcome sales volatility and thus lead to higher returns and lower risks. They concluded that multinational firms increase profits and reduce business-risks through operational flexibility that mitigates the negative impact of a specific country's interest rates, tax rates, labour costs, and raw material costs. This conclusion was later confirmed in (Lee et al., 2006).

Based on the above studies, it appears that it is possible to achieve favourable RRP through corporate diversification. What matters is to understand how the types and degree of corporate diversifications (Miller and Pras, 1980; Kim et al., 1993) combine/interact with other firm characteristics that give unique advantages to firms (Bettis and Mahajan, 1985; Kim et al., 1989; Lubatkin and Chatterjee, 1994; Lu and Beamish, 2004; Barnes and Hardie-Brown, 2006). Theoretical and empirical evidence has shown that financing choice, asset structure, and case size are important in explaining the impact of diversification on RRP as all impact on diversification strategies, business risk-reduction, and profitability.

However, little attention has been given to examine the synergistic-effect of corporate diversification and other corporate characteristics on RRP. Consistent with previous researchers, this thesis argues that diversification per se is neither necessary nor sufficient for favourable RRP. Based on this argument this chapter presents empirical evidence to show how other firm characteristics combine with corporate diversification for favourable RRP.

8.3: METHODOLOGY AND METHODS

8.3.1: DATA SOURCE, SAMPLE AND VARIABLES (CONDITIONS) SELECTION.

Previous researchers examined Bowman 1980's risk-return paradox using U.S data and largely based on (Rumelt, 1974) categorization of firms, and applying methods that ignore interaction effects of diversification types and other firm's characteristics (Kim et al, 1993). This might lead to the assumption that the paradox is only visible in U.S firms and that a particular diversification type is necessary for achieving favourable RRP. The current research examines Bowman's paradox using data from LSE-FASI-Firms obtained from the DataStream. Consistent with previous researchers, I use accounting data that measures managers' ability to create returns and reduce business risks to their firms. This accounting data will help to explain the effect of agency problems on managers' efficiency in utilising firm's assets in order to achieve favourable profitability without exposing the firms to high business risks.

The sample covers a ten-year cross-sectional period (2001-2010). This helps to reduce single year effect on RRP. Deephouse and Wiseman, (2000), noted that the risk-return relationship is sensitive to time across different economic conditions. In addition, corporate diversification is a strategic decision whose effect would require a longer period. Therefore, as discussed in section 4.3.2, the sample of ten year period covered three different economic and corporate governance regimes to reduce the problem identified by Deephouse and Wiseman.

In order to identify the configurations for favourable RRP, across the three groups the sample of 836 cases[99] was used. These cases were sorted into four diversification strategies as defined in table 4.16. This categorisation of the four diversification

[99] See section 4.3.2.2 for discussion about the sample size and period used in this research

strategies is consistent with researchers in finance and accounting (Denis et al., 2002; Singh et al., 2003; Barnes and Hardie-Brown, 2006). Furthermore, the sample was grouped based on RRP as per researchers in strategic management (Bettis and Mahajan, 1985; Kim et al., 1993). RRP has not well featured in accounting and finance research; however it has been extensively used in business and strategic management research. The use of RRP offers an additional level of analysis that provides a contribution in accounting and finance by introducing this important variable. The combination of risk-reduction and profitability (RRP) is however based on underlying variables (ROA, ROS, SDROA, and SDROS) that have been used independently of each other in accounting and finance research. This allows a degree of comparability with prior research in accounting and finance.

Variables (sets) used in this chapter

The outcome of interest of this chapter is favourable RRP. As discussed in section 5.3.1.3, a case is classified as having favourable RRP if it its membership in both profitability (ROA or ROS) and risk-reduction (SDROA or SDROS) sets are above mean and median respectively, otherwise a case is classified as having not-high membership[100]. This is consistent with previous research (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993; Sullivan, 1994; Hitt et al., 1997; Nickel and Rodriguez., 2002; Andersen et al., 2007; Qian et al., 2008)[101].

Other sets that were used on this research include: geographic and business diversification, leverage, internal fund, case size, asset intangibility and tangibility sets. The development process and reasons for using these sets in this chapter have been discussed in section 4.3.1 and 5.3 of this thesis.

8.3.2: RESEARCH METHOD AND ANALYSIS

As noted in chapter 4, in order to explain the sufficiency of diversification strategies for favourable RRP this research starts with cluster analysis. The cluster analysis approach helps to firstly identify a cluster with favourable RRP (here after Winners

[100] See section 5.3.1.3 for further discussion of membership in RRP set and illustration on how RRP set was created.

[101] This literature shows that ROA and ROS, and SDROA and SDROS are widely used measure of profitability and profitability risks.

cluster) and analysis if the Winners have specific characteristics in terms corporate diversifications, leverage, internal fund, case size, asset tangibility and intangibility. Secondly, after identification of the Winners cluster, independent sample mean comparison is used to determine the average memberships of the winner group in the different sets and compare the means across the four diversification strategies (HGHB, HGLB, LGHB, and LGLB). This helps to explain differences and similarities of Winners' attributes across the four diversification strategies. Thirdly, linear regression analysis is used to examine the impact of individual geographic and business diversification on RRP across the four diversification strategies. Finally, I use the FSA to bridge the gap in knowledge as to how geographic and business diversification combines with other firm characteristics for favourable RRP.

8.4: EMPIRICAL RESULTS FROM TRADITIONAL APPROACHES

8.4.1: EMPIRICAL RESULTS FROM CLUSTER ANALYSIS

Consistent with previous researchers such as Bettis and Mahajan, (1985) and Kim et al., (1993), K-mean cluster analysis was used to create four risk-return clusters (that is clusters associated with RRP) which include: Winners, profit-maximisers, risk-reducers, and losers. The ***Winners*** cluster includes cases that have higher than 0.5 memberships in both profitability and risk-reduction sets. The ***Profit-maximisers*** cluster includes cases that have above 0.5 memberships in profitability but 0.5 or less memberships in risk-reduction sets. ***Risk-reducers***, are cases that show high risk-reduction membership (fuzzy set value greater than 0.5) and low profitability membership (fuzzy set value 0.5 or less). The fourth cluster is the ***Losers*** cluster which includes cases with membership 0.5 or less in both profitability and risk-reduction sets.

Cluster analysis was run using SPSS software which uses the K-means algorithm to assign cases in clusters based on distance of cases from cluster centroids, which helps to identify within group homogeneity (Kim et al., 1993). The homogeneity of the group has to be stable in order to allow objective analysis and conclusion. The stability of the clusters was examined by sorting cases into the specified groups using excel sort command and counting them. I found that the number of cases in each group was slightly different to that reported in K-mean results. However, the mean memberships in the sets (variables) across the groups were similar to those reported in SPSS software (K-mean cluster analysis). This implies that the clusters are stable.

Within the risk-return performance clusters, further clusters were constructed based on diversification strategies (low-high classification) as defined in table 4.16. This low-high classification was also used by Singh et al., (2003) using single and two of more segment to associate with low and high diversification respectively, which later was noted that related, dominant and single segment firms have almost similar level of RRP (Lee et al., 2006)[102]. Therefore, in my research not-high diversification include related, dominant, and single segment diversifications as shown in table 4.7 in section 4.3.1.2 of this thesis.

The K-mean cluster analysis was intended to answer supporting research question 3A as stated below.

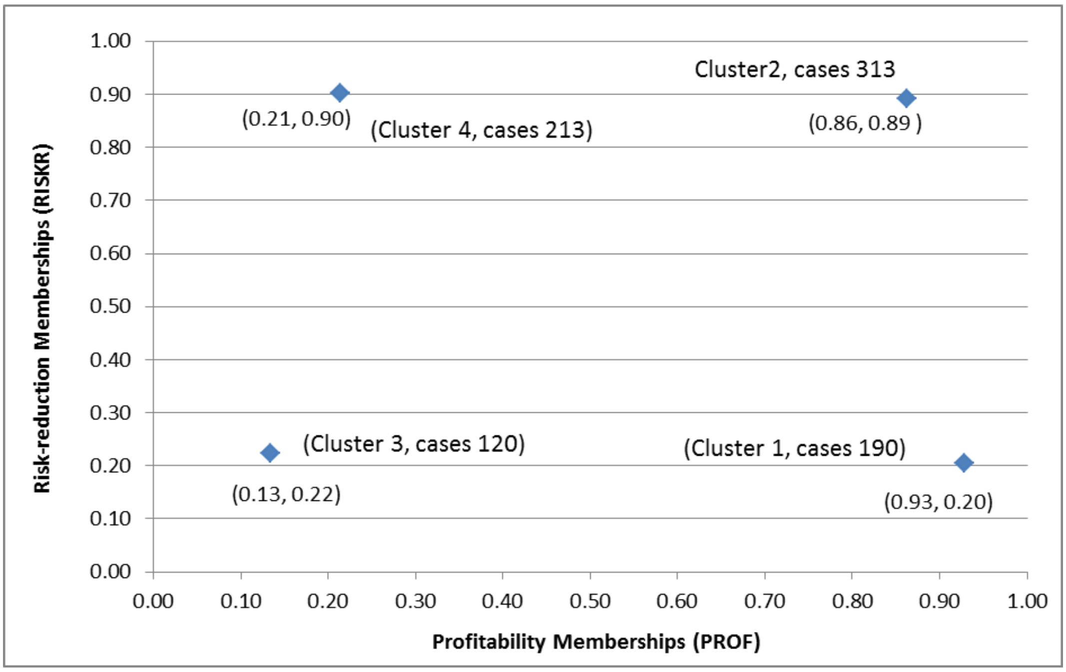
Is there a diversification strategy that is necessary for achieving favourable RRP?

Figure 8.1 is an X-Y plot of the K-mean analysis result. It indicates clusters' centroids and numbers of cases in each cluster. It shows that ***Profit-seekers*** (cluster 1) accounts for 22.7% of all cases, ***Winners*** (cluster 2) comprise of 37.4% of all cases involved in the analysis, ***Losers*** (cluster 3) is 14.4% of all cases, and ***Risk-reducers*** accounts for 25.5% of all cases

Profit-seekers and ***risk-reducers*** show evidence for the idea of the absence of a free lunch for profit seekers and risk-reducers as proposed in finance theories that risk-return trade-off is the basic law in finance when it comes to seeking higher returns (French et al., 1987; Fletcher, 2000; Ghysels et al., 2005), these cluster accounts for 48.2% (403/836) of all cases involved in the analysis. ***Winners*** and ***Losers*** provide support of Bowman paradox, that is absence of risk-return trade-off and they account for 51.8% of cases used in this research. This provides evidence that it is not guarantee that profitable firms have high business risks or firms with less business risk have low level of profitability.

[102] Lee et al, (2006) defined focused firms as those whose largest segment have 95% or more of segmental assets or sales.

Figure 8.1: X-Y Plot of Cluster centroids (Means)



In these contexts, this research explored further the issues to understand how the favourable balance of risk-return can sufficiently be achieved.

Table 8.1: Summary of risk-return clusters across diversification strategies

This table shows four RRP clusters as indicated by profitability (PROF) and risk-reduction (RISKR)). The table also shows the number of cases across the four diversification strategies. The proportion of Winners across diversification strategies is also indicated.

Winners = Cluster whose membership in both profitability and risk-reduction is high (fs > 0.5)

Profit-maximisers = Cluster whose membership in high profitability is high (fs > 0.5) but does not have a high membership in risk-reductions (fs ≤ 0.5)**.**

Risk-reducers = Cluster of low profit achievers (fs ≤ 0.5) but high achievers in risk-reduction (fs > 0.5)

Losers =Cluster whose membership in both profitability and risk-reduction are not-high (fs ≤ 0.5).

HGHB = Cases with high membership in both geographic and business diversification.

HGLB = Cases with high membership in geographic diversification (fs > 0.5) and not-high membership in business diversification (fs < 0.5) .

LGHB = Cases with not-high membership in geographic diversification and high membership in business diversification.

LGLB = Cases with not-high membership in both geographic and business diversification

Clusters	No. Cases	Diversification strategies				Means	
		HGHB	HGLB	LGHB	LGLB	PROF	RISKR
1. Profit-maximisers	190	65	55	17	52	0.93	0.20
2. Winners	313	105	72	74	77	0.86	0.89
3. Losers	120	41	27	25	21	0.13	0.22
4. Risk-reducers	213	104	39	28	34	0.21	0.90
Total Cases	836	315	193	144	184		
Proportion of Winners	37%	33%	37%	51%	42%		

Further analysis was conducted to identify if there is any diversification strategy which appear to be necessary for achieving favourable RRP (Winners). Table 8.1 presents the results of cluster analysis in tabular form across the four corporate diversification strategies.

The table indicates that Winners can come from any of the four categories (HGHB, HGLB, LGHB, and LGLB). It appears that the proportion of Winners across the four diversification strategies is below 50% which is the benchmark for ***more often than not*** necessary or sufficient condition (Ragin, 2000; 2008). This leads to the conclusion that corporate diversification strategy per se is neither necessary nor sufficient for favourable RRP. This is consistent with previous researchers who conclude that diversification per se is not sufficient for favourable RRP (Morck and Yeung 1991; 1992; 1997; Kim et al., 1993; Bodnar et al., 1999; Martin and Sayrak, 2003; Barnes and Hardie-Brown, 2006).This result implies that investors need not to rely solely on diversification strategies as a sufficient indicator for RRP but, that these diversification strategies have to be examined in connection to other firm characteristics.

The results presented in table 8.1, suggests that it is necessary to examine if diversification strategies lead to significant differences in profitability, risk-reduction and RRP. Therefore, the next subsection compares means of cases' membership in profitability, risk-reduction, and RRP across the four diversification strategies.

8.4.2: RESULTS FROM INDEPENDENT SAMPLE MEANS COMPARISON ANALYSIS

This section presents result of independent sample means comparison across the four geographic and business categories. Table 8.2 present results on supporting research question 3B stated below

> ***Do diversification strategies lead to significant differences in firm profitability, risk-reduction, and RRP?***

Table 8.2 compares cases' membership in profitability, risk-reduction, and RRP sets across the four diversification strategies. It shows that on average, HGHB and HGLB cases have no significant differences in risk-return membership (t = -0.62). However, it shows that while HGHB cases significantly reduce business risks at the expense of profitability, HGLB cases enhance profits at the expense of risk-reductions.

Since favourable RRP is determined by the intersection of the two ***sets*** (profitability and risk-reduction), then it is not surprising that membership of HGHB and HGLB cases in the RRP set is not significantly different.

The table also shows that HGHB and LGHB cases have relatively lower profitability but higher risk-reduction as compared to other diversification strategies. In addition, HGHB and LGHB cases appear to have no significant differences of membership in risk-reduction ($t = 1.10$). Furthermore, it appears that HGLB cases and LGLB cases have relatively higher membership in profitability sets and lower membership in risk-reduction sets. These imply that whilst high business diversification reduces business risk at the expense of profitability, not-high business diversification enhances profitability at the expense of business risk-reductions.

Table 8.2: Independent sample mean comparisons across diversification strategies

This table indicates mean differences in profitability, risk-reduction, and RRP across the four diversification strategies as defined below. Against every diversification category the number of cases involved in the analysis is indicated in brackets.

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

T = t-test (2-tailed) of which *, **, and *** represents 10%, 5% and 1% significant level respectively

	Diversification strategies								Means comparisons across diversification groups					
Variables/Sets	HGHB (315) 1		HGLB (193) 2		LGHB (144) 3		LGLB (184) 4		1&2	1&3	1&4	2&3	2&4	3&4
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	T	T	T	T	T	T
Profitability	0.53	0.37	0.64	0.38	0.61	0.37	0.70	0.36	-3.15***	-2.07**	-4.93***	0.73	-1.56	-2.22**
Risk-reduction	0.67	0.33	0.58	0.37	0.71	0.34	0.61	0.39	2.67***	-1.10	1.89*	-3.19***	-0.54	2.52**
RRP	0.38	0.30	0.39	0.34	0.50	0.35	0.44	0.37	-0.62	-3.76***	-2.05**	-2.89***	-1.29	1.55

When comparing HGHB and LGLB cases, I found that LGLB cases have significantly higher membership in profitability (t = 4.93) and RRP (t = 2.05) sets. While HGHB cases have higher membership in risk-reduction performance sets (t = 1.89) than LGLB cases. Furthermore, HGLB and LGHB cases were also compared and it was found that LGHB cases had significant higher membership in both risk-reduction (t = 3.19) and RRP (t = 2.89) sets than HGLB cases.

Figure 8.2 graphically presents the results of table 8.2. This figure clearly shows the trade-off between profitability and business risk-reductions across the four diversification strategies. It shows that regardless of degree of geographic diversification, high business diversification leads to high business-reduction at the expense of profitability (see HGHB and LGHB cases).

Based on these results, I can tentatively conclude that ceteris paribus, high business diversification strategy leads to high business risk-reductions while not-high business and geographic diversification enhances firm profitability. This result challenges Kim et al's, (1993) result which found no evidence of impact of business diversification strategies on RRP, in fact Kim and others' results were based on multinational firms and ignored non-high geographic diversified firms in which high business diversification appears to be important.

Generally, figure 8.2 indicates that it is hard to attain favourable RRP through diversification strategies per se. This is consistent with the previous researchers' results (Bettis and Hall, 1982; Bettis and Mahajan, 1985; Kim et al., 1989; 1993). Indeed figure 8.2 shows that on average all the diversification strategies have below 0.5 memberships in RRP sets and there is a trade-off between risk-reduction and profitability memberships.

Since Winners are of the most interest to this research, I examine mean differences of firm characteristics in the Winners cluster in the next section. This will help to explain if cases within the Winners cluster have significant differences in other firm characteristics across the four diversification strategies. This analysis intends to identify other firm characteristics that are necessary for achieving favourable RRP.

Figure 8.2: Favourable balance and trade-offs of business risk and return

This figure graphically presents the differences in profitability, risk-reduction, and RRP membership of cases across the four diversification strategies. The three performance and the four diversification strategies are defined here below. However, further definitions are found in chapter 5.

Profitability - Is defined by cases' membership in either ***higher*** of ROA or ROS.

Risk-reduction - Is defined by cases' membership in either ***highe***r of standard deviation of ROA or ROS

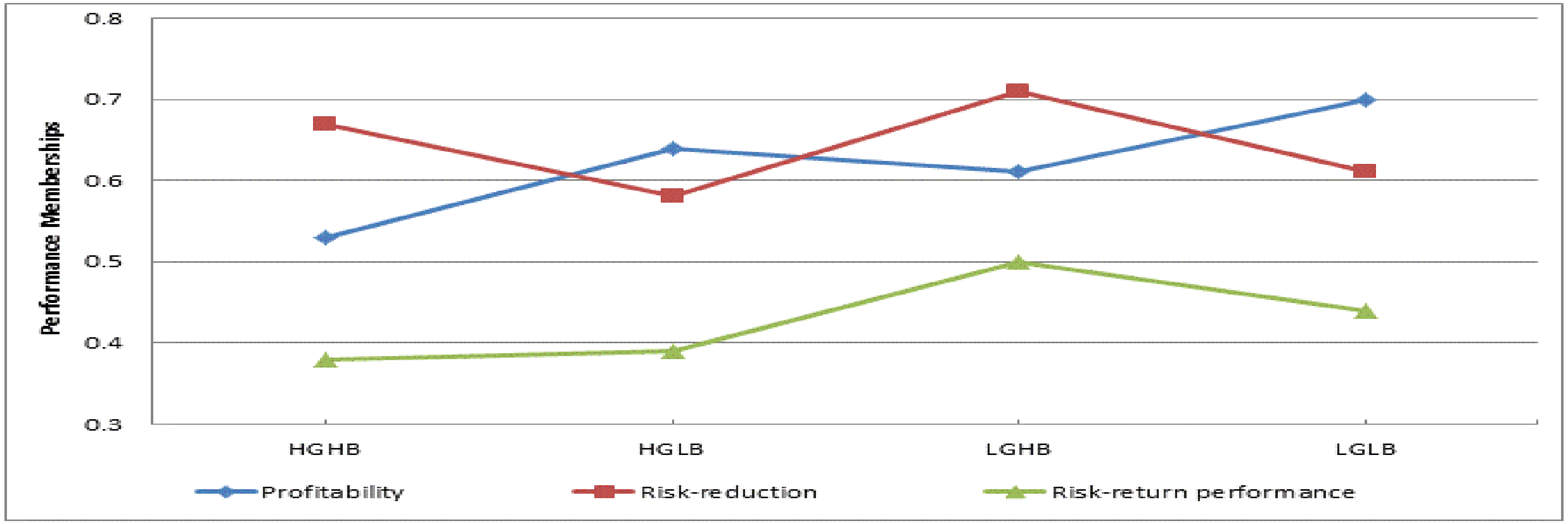
RRP - Is defined by the ***lower*** of PROF and RISKR.

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales



8.4.3: Results from independent sample mean comparisons Winners cluster.

This section presents results of an independent sample means comparison of Winners across the four diversification strategies to explain if firms with similar RRP membership have significant differences in other firm characteristics. Specifically, the section seeks to explore answers to the supporting research question 3C:

> ***Do firms with the same favourable RRP have significant differences in other firm characteristics?***

I examine mean membership of Winners in leverage, internal fund, case size, asset tangibility and intangibility sets across the four diversification strategies (HGHB, HGLB, LGHB, and LGLB). The results are presented in table 8.3 and figure 8.3.

Table 8.3 shows that Winners have significant differences in other firm characteristics across the diversification strategies. However, it appears that on average Winners have above average membership in internal fund and case size sets but below average membership in leverage set. This leads to the tentative conclusion that high membership in internal fund and case size sets are necessary for achieving favourable RRP.

Table 8.3 shows that membership of Winners in internally generated fund sets is high across the four diversification strategies. This indicates that internal funds are important to enhance profitability and business risk-reduction performance. Indeed Myers, (1977) argued that internal funds are important to finance profitable growth opportunities because it provides flexibility of investment choice. In addition, Stein, (1997), noted that the availability of internal funds enable managers to better allocate scarce resources and choose projects that add value. Furthermore, agency cost theory of debt contends that the presence of high levels of retained earnings may signal favourable firm's profitability and less profit volatility, because this reduces equityholders' appetite for choosing high risky projects (Jensen and Meckling., 1976). It is therefore not surprising to find that a high level of internally generated funds is necessary for favourable RRP.

Table 8.3: Mean comparisons of winners cluster

This table indicates means differences in profitability, risk-reduction, and RRP across the four diversification strategies as defined below. Against every diversification strategy the number of cases involved in the analysis is indicated in brackets.

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

T = t-test (2-tailed) of which *, **, and *** represents 10%, 5% and 1% significant level respectively

Variables/sets	HGHB (103) 1		HGLB (69) 2		LGHB (73) 3		LGLB (76) 4		1&2	1&3	1&4	2&3	2&4	3&4
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	T	T	T	T	T	T
Leverage	0.46	0.37	0.42	0.37	0.60	0.41	0.39	0.40	0.71	-2.30**	1.22	-2.69***	0.46	3.13***
Internal Funds	0.62	0.36	0.60	0.39	0.53	0.39	0.67	0.38	0.45	1.56	-0.88	0.97	-1.19	-2.21**
Intangibility	0.58	0.37	0.43	0.40	0.35	0.37	0.24	0.34	2.49***	3.98***	6.42***	1.21	3.15***	1.99**
Tangibility	0.29	0.32	0.42	0.41	0.59	0.41	0.54	0.43	-2.19**	-5.15***	-4.34***	-2.43***	-1.77*	0.66
Case size	0.68	0.34	0.57	0.37	0.59	0.36	0.45	0.33	2.07**	1.71*	4.68***	-0.35	2.13**	2.56***

Table 8.3 also shows that Winners with HGHB diversification strategies are very-large with relatively higher membership in intangible assets and the lowest level of asset tangibility. Theoretically, high business diversified firms are subject to agency problems. According to ACT, high levels of leverage reduce agency costs associated with managers' overinvestment behaviour through business diversification (Jensen, 1993; Li and Li, 1996). However, the agency cost theory of debt also states that high levels of leverage increase the chances of equityholders to collude with managers to engage in risky investments because, both positive and negative results from using debtholders' money on risky investments would leave equityholders better-off than debtholders (Jensen and Meckling, 1976; Hillier et al., 2011). The combination of these arguments questions the ability of leverage to enhance RRP.

Furthermore, the results presented in table 8.3 indicate that LGLB Winners have the lowest membership in leverage and case size. These cases also show highest membership in internally generated funds. In theory, relatively not-very large and not-high diversified firms have less capacity to access cheap external funds. Therefore through avoidance of debt capital, these firms could increase profits. On the other hand, it has been empirically found that not-high business diversification enhances economies of scope through experience and knowledge sharing across the related segments (Bettis and Hall, 1982; Chang and Thomas, 1989; Kim et al., 1993) and reduces the possibility of business risk which may be associated with not-high business diversification

Table 8.3 also shows that cases with high levels of geographic diversification (HGHB and HGLB) have relatively high membership in intangible assets as compared to not-high geographic-diversified cases (LGHB and LGLB). This implies that a high level of information-based assets in geographic diversified cases enhances RRP (Kim et al., 1993). Similarly, Morck and Yeung, (1992; 1997), observed that geographically diversified firms that had high level information-based assets had high level of MTB. Based on these results, it appears that the combination of geographic and intangible assets have similar impact in RRP and MTB.

In addition, table 8.3 shows that high business diversified cases (HGHB and LGHB) have higher membership in leverage and case size than less business diversified

(HGLB and LGLB) cases. This can be explained through ACTs and TCT which generally explain that business diversification and large case size are major sources of agency problems associated with overinvestment (Jensen, 1986; Stilz, 1990; Li and Li, 1996), underinvestment (Jensen and Meckling, 1976), and managers' employment protection strategies (Harris and Raviv, 1991). These problems are reduced through financing choices such as the application of high level debt in the capital structure (Li and Li., 1996) because it reduces the amount of resource in the hands of managers for selfish use. Li and Li conclude that leverage is necessary for favourable financial performance in a diversified firm.

However, non-high business diversified cases need to avoid high leverage because it is expensive and this can also be explained through the coinsurance effect. According to the coinsurance effect (Lewellen, 1971; Martin, and Sayrak, 2003), firms which are not-highly diversified in terms of business do not provide enough insurance of cash flow to debt capital investors which leads to high costs of obtaining external finance. However, not-high business diversified firms can create high profits through avoidance of external finance.

Figure 8.3 graphically shows the mean differences of the Winners cluster across the four diversification strategies. The results clearly show how cases with similar RRP (Winners) have different characteristics across the four diversification strategies. It shows that memberships of Winners cluster in internal fund set and firm size set are relatively high across the four diversification strategies. This implies that having high membership in both internal fund and firm size sets may necessarily lead to favourable RRP.

Based on the results presented above, it appears that cases with similar RRP may have different characteristics in terms of geographic and business diversifications, levels of leverage, internal funds, case size, asset tangibility and intangibility as clearly indicated in figure 8.3 this implies that it is difficult to draw conclusion as to how the mentioned firm attributes can adequately indicate favourable balance of RRP. However, these results are theoretically justifiable as highlight above and discussed in the later sections.

Figure 8.3: Firm characteristics mean differences in the winner cluster

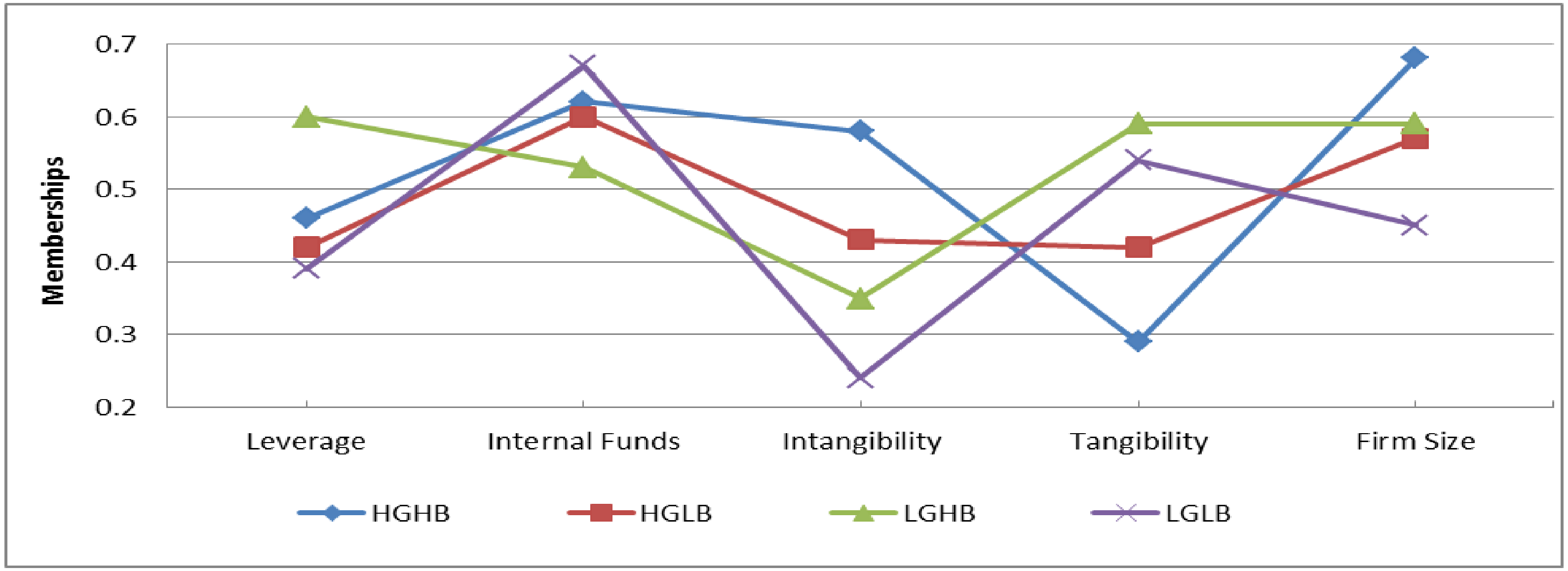
This figure indicates means differences of firm characteristics in cases with favourable RRP across the four diversification strategies

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales



In the next section, this research examines the individual contribution of geographic and business diversification and other firm characteristics on the RRP across the diversification strategies.

8.4.4: RESULTS FROM REGRESSION ANALYSIS

One of the objectives of this chapter is to explain the impact of standalone geographic and business diversification on RRP across the four diversification strategies. Specifically, this section addresses the supporting question 3D:

> ***What is the contribution of geographic and business diversification on RRP across the corporate diversification strategies?***

In order to answer the above questions, ordinary least square regressions (OLS) were used across the four diversification strategies (HGHB, HGLB, LGHB, and LGLB). The results of OLS are presented in table 8.4 which shows fragmented and conflicting results. This implies that there is no simple answer to the above question because it appears that geographic and business diversifications have different contribution on RRP across the four diversification strategies. In this context, I argue that geographic and business diversification on their standalone basis cannot sufficiently be used as sufficient indicator of favourable balance of RRP; rather they have to be examined in combination with other firm attributes.

Table 8.4 shows that throughout the five models, internally generated fund is significantly and positively related to RRP. Furthermore, case size seems to be positively related to RRP except in LGLB cases. This is consistent with results presented in table 8.3 and figure 8.3 above which show that on average Winners have above average retained earnings and case size except for LGLB cases where case size membership is 0.45. Furthermore, it appears that leverage brings positive and significant relations with RRP in cases with high business diversification strategy (HGHB and LGHB). Basing on agency cost theory and coinsurance effect explained in chapter 2, it can be argued that the combination of leverage and business diversifications provides dual effect: reduces agency problem (Li and Li., 1996), and reduces cost of capital (Lewellen, 1971) which may lead to favourable RRP.

Table 8.4: Regression analysis results

This table shows ordinary least square regressions of geographic and business diversification and other firm characteristics on RRP (RRP). RRP is a combined measure of profitability and risk-reduction, this measure is calculated using fuzzy set logical "and" that is by taking minimum membership between profitability and risk-reductions. A firm is classified as having favourable risk-return performance if its membership in both profitability and risk-reductions is higher than 0.5

HGHB = Cases with high membership in both geographic and business diversifications whose entropy measure of diversification is above 0.6 in either segmental assets ***or*** segmental sales. The entropy measure above 0.6 is equivalent to a fuzzy set value higher than 0.5.

HGLB = Diversification strategy that indicates cases with high membership in geographic and not-high membership in business diversification sets. These are cases which show an entropy index above 0.6 (fs > 0.5) in geographic diversification and equal or below 0.6 (fs ≤ 0.5) in business diversification

LGHB = Diversification strategy which represents cases with non-high membership (entropy measure equal or less than 0.6 (that is fs ≤ 0.5) in geographic diversification and high membership in business diversification, that is with segmental assets ***or*** segmental sales entropy measure not-higher than 0.6 (fs > 0.5) in geographic diversified cases and higher than fs 0.5 in business diversification set.

LGLB = Diversification strategy that represents cases with low membership in both geographic and business diversification sets, that is an entropy measure of diversification equal or below 0.6 (fs ≤ 0.5) in segmental assets ***and*** segmental sales

*, **, and *** represents 10%, 5% and 1% significant level respectively

Variables/Sets	ALL	HGHB	HGLB	LGHB	LGLB
(Constant)	.32*** (7.88)	-.24 (-1.41)	.13 (.80)	.56*** (2.77)	.50*** (5.61)
Geographic Diversification	-.09*** (-3.09)	.33** (2.28)	.15 (.96)	.36 (1.51)	-.48** (-2.35)
Business Diversification	.01 (.29)	.20 (1.57)	-.08 (-.48)	-.41* (-1.83)	-.07 (-.35)
Leverage	.11*** (3.15)	.20*** (3.78)	.07 (1.06)	.15* (1.70)	-.04 (-.51)
Retained Earnings	.24*** (7.82)	.28*** (6.02)	.25*** (4.00)	.25*** (3.13)	.14* (1.86)
Asset Intangibility	-.01 (-.28)	-.08 (-1.37)	-.03 (-.40)	.04*** (.37)	.04 (.45)
Asset Tangibility	-.11*** (-2.90)	-.20*** -(3.21)	-.06 (-.77)	.02 (.24)	-.13* (-1.70)
Case size	.05 (1.41)	.02 (.47)	.06 (.89)	.10 (1.12)	-.03 (-.31)
R-Square	0.088	0.156	0.105	0.138	0.087
Number of Cases	836	314	194	143	185

The first model (ALL model) in table 8.4 represents full sample OLS regression which shows that membership in geographic diversification have a negative contribution in RRP. In addition, it appears that the negative contribution is only found in All sample model and in LGLB model. The negative contribution in LGLB is consistent with the results presented in table 8.3 (see also table 6.1 in chapter 6), which indicated that LGLB cases have the lowest membership in intangible assets

It appears that increase in geographic diversification strategy in cases with less intangible assets like LGLB cases would not lead to favourable RRP. This suggests that the synergistic benefits of combining geographic diversification strategy and information-based assets is not limited to MTB (Morck and Yeung, 1991; 1992; 1997) or investment opportunities as indicated in Jones and Danbolt, (2005), but also the combination is a good indicator of favourable RRP. Indeed, table 8.3 above shows that winners with high geographic diversification strategy have also relatively high memberships in asset intangibility.

Table 8.4 also shows that the relationship between business and geographic diversification and RRP is not similar across the four diversification strategies. It appears that business diversification can have negative or positive contribution to RRP likewise geographic diversification. This implies that there is no diversification strategy that appears to be sufficient indicator of favourable RRP. However, the results show that high level of internal funds and large firm size are the important indicators of favourable RRP (see section 2.5).

Generally speaking, the results from these regression models indicate presence of partial and fragmented results which appears to be caused by the possible complex relationships amongst geographic and business diversification and RRP that cannot be sufficiently examined through regression models or explained by one theory. It seems that theories could hybridise to provide sufficient explanation about the impact of corporate diversification on RRP.

8.4.5: SUMMARY – RESULTS OF CLUSTER, MEAN COMPARISONS, AND REGRESSION ANALYSIS

The results from cluster analysis, independent sample mean comparisons, and regression analysis are summarised as follows: firstly, there is no specific corporate diversification strategy that is necessary or sufficient for favourable RRP. However high level of internal funds and large firm size, empirically appear to be important indicators of favourable RRP. Secondly, it appears that the trade-off between risk-reduction and profitability is ***not always*** a "fundamental law of finance" as suggested by Ghysels et al., (2005, p. 510), the results have shown that about 52% of the cases involved in this analysis refute the presence of the said trade-off, while 48% of the cases have shown existence of the trade-off (see figure 8.1). This means, although it appears difficult to attain a favourable balance between business risk-reduction and profitability as indicated in figure 8.2, still there are opportunities in LSE-FASI-Firms to achieve the favourable RRP. However, these opportunities have not been clearly identified by these models. Thirdly, it appears that geographic and business diversifications have different contribution on RRP across the four diversification strategies. The regression models presented in table 8.4 have shown that the contribution of the individual geographic and business diversification on RRP might have been influenced by the four diversification strategies and other firm characteristic, but the models seem to overlook these possible influences (Fiss, 2011). Therefore, the next section uses FSA to empirically and theoretically uncover this issue by examining configurations that sufficiently lead to favourable RRP.

8.5: Empirical results from fuzzy set analysis

8.5.1: INTRODUCTION

The empirical evidences presented in section 8.4 have indicated that geographic and business diversification, level of leverage, internal funds, firm size, and asset tangibility and intangibles appear to be interdependent and interacts in different ways to enhance or destroy RRP. It appears also that some firm characteristics are core while others seem be supporting in explaining impact of corporate diversification strategies on RRP. However, the traditional models were unable to clearly identify the core and the supporting conditions or configurations that adequately indicate favourable or unfavourable RRP.

As discussed in earlier empirical chapters, FSA is capable of handling complex causality problems (see also Ragin, 2000, 2008; Fiss, 2011 see also chapter 4). In this case, the next section presents, analyses, and discusses configurations for favourable risk-return performance by empirically answering the key research question 3:

> ***How does corporate diversification necessarily and sufficiently lead to favourable risk-return performance?***

In order to answer this question, I use FSA to help explain ***how*** different diversification strategies combine with core and supporting firm characteristics to create sufficient configurations for achieving favourable balance of risk-return performance in LSE-FASI-Firms.

8.5.2: CONFIGURATIONS FOR FAVOURABLE RISK-RETURN PERFORMANCE

Figure 8.4 is a set-theoretical framework that has been used to link corporate diversification (geographic and business diversification) and RRP. The model is used to explore configurations for favourable RRP. The dots in figure 8.4 represent cases' membership in geographic and business diversification sets, internal fund set, leverage set, intangibility set, tangibility set, and case size set. This model was based on previous studies that have shown that not-high business diversification allows synergistic benefits to arise from economies of scope and market power. Also the model considered the results presented in section 8.4.

The model shows that a configuration of not-high membership in business diversification sets and high membership in internal funds and case size sets is necessary for achieving favourable RRP. This configuration was highlighted in section 8.4 of this thesis.

Theoretically, not-high business diversification enables internalisation of human assets through the acquisition and sharing of knowledge, skills, and experience across the related business segments which reduce the chances of making mistakes in business (Fang et al., 2007), as a result, these cases reduce business risks and enhance firm profitability (Bettis and Hall, 1982), However, TCT suggests that it is expensive to finance not-high business diversification growth using debt because of possible cash flow risks from the related businesses. Therefore in order to enhance profitability, high level of internal funds is necessary to finance related diversification strategy. In addition, internal funds can more easily be accumulated in large than not-large firms.

Based on the agency cost theory of debt (Jensen and Meckling, 1976), a high level of debtholders' funds can lead to risky diversification, whilst high level internal (shareholders') funds reduce the chances of making risky investments because bad results from risky diversification is entirely the burden of shareholders. However, high level of internal fund can be associated high level of free cash flow which can lead to agency problems between managers and shareholders. In this context, it can be agreed that basing on one theory it is hard to provide adequate explanation on determinants of financial performance. Presence of high level of internal funds could be associated with lower business risk investments and positive investment opportunities, in the sense that firms with high growth opportunities would like to keep high level of internal funds to benefit from flexibility in taking the opportunities (Myers, 1977). Indeed, Jones and Danbolt, (2005), found that UK firms with less or zero dividend yields have high investment opportunities this may mean that high level of internal funds implies high investment opportunities.

It appears that a configuration of not-high memberships in business diversification, high memberships in internal funds, and case size sets appears necessary but not sufficient for achieving favourable risk-return performance. This lead to construction of the set-theoretic model indicated in figure 8.4 (see also figure 2.6).

The sufficiency of this configuration for favourable RRP will be determined by membership in leverage, geographic diversification, asset tangibility and intangibility sets as explained through a hybridisation of TCT, ACTs, and ITS as summarised below.

Figure 8.4 is the generic model relating to corporate diversification and RRP developed in section 2.5 (see figure 2.6). It shows that there are many ways in which case attributes as measured by set values might combine to achieve favourable RRP. However for clarity, this model was developed to explain the combination of necessary and ambivalent attributes as discussed above. Hybridisation of ITS, TCT, and ACTs is then used to theoretically justify and explain the favourable RRP configurations.

Theoretically, geographic diversification allows firms to benefit from cross country tax, labour costs, and material cost differences which enable firms to increase profitability (Grubert and Mutti 1991; Kim et al , 1993): geographic diversification reduces business risks associated with imbalance of demand and supply of products and services across geographic locations (Kim et al., 1989; 1993; Lee at al., 2006). Therefore, geographic diversification may appear to influence RRP in not-high business diversified cases. Indeed, it has been recently noted that geographic and business diversification complements or substitutes for one another in impacting RRP (Hashai and Delios, 2012). Furthermore, the results presented in section 8.4 have shown that geographically diversified cases with high level of information-based asset appear to have high memberships in RRP set. This implies geographic diversification and asset intangibility are interdependent, and are considered as ambivalent situation in figure 8.4

Based on TCT, leverage and asset tangibility in figure 8.4 have been considered as ambivalent conditions. Tangible assets can be collateralised and cases with high level of tangible assets have high borrowing capacity (Williamson, 1988). This enables cases with these assets to access cheap debt capital which could enable them to enhance and stabilise profitability. This implies that the benefits of high leverage on RRP depend on the level of asset tangibility. Therefore, these conditions are set to ambivalent situations as shown in figure 8.4.

Based on the argument summarised above, it can be seen that there is a complex cause-effect relationship between corporate diversification strategies and RRP which might be examined through a set-theoretic approach (Ragin, 2000; 2008; Pajunen, 2008; Greckhamer et al., 2008; Crilly, 2011; Fiss, 2011).

Figure 8.4: Set-theoretic framework of configurations for favourable RRP

This figure is a set-theoretic framework adopted to examine configurations that lead to favourable risk-return performance (RRP). The dots represent firms' membership in different attributes that include: geographic and business diversification sets, internally generated fund (internal) set, leverage set, intangibility set, tangibility set, and case size set. The filled dots represent the presence of above 0.5 memberships in the respective set and a dot with a cross represents cases' membership of 0.5 or less in the respective sets. The unfilled dot represents ambivalent situation where the level of a firm's membership doesn't matter when it comes to identification of the configuration that leads to favourable RRP. Large and small dots represent core and supporting conditions respectively in the configurations for favourable RRP

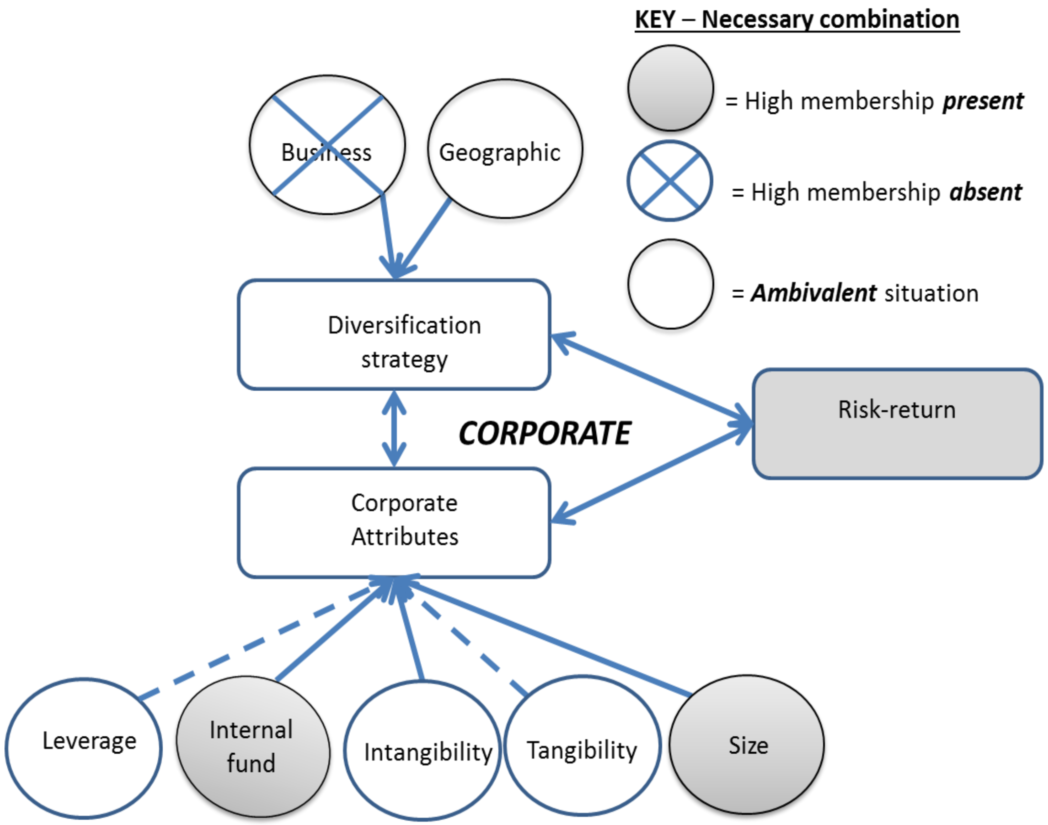


Table 8.5 is a truth table that shows the configurations that consistently are associated with favourable RRP. The consistency and frequency cut-off points used to construct the truth table are 79.7% and seven (7) respectively. As noted in section 3.3.3.2 that a consistency closer to 80% will be used when configurations appear to have less than 85% consistencies. Lower consistency across configurations implies that it is difficult to achieve the expected outcome basing on the identified causal factors as the case for favourable balance of risk-return performance. In this context, in truth table 8.5, a cut-off of 79.7% is used. The table indicates forty seven (47) configurations (rows) that have 7 or more cases. These rows constitute 76% of the total cases involved in this analysis. The table shows that there are only four configurations that pass the consistency cut-off of 79.7%. This implies that it is hard to achieve favourable RRP. Indeed, figure 8.2 above has clearly shown that there is often a trade-off between risk-reduction and profitability.

The outputs of the truth table 8.5 are minimised to produce parsimonious and intermediate solutions as presented in table 8.6. This enables the identification of configurations that consistently lead to favourable RRP. Table 8.6 shows that there are four configurations leading to favourable RRP.

The four configurations presented in table 8.5 show the presence of equifinality (Payne, 2006; Fiss, 2011), which is one of the basic assumptions of this research (see section 1.4). Table 8.6 shows that although consistencies are higher than the minimum level of 75%, coverage of the solutions is generally not good[103]. This implies that it is hard for the cases to find a configuration for favourable RRP. This is consistent with the results presented in section 8.4 of this thesis[104]

[103] Solution coverage is similar to R-square in regression models, it generally measures model fit;, consistency in fuzzy set analysis is considered as a measure of significance, it shows how the result not by luck which s means that as the consistency approaches one the result becomes more significant (the minimum acceptable level of consistency is 75%) (Ragin, 2008). The significance of the configurations can be tested using Z-test as demonstrated in Ragin, (2000, p. 111-114).

[104] See also Bettis and Mahajan, (1985) and Kim et al., (1993) for further support of the results

Table 8.5: Truth table of configurations for favourable RRP.

This table presents the distribution of configurations of seven or more cases that achieve favourable risk-return performance **(RRP)** at different levels of consistency. **Yes** = are cases that have high membership in the respective set/variable that is membership higher than 0.5. **No** = are cases that have not-high membership in the respective set that is membership 0.5 or less. **YES** = are cases that are found in the respective configuration and agree to display favourable **RRP**, that is the membership of the configuration appears subset of the **RRP** set. **NO** = are cases within the respective configuration that do not show favourable RRP.

Diversification:

DG = Membership in geographic diversification set; **DB** represents membership in business diversification sets. Membership of corporate diversification is commonly calculated using segmental assets ***or*** segmental sales and usually represented by entropy measures of diversification (Palepu, 1985; Hitt et al., 1997; Qian et al., 2008, Chiao and Ho, 2012), which are then calibrated to fuzzy sets.

Financing choice:

TDTA = membership in leverage *sets* as defined by total debts to total assets. **RETA** = membership in internal funds *set* as defined by total retained earnings to total assets.

Asset structure and case size:

TANG = membership in asset tangibility *set*, it is measured as the percentage of total property, plant, and equipment (PPE) on total assets. **INTA** = membership in asset intangibility *set* refers to as percentage of total intangible assets on total assets (Rocca et al., 2009). **SIZE** = membership in case size set; case size is usually reflected in a firm's structure (assets) ***or*** performance (sales) (Gooding and Wagner III., 1985). Thus assets and sales volumes are used to identify firm's membership in case size as represented by macrovariable. All the sets are defined using fuzzy set values.

Number = numbers of cases in each configuration; **RRP** is the membership in risk-return performance which is determined by the lower of profitability ***and*** risk-reduction membership.

Raw consist. = raw consistency is the proportion that the configurations agree in displaying favourable **RRP** performance.

Row	Diversification		Financing Choice		Case size and Asset Structures			Cases	RISK RETURN	Raw consist
	DG	DB	TDTA	RETA	INTA	TANG	SIZE	Number	RRP	Raw consist.
1	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**19**	***YES***	**81.612%**
2	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**Yes**	**12**	***YES***	**81.479%**
3	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**8**	***YES***	**80.224%**
4	**No**	**No**	**No**	**Yes**	**No**	**No**	**Yes**	**16**	***YES***	**79.744%**
5	No	Yes	No	Yes	No	Yes	No	8	NO	78.871%
6	No	Yes	No	Yes	Yes	No	No	9	NO	78.631%
7	No	Yes	Yes	No	Yes	No	Yes	9	NO	77.658%
8	Yes	Yes	No	Yes	Yes	No	Yes	25	NO	77.615%
9	Yes	Yes	Yes	Yes	No	Yes	Yes	11	NO	77.448%
10	Yes	No	Yes	Yes	No	Yes	Yes	9	NO	77.380%
11	No	No	No	Yes	No	Yes	No	19	NO	77.224%
12	Yes	Yes	No	Yes	No	No	Yes	16	NO	77.045%
13	No	Yes	Yes	Yes	No	Yes	Yes	20	NO	77.023%
14	No	No	Yes	Yes	No	No	Yes	7	NO	76.905%
15	Yes	No	No	Yes	No	Yes	No	8	NO	76.713%
16	No	No	No	Yes	No	No	No	11	NO	76.676%
17	No	Yes	Yes	Yes	No	Yes	No	7	NO	75.936%
18	Yes	No	No	Yes	Yes	No	No	10	NO	75.477%

Row	Diversification		Financing Choice		Case size and Asset Structures			Cases	RISK RETURN	Raw consist
	DG	DB	TDTA	RETA	INTA	TANG	SIZE	Number	RRP	Raw consist.
19	Yes	Yes	Yes	No	No	No	Yes	7	NO	75.401%
20	Yes	No	No	Yes	No	No	No	12	NO	74.872%
21	Yes	Yes	No	Yes	Yes	No	No	22	NO	74.002%
22	Yes	No	No	Yes	No	No	Yes	11	NO	73.901%
23	No	Yes	Yes	No	No	Yes	Yes	16	NO	73.518%
24	Yes	No	Yes	No	Yes	No	Yes	7	NO	72.199%
25	Yes	Yes	No	Yes	No	No	No	18	NO	72.116%
26	Yes	No	No	No	Yes	No	Yes	9	NO	72.096%
27	Yes	Yes	Yes	No	No	Yes	Yes	14	NO	71.617%
28	Yes	No	Yes	No	Yes	No	No	13	NO	71.358%
29	Yes	Yes	Yes	No	Yes	No	Yes	34	NO	71.350%
30	Yes	Yes	No	No	No	Yes	Yes	9	NO	71.279%
31	No	No	Yes	Yes	No	Yes	Yes	12	NO	70.962%
32	No	No	No	No	No	Yes	No	7	NO	70.957%
33	Yes	Yes	Yes	No	Yes	No	No	16	NO	70.418%
34	Yes	Yes	No	No	Yes	No	Yes	15	NO	70.367%
35	Yes	No	Yes	No	No	Yes	Yes	11	NO	70.180%
36	No	No	No	Yes	No	Yes	Yes	15	NO	69.377%
37	Yes	Yes	No	No	No	No	Yes	18	NO	69.323%
38	No	No	Yes	No	No	Yes	Yes	16	NO	69.065%
39	Yes	Yes	No	Yes	No	Yes	Yes	25	NO	67.802%
40	No	No	Yes	Yes	No	Yes	No	11	NO	66.974%
41	No	No	No	No	No	No	No	9	NO	66.557%
42	No	Yes	No	No	No	No	Yes	8	NO	65.990%
43	Yes	No	Yes	No	No	Yes	No	10	NO	65.670%
44	Yes	No	No	No	Yes	No	No	15	NO	64.519%
45	No	No	Yes	No	No	Yes	No	13	NO	62.613%
46	Yes	No	No	No	No	No	No	8	NO	61.512%
47	Yes	Yes	No	No	Yes	No	No	15	NO	60.967%
Total cases - Accumulated percentage = 76%										

The configurations presented in table 8.6 show that a combination of high levels of internal funds and case size is usually necessary but not sufficient for achieving favourable RRP in not-high business diversified cases. This is consistent with ***hypothesis d*** of this thesis. It appears that there is a synergistic-effect between case size and internally generated funds. In principle, very-large firms have defined organisational routines and capabilities (Lavie, 2006; Bercovitz and Mitchell, 2007), and they are expected to have relatively "better" employees who are capable of bringing about better performance (Agarwal, 1981). These allow large firms to have better chance of avoiding risky investments and able to allocate internal funds in profitable making investments.

Furthermore, according to the agency cost theory of debt proposed in Jensen and Meckling, (1976), high level of internal funds (shareholders' funds) reduces the risk-averse behaviour of shareholders and encourages careful selection of investment opportunities that reduces business risks while enhancing profitability (Grass, 2012). However, it can also be argued that high level of internal funds encourages overinvestments in favour of managers' interest. Again, these arguments are consistent with the idea that because of possible interactions of variables (hybridisation), standalone theory can hardly provide sufficiently explanation about financial performance as suggested in this thesis. Indeed, Ory and Lemzeri, (2012, p. 238) noted that "agency theory is not sufficient in itself to explain the hybridization" of factors that led to the survival of corporations during the recent financial crisis. In this context, it is not surprising to notes that the two agency theories appear to contradict in explaining impact of standalone internal fund variable on financial performance. However, empirical evidence from configuration approach has indicated that a combination of high level of internal funds and large firm size is a necessary indicator of favourable RRP as shown in table 8.4, however, this require presence or absence of high level of other firm characteristics for this combination to adequately explain favourable balance of RRP.

Table 8.6 Configurations for favourable risk-return performance (RRP)

This table presents the results of the truth tables which show configurations that lead to favourable risk-return (RRP). The consistencies of the configurations were further tested for significance using Z-test one-tailed (Ragin, 2000). *, **, and *** represents 10%, 5%, and 1% significant level. ***Definitions***: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures the empirical importance of a solution: raw coverage is the proportion covered by the solution in the favourable firm value set; this does not exclude shared coverage. Unique coverage is the proportion that is uniquely covered by a solution in favourable firm value set. ● = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal condition present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions	Configuration to favourable RRP				Robust configuration – post hoc analysis		
	RRP-1A	RRP-1B	RRP-2	RRP-3	RRP-1	RRP-2	RRP-3
Diversifications:							
Geographic	○	•	•	⨁	•	•	⊕
Business	⨁	⨁	○	⨁	⨁	•	⊕
Financing Choices:							
leverage	⊕	○	●	⊕	⊕	●	⨁
Retained Earnings	●	●	●	•	●	●	•
Asset Structure & Size:							
Intangibility	●	●	●	⊕	●	●	○
Tangibility	⊕	⊕	⊕	⨁	⊕	⊕	⨁
Size	●	●	•	●	●	●	●
Consistent cases	12	20	27	16			
Z-test: Usually sufficient (0.65)	1.02	1.26	1.62	1.17			
Z-test: More often than not(0.5)	2.14**	2.70***	3.27***	2.47**			
Raw coverage	0.11	0.10	0.14	0.08	0.20	0.29	0.24
Unique Coverage	0.00	0.02	0.07	0.05	0.20	0.29	0.24
Consistency	0.81	0.79	0.80	0.80	0.79	0.81	0.77
Solution Coverage	0.23						
Solution Consistency	0.78						

The Post hoc analysis has revealed that there are three robust configurations for RRP, and these configurations are consistent with hypothesis d. It appears that all the three robust configurations appear to show high memberships in very-large cases and internal funds sets which are consistent with results from the traditional approaches presented and discussed in section 8.4. This implies that it is the large firms with high level of internal funds that usually provide investors with an opportunity to enjoy high profitability without incurring high business risks. The three configurations are discussed in the following subsections

8.5.2.1: Configuration RRP-1 in very-large HGLB cases

Configurations RRP-1A and RRP-1B have similar core conditions but different supporting conditions. This indicates the presence of second-order equifinality which was overlooked in net-effect models (Fiss, 2011). I performed post hoc analysis as in Greckhamer et al., (2008) to check if the two solutions are robust (see table 8.8). I found that configuration RRP-1B is robust and therefore is used for further analysis as configuration RRP-1. It appears that configuration RRP-1 is consistent with the results of traditional approaches presented in table 8.3 and figure 8.3 of this chapter which shows that Winners in the HGLB group have relatively high membership in intangibles and case size sets and retained earnings.

Configuration RRP-1 consists of twenty cases (79%) with similar configurations that consistently showed above 0.5 membership in RRP set. This consistency is relatively higher than the acceptable level of 75% suggested in (Ragin, 2000). However, this consistency (79%) is not significantly higher (Z = 1.26) than 65% (usually the necessary benchmark), but it is significantly higher (Z = 2.70) than 50% (more often than not benchmark). This implies that the configuration is *more often than not* sufficient for favourable RRP at 1% significant level.

Configuration RRP-1 shows that HGLB cases can achieve favourable RRP through possession of high membership in intangible asset, internal fund, and case size sets as core conditions and not-high membership in leverage and tangible asset set as supporting conditions. This configuration is consistent with the argument that business focused (Bettis and Hall, 1982; Bettis and Mahajan, 1985), and geographic-diversified firms (Kim et al., 1989; 1993) create favourable RRP when the degree of leverage is not high and the degree of intangibles is high (Bettis and Mahajan, 1985). This configuration is consistent with ***hypothesis d*** and is sufficiently explained by hybridisation of two theories: ITS and TCT.

Basically, related business diversification has been found to allow synergistic gains from managerial economies (Mueller, 1969; Roll, 1986; Porter, 1987; Shelton, 1988; Kaplan and Weisbach., 1992; Whitley, 1994), and high geographic diversification provides internal markets for firm-specific assets like intangibles (Morck and Yeung, 1991; 1992; 1997; Denis et al., 2002 Qian et al., 2008; Hall and Lee, 2010). This is consistent with the argument that geographic and business diversifications substitute for one another to enhance risk-return performance (Hashai and Delios., 2012). Hashai and Delios, noted that a combination of high geographic diversification and not-high business diversification enables firms to reduce business risk and benefit from economies of scope.

In addition, this configuration indicates that since intangible assets have less collateral value then internally generated funds are more important to finance the intangibles rather than debt capital. However, the presence of relatively very-large membership in case size makes the absence or presence of high leverage less relevant in this configuration even in the absence of asset tangibility. This is because relatively very-large firms have greater capacity to access cheap debt capital (Chang and Thomas, 1989) and so reduce the negative effect of leverage on intangible assets leading to favourable risk-return performance. Indeed Chang and Thomas, (1989), found that large firm size leads to a better risk-return profile.

Furthermore, this configuration shows that high levels of internal funds are a core condition. As noted earlier, theoretically, high levels of equityholders' funds in the capital structure shifts risk taking preferences of equityholders from risk-loving to risk-averse (Jensen and Meckling, 1976). This reduces agency costs between equityholders and debtholders. As it has been recently noted;

> *"shareholders of levered firms are risk-loving ….given the choice between two projects with identical expected returns, one of which has a high and the other a low level of idiosyncratic risk, shareholders have an incentive to choose the former*" (Grass, 2012, pp. 831-832)

The results presented and analysed in this section have shown that standalone theories cannot sufficiently explain this configuration. For example, it appears that ITS is a necessary but not sufficient theory in explaining the impact of firm-specific (intangible) assets on risk-return performance in very-large HGLB cases. This is because financing choices can significantly change the results. It shows that in the absence of high business diversification and tangible assets, firms would necessarily use internal funds to finance intangibles as this will lower the cost of capital and therefore increase returns. In this context, it appears important that TCT hybridises with ITS in order to provide sufficient explanation of how HGLB cases create favourable RRP.

In addition, based on ACTd, the configuration shows that due to high levels of equityholders' fund, asset substitutability problems will be reduced and lead to lower business risks. Finally, relatively very large firms are capable of creating high levels of internal funds which act as a buffer for future business turbulence (Deephouse and Wiseman, 2000; Nickel and Rodriguez, 2002). As such case size has a greater influence on risk-return performance (Chang and Thomas, 1989).

To summarise, this configuration has empirically answered the question ***how HGLB*** diversification strategy sufficiently creates favourable RRP by showing that a configuration of high membership in retained earnings, intangibility, and firms size sets as core conditions and not-high membership in asset tangibility set as supporting conditions, and ambivalence in membership of leverage sets is ***more often than not a*** sufficient indicator of favourable RRP at 1% significant level (table 8.9 and figure 8.5). This configuration carries direct implications for the hybridisation of three theories, and it appears that ITS, TCT, and ACTd provide sufficient explanation of the impact of corporate diversification on risk-return performance.

8.5.2.2: Configuration RRP-2 in very-large HGHB cases

Section 8.4 has also shown that HGHB cases can sufficiently create favourable RRP through possession of high membership in case size, leverage, retained earnings, and intangible asset sets as core conditions and not-high membership in asset tangibility sets as supporting conditions.

I examined the significance of configuration RRP-2, and I found that 27 cases with this configuration display similar high membership (membership above 0.5) in RRP set (80% consistency). This consistency is significantly greater than 65% at 10% significant level (Z = 1.63 one-tailed Z-test). This means that the configuration is ***usually*** sufficient for favourable RRP. The post hoc analysis has also shown that this configuration is robust.

High geographic and business diversifications are theoretically and empirically associated with favourable RRP because, geographic and business diversification complement each other in the sense that excess amount of assets can be efficiently used across business lines and geographic locations and this enhances returns and reduces business risks (Delios and Beamish, 1999; Hashai and Delios, 2012). Likewise HGHB cases reduce business risks that relate to demand and supply fluctuations that would otherwise be caused by not-high geographic and business diversification. Indeed, Kim et al., (1993) found that geographic diversification reduces business risks and enhances returns through product diversification. This is because geographic diversification provides opportunities for optimal allocation of assets across business lines (Hashai and Delios., 2012).

Although configuration RRP-2 shows that both leverage and retained earnings must be high, the cluster analysis has shown that on average, the Winners cluster with HGHB diversification strategy has relatively higher membership in equityholders' fund than in debtholders' fund sets (see table 8.3). This leads to a lower risk-averse preference than otherwise would have existed in equityholders' investment decisions as outlined in Hillier et al., (2011, p.642). In other words, the configuration does not allow the selfish strategies identified in Hillier and others to happen because the equityholders fund is relatively higher than that of debtholders.

On the other hand, very-large HGHB cases that have high levels of internal funds can be associated with high agency costs of overinvestment (Jensen, 1986; Stulz, 1990) and high agency costs associated with managers' interest in keeping their employment (Harris and Raviv, 1990). These agency problems are mitigated through debt financing (leverage). High leverage reduces excess resources available to managers to pursue investments decisions that lead to overinvestment (Jensen, 1986; Li and Li, 1996). This combination of high level of leverage, internal funds, and corporate diversifications may necessarily leads to favourable returns (Li and Li, 1996).

It appears that high levels of both debtholders' and equityholders' funds in the capital structure leads to a reduction of both agency problems; that is between managers and equityholders and between equityholders and debtholders. Therefore, it is not surprising to find that configuration RRP-2 leads to favourable RRP.

In principle, HGHB cases create synergies that enable them to enjoy lower external financing costs, product differentiation, and benefits from the internalisation of firm-specific assets. It appears that because of high geographic diversification and intangible assets, HGHB cases create high profits by internalizing firm specific assets such as intangibles (Morck and Yeung, 1997; Delios and Beamish, 1999; Hashai and Delios., 2012), operational flexibility, cost arbitraging, cross country tax, wage rates, material costs, and other overheads cost differences (Denis et al., 2002). This is consistent with ITS and the winner-picking' hypothesis advocated in Stern, (1997).

Likewise, high business diversification enables HGHB cases to reduce the volatility of profits caused by uncorrelated businesses. More importantly, uncorrelated businesses reduce the risk to cash flow and reduce the cost of accessing external capital (debt) (Lewellen, 1971) and enhance financial performance (Ferris et al., 2002). Indeed, Ferris et al., (2002) noted that diversification leads to lower financial performance in firms with weak cash flows but not in firms with healthier cash flows.

Finally, it shows that the configuration for favourable RRP in very-large *HGHB cases* can be explained through the hybridisation of three theories: ITS, TCT and ACTs. While ITS explains how geographic diversification provides internal markets for intangible assets, TCT explains that internally generated funds and relatively very-large firms reduce the cost of financing intangibles. ACTs explains that the combination of high levels of equityholders' and debtholders' funds reduce both the agency cost of debt and agency costs of equity.

To summarise, the question of ***how*** HGHB diversification strategies sufficiently lead to favourable risk-return performance, is empirically answered by showing that this diversification strategy would sufficiently lead to favourable RRP in LSE-FASI-Firms by taking high membership in case size, leverage, retained earnings, and intangible asset sets as core conditions and not-high membership in asset tangibility sets as supporting conditions. This is configuration is ***usually*** sufficient for favourable RRP at 10% significant level, and it is summarised in table 8.9 and figure 8.5

8.5.2.3: CONFIGURATION RRP-3 IN VERY-LARGE LGLB CASES

Configuration RRP-3 in table 8.6 shows a configuration for favourable RRP in very-large LGLB cases. The consistency of this configuration is 80% which is good and its coverage is 8%. This configuration is robust and *more often than not* sufficiently leads to favourable RRP at 1% conventional significant level (Z = 2.47).

Cluster analysis and mean comparisons have also shown that LGLB cases have the lowest membership in leverage sets. This implies that leverage usage is not favoured in not-high diversified cases. Indeed, Rocca et al., (2009) argued that debt level is a function of degree of diversification, and related diversification leads to less usage of leverage. This is consistent with transaction cost theory (Williamson, 1988) and coinsurance effect (Lewellen, 1971).

Theoretically, LGLB cases have the advantage of accumulating expertise in core businesses that reduces business risk and increase profitability (Bettis and Hall, 1982; Battis and Mahajan, 1985) but have disadvantages in accessing debt capital

(Rocca et al., 2009) which implies that internally generated funds are necessary to finance growth in LGLB cases.

It appears that hybridisation of ACTd and TCT can best explain the existence of Bowman's, (1980) risk-return paradox in very-large LGLB cases. It is theoretically argued that asset tangibility is an important determinant of leverage (Williamson, 1988), and high leverage leads to firms engaging in higher-risk investments (Jensen and Meckling., 1976). Configuration RRP-3 negates the above theory by showing that relatively not high degrees of asset tangibility and leverage and high degrees of internal funds (retained earnings) can sufficiently create favourable RRP

To summarise, the question of ***how LGLB*** diversification strategy can sufficiently lead to favourable risk-return performance, has been answered by indicating that this diversification strategy can create favourable risk-return performance through acceptance of high membership in case size sets and not-high membership in leverage and asset tangibility sets as core conditions, and taking high membership in internal fund and not-high membership in intangible asset sets as supporting conditions. However, it appears that this configuration rarely leads to favourable RRP as compared to the other configurations.

8.5.3: CONFIGURATIONS FOR UNFAVOURABLE RRP

Although firms are not created to achieve an unfavourable balance of risk-return performance, it is better to identify the possible configurations for unfavourable RRP so that they can be avoided. This subsection presents configurations that are likely to lead LSE-FASI-Firms to unfavourable RRP indicators, and table 8.7 presents the results which indicate that a combination of high geographic diversification and not-high internal funds is usually necessary for unfavourable RRP.

Table 8.7: Configurations for unfavourable RRP

This table presents results of the truth tables which show configurations that lead to unfavourable risk-return (RRP). ***Definitions***: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures the empirical importance of a solution: raw coverage is the proportion that the solution covers in the favourable firm value set; this does not exclude shared coverage. Unique coverage is the proportion that is uniquely covered by a solution in favourable firm value sets. ● = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal condition present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions	Configuration to unfavourable RRP				
	RRP-1A	RRP-1B	RRP-2	RRP-3A	RRP-3B
Diversifications:					
Geographic	●	●	●	●	●
Business	⨁	⨁	○	⊕	○
Financing Choices:					
leverage	⨁	⨁	⨁	●	●
Retained Earnings	⨁	⨁	⨁	⨁	⨁
Asset Structure & Size:					
Intangibility	○	•	•	⊕	⊕
Tangibility	⊕	⊕	⊕	●	●
Size	⊕	○	⨁	○	•
Raw coverage	0.10	0.11	0.13	0.11	0.15
Unique Coverage	0.02	0.02	0.04	0.01	0.04
Consistency	0.85	0.82	0.82	0.83	0.81
Solution Coverage			0.29		
Solution Consistency			0.79		

Theoretically, not-high levels of internally generated funds prohibit investment flexibility (Myers, 1977), and may signal lack of positive investments opportunities (Jones and Danbolt, 2005). In addition, since high level of equityholders' funds reduces underinvestment problems (Jensen and Meckling, 1976), then it is not surprising to find that not-high level of equityholders' funds such as internally generated funds would increase shareholders-debtholders agency problems of underinvestment (risky investment choices as discussed in chapter 2) (see also Grass, 2012) and increase business risks. In these contexts, it not surprising that absence of high level of internal funds is a necessary indicator of unfavourable RRP.

The results presented in figure 8.7 provide additional insight on the previous results which indicated that a combination of high geographic diversification and high level of asset intangibility would enhance financial performance. Configurations RRP-1B and RRP-2 has clearly shown that this combination does not guarantee better RRP when levels of internal fund and leverage are not-high. In addition, these configurations show that presence of high level of shareholders' funds (not internal funds) and low level of leverage in geographic diversified firms is a core signal of unfavourable RRP.

Surprisingly, configuration RRP-3A and RRP-3B indicates that a combination of high geographic diversification, high level leverage and asset tangibility is core condition for unfavourable RRP. This result is surprising because, it is theoretically expected that a combination of high level of asset tangibility and leverage could reduce cost of capital (TCT perspective) and high level leverage is expected to reduced agency problems of overinvestment (Jensen, 1986), and these could lead to favourable returns which then would enable better RRP.

Alternatively, configuration RRP-3A and RRP-3B can be interpreted through agency theory of debt (ACTd) that presence of high leverage increase bankruptcy risks which leads to underinvestments problem (Meckling and Jensen, 1976) that results to unfavourable RRP. In this context, ACTd provides better explains on these configurations than TCT.

Finally, the results presented here and those presented in section 8.5.2 above have indicated that levels of retained earnings play a big part in explaining favourable and unfavourable RRP as clearly indicated in table 8.6 and 8.7.

8.5.5: ROBUST TESTS

As noted in previous chapters, FSA solutions are likely to be less objective because data is always scaled as per researchers' decisions (Lieberson, 2004; Seawright, 2005; Skaaning, 2011). FSA procedures on data processing are highly determined by researchers' decisions about thresholds for transforming original data to fuzzy sets and decisions about number of cases to include in the analysis and consistency cut-offs (see section 3.2.3 of this thesis). These decisions are likely to lead to biased results (Skaaning, 2011).

Skaaning, (2011), identified a numbers of ways for testing robustness of FSA results, these include; application of method triangulation, sensitivity analysis (see for example Fiss, 2011; Crilly, 2011), and post hoc analysis (see for example

Greckhamer et al., 2008). In chapter 6 and chapter 7, I use method triangulation and sensitivity analysis to test the robustness of the FSA solutions. In this chapter, I use method triangulation and post hoc analysis as in Fiss, (2011) and Greckhamer et al., (2008) respectively.

8.5.5.1: ROBUST TEST BASED ON METHOD TRIANGULATIONS

Consistent with Fiss, (2011) and as discussed in chapter 4 of the thesis; cluster analysis, independent sample mean comparison, and regression analysis have been performed and their results presented in section 8.4. A comparison of the results of FSA and traditional approaches show that FSA results are well supported. However, as noted in Fiss (2011), the results from traditional approaches provide limited insights regarding the identification of core and supporting conditions and linkages for achieving favourable RRP. FSA solves this problem.

8.5.5.2: ROBUST TEST BASED ON POST HOC ANALYSIS

FSA uses QMA which is based on prime implicants of complex interaction of causal variables (see section 3.3.3.2), so it is possible for solutions to happen by chance and so solutions from the same theoretical background may appear different in different settings (Greckhamer et al., 2008). Greckhamer and others recommend post hoc analysis to test the robustness of FSA results. Post hoc is Latin word which means "afterward" or "after the fact". Post hoc tests are tests for particular differences after initial statistically significant results. They are intended determine if the observed results can be significantly different in different settings. Post hoc tests generally require comparing original results with follow-up results. I use post hoc analysis to re-examine the observed configurations. In specific, I used condition type of post hoc analysis.

In order to conduct the conditional post hoc analysis, the sample was split into four diversification strategies (HGHB, HGLB, LGHB, and LGLB). Since the results in table 8.6 didn't identify any configurations for favourable RRP in LGHB diversification strategy, then, no robustness test was done on the LGHB sample. Based on the three diversification strategies (HGHB, HGLB, and LGLB), I repeated the truth table analysis to identify configurations that are associated with favourable balance of RRP in every sample. I found that there was only one configuration in every diversification strategy that met the consistency and frequency cut-offs as shown on table 8.6. The truth table for this analysis was constructed by setting consistency and frequency cut-offs at 77% and seven (7) cases respectively. The 77% consistency was decided because I wanted to keep the seven cases rule and I didn't wanted to test for more restrictive significance rather the results were intended for comparison purpose. This is because it appears hard to achieve favourable balance of RRP as clearly indicated in figure 8.2, therefore level of consistency cut-off was less important.

The results of the post hoc analysis are presented in table 8.8, and in table 8.6, I presented the results of the original model to allow results comparisons. I find that the configurations were similar to those of original model (see also table 8.6). This means the FSA results presented in this chapter are robust and objective.

Table 8.8: Robust configurations from post hoc analysis

This table presents results of the truth tables which show robust configurations for favourable risk-return (RRP). The table compares results of the original model and that of post-hoc analysis. ***Definitions***: **Consistency** score measures how well the solution corresponds to the data and theory. **Coverage** measures the empirical importance of a solution: raw coverage is the proportion that the solution covers in the favourable firm value set; this does not exclude shared coverage. Unique coverage is the proportion that is uniquely covered by a solution in a favourable firm value set. ● = presence of core causal condition; ⨁ = Core condition absent; • = Supporting causal condition present; ⊕ = Supporting condition absent; ○ = Ambivalent situation

Conditions	Risk-return Performance – Robust test (post hoc analysis)						
	Original Models – Diversification categories				Post hoc analysis results		
	RRP-1A	RRP-1B	RRP-2	RRP-3	RRP-1	RRP-2	RRP-3
Diversifications							
Geographic	○	•	•	⨁	•	•	⊕
Business	⨁	⨁	○	⨁	⨁	•	⊕
Financing Choices							
leverage	⊕	○	●	⊕	⊕	●	⨁
Retained Earnings	●	●	●	•	●	●	•
Asset Structure & Size							
Intangibility	●	●	●	⊕	●	●	○
Tangibility	⊕	⊕	⊕	⨁	⊕	⊕	⨁
Size	●	●	•	●	●	•	●
Raw coverage	0.11	0.10	0.14	0.08	0.20	0.29	0.24
Unique Coverage	0.00	0.02	0.07	0.05	0.20	0.29	0.24
Consistency	0.81	0.79	0.80	0.80	0.79	0.81	0.77
Solution Coverage	0.23						
Solution Consistency	0.78						

8.6: SUMMARY AND CONCLUSION OF THIS CHAPTER

The objective of this chapter was to apply FSA to explain ***how*** geographic and business diversification strategies necessarily or sufficiently combine with other firm characteristics for favourable RRP. In order to achieve this objective; traditional approaches like cluster analysis, independent sample mean comparison, and linear regression analysis were used as "stepping stones" towards the application of FSA in searching for answers to key research question 3:

> ***How does corporate diversification necessarily and sufficiently lead to favourable risk-return performance?***

The results to this research from the tradition approaches replicated the partial, fragmented, and conflicting results from prior research, and the results have been discussed in section 8.4. However, these approaches provide a room for using FSA which appeared to complement the weakness of the traditional models. The traditional approaches have shown that it is hard to achieve favourable RRP in LSE-FASI-Firms because there is a trade-off between risk-reduction and profitability (figure 8.2). However, the cluster analysis in section 8.4.2 has shown that about 52% of the cases involved in the analysis showed absence of risk-return trade-offs, and 48% showed the presence of the trade-offs. These results add insight on finance theories which considers risk-return trade-off as a "fundamental law of finance" (Ghysels et al., 2005, p. 510). These results have implied that favourable RRP is achievable in LSE-FASI-Firms perhaps with higher rate than risk-return trade-off.

The answers form FSA to the key research question 3 are summarised in table 8.9 below. This table shows ***how*** LSE-FASI-Firms can necessarily or sufficiently achieve favourable RRP through three diversification strategies: HGHB, HGLB, and LGLB. It appears that a combination of high membership in internal fund, case size, and not-high membership in asset tangibility sets is necessary but not sufficient for favourable RRP across the three diversification strategies.

Table 8.9: Summary of configurations for favourable RRP

This table summarises the three robust configurations/configurations for favourable risk-return performance (RRP-1, RRP-2, and RRP-3) and also shows conditions that appear necessary for the configurations for achieving favourable risk-return performance (RRP). The table indicates firms' membership in core, supporting, and ambivalent attributes. The first column of the table shows the configurations. **Core** - represents attributes where their presence or absence is important for the configuration for indicating favourable RRP. **Supporting** –represents attributes that appear to support the core attributes when they are present or absent. The ambivalent column includes conditions whose presence or absence does not make a different to the configurations. Common - represents conditions that appear common across the three configurations.

Configurations	Core		Supporting		Ambivalent
	Presence of high membership	Absence of high membership	Presence of high membership	Absence of high membership	
RRP-1	Retained earnings Intangibility Case size	Business diversification	Geographic diversification	Leverage Tangibility	None
RRP-2	Leverage Retained earnings Intangibility Case size	None	Geographic diversification Business diversification	Tangibility	None
RRP-3	Case size	Geographic diversification Business diversification Tangibility	Retained earnings	Leverage Intangibility	None
Common	Case size	None	None	None	None

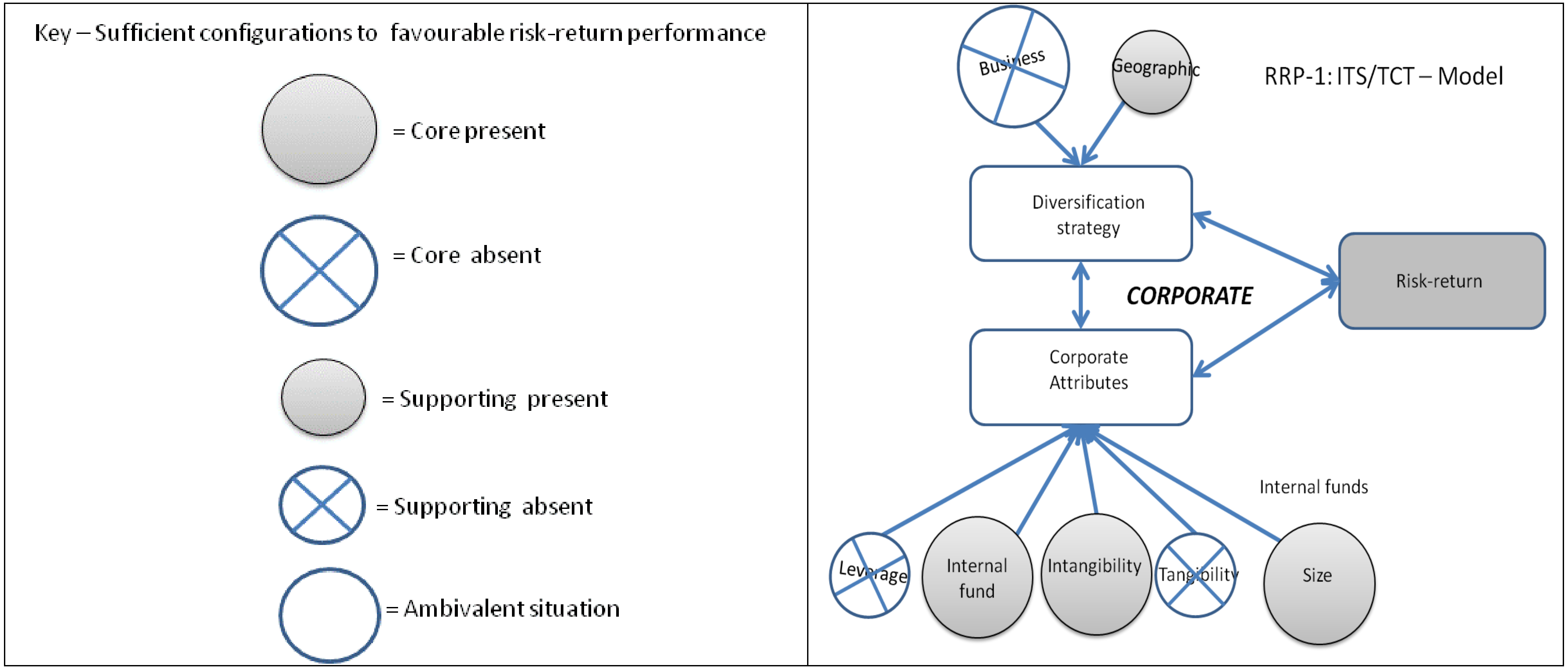
Identification of necessary condition(s)

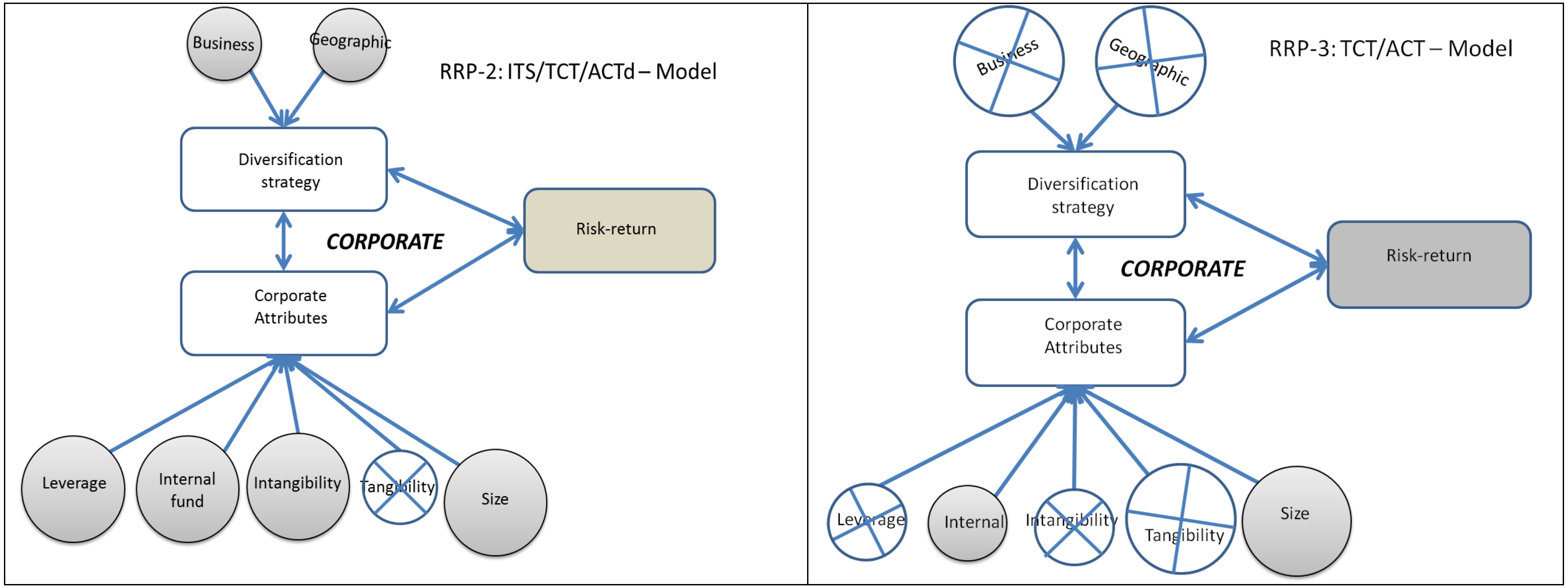
	Presence of high membership	Absence of high membership	Ambivalent
Common	Retained earnings Case size	Tangibility	None

Source: Constructed from table 8.6

Figure 8.5: Summary of set-theoretic frameworks for favourable RRP

This figure summarises the three robust configurations for favourable RRP (RRP-1, RRP-2, and RRP-3). It shows the three set-theoretic frameworks which can be used to explain sufficient indicators of favourable RRP. The figure indicates firms' membership in core, supporting, and ambivalent conditions that sufficiently create configurations for favourable RRP.




RRP-2: ITS/TCT/ACTd – Model
Business
Geographic
Diversification strategy
Risk-return
CORPORATE
Corporate Attributes
Leverage
Internal fund
Intangibility
Tangibility
Size
RRP-3: TCT/ACT – Model
Business
Geographic
Diversification strategy
Risk-return
CORPORATE
Corporate Attributes
Leverage
Internal
Intangibility
Tangibility
Size

In addition to the necessary conditions, it appears that the ***HGLB*** diversification strategy is ***more often than not*** sufficient to achieve favourable RRP by taking high membership in intangible assets as a core condition and avoiding leverage as a supporting condition. ***HGHB*** diversification strategy is ***usually*** sufficient to achieve favourable RRP by avoiding high membership in leverage and intangible asset sets. Finally, the ***LGLB*** diversification strategy enables LSE-FASI-Firms to ***more often than not*** sufficiently achieve favourable RRP through taking not-high membership in leverage and intangible asset sets.

The results presented in this chapter have shown that there is no simple and straight forward answer on how corporate diversification strategies enhance RRP. It appears that even conditional regression analysis (see table 8.4) struggled to identify firm characteristics that appears important for a particular diversification strategies for enhancing favourable balance of RRP. Whilst there is still no straight forward answers to the question above, configurations presented in table 8.6 and the theoretical framework used in this research have made important practical contributions to researchers, managers, and investors beyond linear models. I summarise these contributions in the following paragraphs.

First, the results have added to corporate diversification literature by revealing the source complexity in corporate diversification and financial performance relationship. I have shown that diversification strategies per se have less individual impact of financial performance (see for example table 8.4). For example, table 8.4 has clearly shown the conflicting impacts of geographic diversification on RRP. It shows that based on unconditional regression analysis (ALL model), geographic diversification brings negative impact on RRP; HGLB model shows positive impact, and in LGLB model geographic diversification have negative impact; all the impacts are significant at 1% conventional level! Based on these results we cannot answer with confidence the question how and when does corporate diversification brings positive impact on RRP? Configurations presented in table 8.6 provide answers to this questions, it appears that certain combination of firm attributes makes a particular diversification strategy bring favourable or unfavourable RRP. In other words, although previous researchers highlighted the influence of other firm characteristics on this relationship, their models struggled to pinpoint which and how other firms' characteristics combine with corporate diversification for favourable balance of RRP (see table 2.4). Through application of configuration approach (FSA), I was able to at least to pinpoint firm's characteristics and corporate diversification strategies that appear to be *more often than not* sufficient for favourable balance of RRP. I have shown also that there are synergistic-effects between corporate diversifications and other firm characteristics for achieving favourable and unfavourable RRP.

Secondly, the results (configurations) presented in table 8.6, provide a new way of providing theoretical explanation about corporate diversification and RRP. In specific, it appears that standalone ITS, TCT, and ACTs struggled to provide adequate explanation on how corporate diversification brings favourable or unfavourable balance of RRP. Through application of FSA, I contribute to this issue by showing that hybridisation of ITS, TCT, and ACTs would "more often than not" sufficiently explain this question. This fact has been ignored but implied in conventional models as discussed in chapter 2. Therefore, through FSA it is possible to reduce theory biased research results and conclusions by applying hybrid theories. This finding have significant implication to researchers because in principle cause variables are theoretically differently connected to explain an outcome of interest, logically, this translates that it is possible for two or more theories to be used to connect three or more causal variable for an outcome of interest. This idea is possible in FSA configuration approach when idea, data, and theory can be easily connected (Ragin, 2000). In this context researchers need to think applying hybrid theories especially when causal variables are highly interactive, and when ***absence of a cause*** allows other variables to bring contribution to an outcome.

Thirdly, FSA contributes to methodology by informing the finance and accounting "world" that, it is possible to identify sufficient configurations of firm characteristics that would more often than not be associated with favourable balance of RRP. In principle, necessary and sufficient conditions/configurations for better financial performance can hardly be identified through traditional approaches like regression analysis. Thus, it is FSA that was able to answer the key research question 3 as summarised in table 8.9 and figure 8.5. This has important contribution to researchers because; they can complement linear relationships studies by necessity and sufficiency when causal variables are highly interactive.

Fourthly, the results presented above have shown that on average it is hard to achieve a favourable balance of risk-return performance in LSE-FASI-Firms because every configuration require at least three core conditions and at least three supporting conditions and no condition appears ambivalent. This is perhaps due to trade-off behaviour between risk and return as found and discussed in section 8.4 (see figure8.2) and identified in previous research (see for example French et al., 1987; Fletcher, 2000; Ghysels et al., 2005). This result adds to literature in finance where risk-return trade-off is considered inevitable (Ghysels et al., 2005), by showing that there is higher chance of avoinding risk-return trade-off than not (see section 8.4.1) ceteris paribus, what matters in the fit between firm's attributes and diversification strategy.

The results, the theoretical framework, and the contribution of this research have a numbers of implications to researchers, corporate managers, and investors. *Firstly* the results have shown how geographic and business diversification and other firm characteristics more often than not sufficiently combine to achieve favourable RRP. This will help managers in choosing an appropriate mix of these attributes for achieving the best balance of RRP. Although, most the firm attributes are beyond managers' control; managers can influence strategic decisions like diversification strategy. Therefore given the current firm characteristics and the configurations presented in table 8.6; managers can choose a particular diversification strategy that would *more often than not* sufficiently enable their firms achieve favourable balance of RRP. This has significant implication to managers and investors; with response to their firm's attributes, managers can choose a diversification strategy that reduces business risk while enhancing results, and investors would choose firms with the configurations presented in table 8.6 to benefits from both low risk and high return. However, possibility of sufficiently choosing diversification stratetegy for favourable RRP based on the configrations presented in table 8.6 is less than 65% (usully sufficient), but is higher than 50% (more often than not sufficient).

Secondly, the set-theoretic framework developed here allows investors and other decision makers to identify core and supporting conditions and explain how the conditions connect for favourable RRP. This is important because reliance on individual factors' ability to predict outcomes may not lead to the identification of necessary or sufficient conditions for an outcome (Fiss, 2011). *Thirdly,* the research enormously contributes to research literature and methodology by providing additional theoretical frameworks that allow hybridisation of theories to provide sufficient explanations of complex relationship studies. More discussion on practice implication is presented later in section 9.2.2.

Chapter 9 : Conclusion, Contribution, and reflection of the thesis

9.1: Introduction

The main aim of this thesis was to explore the complex relationship amongst corporate diversification strategies, firm characteristics and financial performance (as measured by firm value, profitability, and risk-return performance). Prior research had indicated that the conventional statistical techniques were unable to provide compelling or robust answers to this research problem. In the field of corporate diversification strategies there were a number of competing theories, inconsistent empirical findings but an intriguing collection of partial answers. The complex causality relationships identified in this body of research stretched the ability of traditional statistical methods to provide robust and reliable answers.

In responding to the calls in the prior literature for new statistical methods to address this causal complexity it was decided to apply fuzzy set analysis (FSA). FSA is a research method specifically designed to deal with the analysis of complex configurations and complex causality relationships. Fuzzy set analysis was felt to offer a number of complementary insights to conventional finance research methods as well as having the potential to integrate the theoretical and empirical results of past research. FSA could provide a bigger picture to frame, reposition and evaluate past theoretical and empirical findings. A major contribution of this thesis is to evaluate the usefulness of FSA in addressing empirical sites characterised by a large number of inter-connected variables, complex causality and different configurations that lead to similar outcomes.

The sample cases were drawn from companies listed in London Stock exchange FTSE Allshare index in the period 2001 to 2010. To reflect the medium to long term nature of corporate diversification choices (which are characterised as strategic rather than operational decisions) and the changing economic conditions and corporate governance priorities each case consisted of a 3 or 4 year average value of a number of financial variables. The selection of variables was informed by prior research findings and then translated into fuzzy set values to create 836 cases in a form suitable for configuration analysis and conventional statistical analysis. The case set values were tested using a range of conventional statistical methods as well as using fuzzy set analysis in order to confirm the robustness and reliability of the fuzzy set results and to isolate the additional contributions from applying FSA to this complex problem. The results suggest that FSA offers additional insights into this and other finance related research problems and provides important theoretical and empirical answers to the main question posed in this thesis which was:

> ***How does corporate diversification necessarily or sufficiently lead to favourable financial performances?***

This concluding section will attempt to answer the "so what" question and in doing so identifies the most significant empirical results, impact on corporate diversification theories, the main implications of these results and what I consider to be the most important contributions. As well as reflecting on the limitations of this study, this section attempts to identify the opportunities this thesis offers to future research and researchers.

9.2: SUMMARY AND IMPLICATION OF THE RESULTS

9.2.1: SUMMARY OF THE RESULTS.

This thesis was structured round two types of research questions. The first group of research questions were designed to provide a comparative baseline to interpret the results of the FSA. These research questions were addressed using traditional statistical methods and were also used to judge the suitability of the data set for analysis using a fuzzy set approach. The detailed findings of traditional approaches are discussed in section 5.2, section 6.3, section 7.3, and section 8.4 of this thesis. The preliminary statistical investigations demonstrated a high level of sensitivity and lack of correlations of results dependant on the selected proxy for a 'good' financial outcome. The results of these statistical investigations confirmed the suitability of the underlying data for FSA, however they did lead to the deconstruction of 'financial performance' into three elements, growth (MTB), profitability (PROFIT) and risk-return performance (RRP). In general the results from the traditional statistical methods replicated the conflicting, partial and rather fragmented results from prior studies. Similar to previous research these results did not identify the configurations of diversification strategies, corporate attributes that were necessary or sufficient to achieve favourable financial performance (regardless of the proxy selected). It was also noted that the empirical results from the traditional statistical analysis did not fully support the main standalone theories previously used to explain the relationship between corporate diversification strategies and financial outcomes. The results of the traditional analysis did provide a baseline against which to compare the FSA results and a "green light" for the application of FSA methods to examine the necessity and sufficiency of different configurations of corporate diversification strategies and attributes for favourable financial performance as suggested by Fiss, (2011).

The lack of consistency between these results and main theoretical explanations led to a search for an alternative theoretical model to construct the underlying set-theoretic framework necessary for FSA. There was sufficient evidence from the literature review and the preliminary statistical analyses to identify elements of these standalone theories that partially explained the empirical observations in certain contexts and it was concluded that no single theory could be universally applied to sufficiently explain the outcome of different corporate diversification strategic choices. This was similar to Ory and Lemzeri, (2012, p. 238) who noted that "agency theory is not sufficient in itself to explain the hybridization" of factors that led to the survival of corporations during the recent financial crisis.

In order to make sense of the preliminary empirical evidence on ***how*** causal set values interconnect with favourable financial performance a hybrid theoretical model was constructed (Greckhamer et al., 2008; Crilly, 2011; Fiss, 2011) from elements of internalisation theory (ITS), transaction cost theory (TCT), and agency cost theories (ACTs). This hybridisation allowed a shift from examining the net-effect of a standalone causal factor determined by the assumptions of a single theory, to "a finer-grained understanding" of how causal attributes hybridise to achieve outcomes of interest (Fiss, 2011, p.411) determined by the insights from a range of theories. The key elements of this theoretical model are represented in figure 1.1. This led to the development of three further hybrid theoretical models to explain the possible relationship between corporate diversification strategies and firm value (fig 2.4), corporate diversification strategies and profitability (fig 2.5) and diversification strategies and risk-return performance (fig 2.6). Chapter 2 provides the justification for these theoretical hybrids which are then used to investigate the three key subsidiary research questions (see below) in order to answer the main question of the thesis.

1. ***How corporate diversifications necessarily and sufficiently lead to favourable firm value?***
2. ***How corporate diversifications necessarily and sufficiently lead to profitability?***
3. ***How corporate diversification necessarily and sufficiently leads to favourable risk-return performance?***

It is argued that these hybrid theoretical models are important developments in establishing a more robust and nuanced conceptual understanding of the dynamics amongst corporate diversifications, corporate attributes and different measures of corporate financial performance. They allow the possibility of replicating this study in other samples in order to empirically confirm (or otherwise) the results of this study.

Following FSA, different case configurations were found to be related to favourable firm value (3 configurations), favourable profitability (3 configurations) and favourable risk-return performance (3 configurations) and these are presented in Table 9.1. It should be noted that it is a statistical co-incidence that there were three configurations for each outcome that emerged after the robust tests. It is perhaps a little disappointing for the corporate world that there was not one single configuration that ***sufficiently*** led to the attainment of all three components of favourable financial performance. These configurations are generally consistent with the theoretical models developed in chapter 2 (figs 2.4, 2.5, 2.6) but they have been further developed in defining the nature and scope of the relationships in terms of favourable firm value (figure 6.2), favourable profitability (figure 7.8) and favourable risk-return performance (figure 8.5) and unfavourable risk-return performance (Table 8.7). These results provide evidence to support the existence of asymmetric causality, conjunctural causality, and equifinality (Fiss, 2011) in the relationships amongst corporate diversification strategies, corporate attributes and favourable financial performance.

Table 9.1 demonstrates ***how*** different case configurations of geographic and business diversification strategies in LSE-FASI-Firms ***necessarily and sufficiently*** lead to favourable firm value, profitability, and risk-return performance. It is the differences as much as the similarity of the configurations that lead to favourable financial performance that are interesting. See for example the significant differences in 4 of the 6 case configurations for favourable profitability and for firm value. However, MTB-3 and PROF-2 are effectively the same, which suggests there is one case configuration that can lead to both favourable profits and favourable firm value. The configurations also demonstrate that profitability and firm value should not be conflated as outcome measures in further research studies.

In terms of configurations that sufficiently achieve favourable firm value ***HGLB*** diversification strategy features in all three different configurations (see section 6.4.2), but varies in terms of when it is a core or supporting factor and its relationships with the other necessary attributes summarised in table 9.2.

There is evidence to suggest that diversification strategies which contain ***low or ambivalent business*** diversification values (***LGLB, HGLB)*** lead to favourable profitability. The third configuration for favourable profitability (PROF-3) is ambivalent in terms of business diversification but also contains low geographic diversity values. The results suggest that LSE-FASI-Firms can more easily create profits through the LGLB diversification strategy in the presence of high levels of retained earnings (see section 7.3.4.1).

There is much greater diversity in the configurations associated with favourable risk-return performance (RRP) in relation to corporate diversification strategies. Table 9.1 demonstrates that configurations that contain ***HGLB, HGHB, and LGLB*** diversification strategies are ***more often than not sufficient to*** enable LSE-FASI-firms to achieve favourable RRP.

Table 9.1: Summary of configurations for favourable financial performance

This table summarises the configurations that ***sufficiently*** lead to favourable firm value, profitability and risk-return performance (MTB, PROF, and RRP respectively). The table indicates firms' memberships in core, supporting, and ambivalent attributes that sufficiently create paths to favourable financial performances. The "Core" heading shows which attributes are so essential that their presence or absence is key for the configuration to achieve /favourable financial performance. The "Supporting" heading shows which attributes appear to support the core attributes. The "Ambivalent" column shows attributes whose presence or absence does not make a difference.

Paths	Core		Supporting		Ambivalent
	Presence of high membership	**Absence of high membership**	**Presence of high membership**	**Absence of high membership**	
MTB-1	Geographic diversification Retained earnings Tangibility	Firm size	None	Leverage Intangibility Business diversification	None
MTB-2	Leverage Firm size Intangibility	Business diversification	Geographic diversification	Tangibility	Retained earnings
MTB-3	Retained earnings Intangibility	Business diversification	Geographic diversification	Leverage Tangibility	Firm size
PROF-1	Retained earnings	Business diversification	None	Geographic diversification Intangibility	Leverage, Tangibility Firm Size
PROF-2	Retained earnings, Intangibility	Business diversification	Geographic diversification	Leverage Tangibility	Firm size
PROF-3	Retained earnings	Geographic diversification Leverage	None	Tangibility Firm Size	Business diversification Intangibility
RRP-1	Retained earnings Intangibility, Firm size	Business diversification	Geographic diversification	Leverage, Tangibility	None
RRP-2	Leverage, Retained earnings, Intangibility, and Size	None	Geographic and Business diversification	Tangibility	None
RRP-3	Firm Size	Geographic and Business diversification Tangibility	Retained earnings	Leverage Intangibility	None

It would appear from tables 9.1 and 9.2 that firm size and retained earnings are necessary conditions rather than any particular diversification strategies. Table 9.1 demonstrates that the configurations for favourable risk-return performance in LSE-FASI-Firms involve more attributes to be aligned in a particular way and each configuration requires at least three core and supporting attributes in order to achieve favourable RRP (see section 8.5.2).

The results also have shown that there is no any configuration that consistently results in poor profitability (see also Fiss, 2011). There are limited paths that lead to unfavourable firm value and risk-return performance; however, it appears that a low level of internally generated funds is usually a necessary indicator of unfavourable firm value and risk-return performance.

Despite the differences in the overall configurations for favourable firm value, profitability and RRP there were a number of characteristics that are common to the favourable firm value, profitability and RRP configurations (See Table 9.2). These are characteristics that ***are necessary (but not sufficient)*** for the different favourable financial outcomes. In particular high levels of retained earnings are ***necessary (but not sufficient)*** for all nine configurations. High membership in the retained earnings set is a necessary attribute/indicator of favourable firm value, profitability, and RRP. The importance of retained earnings is consistent with a number of prior studies as discussed in chapter 2 (for example Fama and French, 2001; Jones et al; 2004; Jones and Danbolt, 2005).

The table shows that **HGLB** diversification positioning requires the presence of high memberships in internal funds as a necessary attribute for achieving favourable firm value. Where not-high business diversification, requires presence of high and not-high membership in internal fund and firm size sets respectively for LSE-FASI-Firms to achieve favourable profitability. Finally, it appears that there is no specific diversification strategy needed to achieve favourable risk-return performance. But, a combination of high membership in retained earnings and firm size, and not-high membership in asset tangibility set is necessary for achieving favourable risk-return performance.

Table 9.2: Necessary attributes for favourable financial performance

This table summarises configurations that are necessary for achieving favourable firm value, profitability and risk-return performance. **MTB** = favourable firm value, **PROF** = favourable profitability, and **RRP** = favourable risk-return performance. **The table shows the Presence (or absence) of high memberships to** indicate that firms' memberships in the respective sets are necessary in configurations that sufficiently achieve MTB, PROF, and RRP. The **ambivalent** column indicates attributes where the presence or absence of high memberships makes no difference to the configurations. The table shows that there is no attribute which is necessary that appears ambivalent.

Identification of necessary attributes or configurations			
Outcome	**Presence of high memberships**	**Absence of high memberships**	**Ambivalent**
MTB	Geographic diversification Retained earnings	Business diversification	None
PROF	Retained earnings	Business diversification Firm Size	None
RRP	Retained earnings Firm size	Tangibility	None

9.2.2: IMPLICATIONS OF THE RESULTS.

It appears that there are many ways to achieve favourable firm value, profitability, and risk-return performance that confirm the presence of *equifinality* in financial performance studies. There multiple ways would hardly be identified without FSA configuration approach. The configurations imply that managers can achieve favourable financial performance of their firms by choosing a different mix of financing choice, asset structure, firm size and diversification strategies. I agree that managers have less or no control on some of firm's characteristics, but they can influence decisions about diversification strategies. Therefore, given current firm's characteristics managers' can choose the best diversification strategy that would fit to current firm attributes for favourable financial performance. Furthermore, I presented nine different configurations across the three financial performances. This allows investors to select firms that would enable them to *usually* or *more often than not* sufficiently meet their investment expectations. The theoretical framework developed in this thesis is expected to provide investment opportunities that reduce level of less informed investment decisions. I also expect that analysts would use the results and the theoretical framework to provide more sufficient advices to investors and managers as regards to impact of diversification on financial performance.

It appears that configurations leading to favourable firm value, profitability, and risk-return performance are quite different to those leading to unfavourable performance. This confirms the presence of *asymmetric causality* in financial performance studies which has significant implications for cause-effect relationship studies in accounting and finance, which embrace symmetric causality that may ***not always*** exist in reality. It is therefore important for both academia and practitioners in accounting and finance to understand that the causal dynamics that lead to different financial performance outcomes are not always symmetric. Furthermore, the idea of asymmetric causality presented in this thesis has important implication to manager and investors. Given firm's characteristics that managers have less or no control, managers would require identifying the type of financial performance intend to achieve, and then select the appropriate diversification strategy that would usually or more often than not enhance a desired financial performance. This is because different firm characteristics appear to require different diversification strategy for achieving different financial performance (see table 9.1)

The results have also shown that there are core and supporting attributes within configurations that lead to favourable financial performance. This is an important observation as academia and practicing managers can use the idea of core and supporting attributes to analyse the attributes or configurations that are most relevant for creating favourable financial performance depending upon which type of financial outcome they are intending. These concepts are overlooked in net-effect models (Fiss, 2011). Furthermore based on core and supporting conditions, managers would be able to reduce multi-criteria decision associated problems. Recently researchers have been using FSA approaches to solve multi-criteria associated problems see table 3.6 (see for example Kahraman et al., 2010; Greco et al., 2013; Luhandjula and Rangoaga, 2013; Merad et al., 2013; Serrano-Cinca and Gutiérrez-Nieto, 2013; Wang, et al., 2013). Basing on configurations presented in this research, investors would able to identify firms with higher chances of maximising profits, value of the investments, or favourable risk-return performance. This is important because investors have diverse need as regards to returns of their investments.

The empirical findings imply that the relationships between geographic and business diversifications and financial performance are complex and cannot be understood solely through linear relationship models but require to be complemented by set-theoretic frameworks that draw upon hybrid theoretical models (e.g. Kurunmaki, 2004; Jacobs, 2005; Thomson et al., 2012). Indeed, Power, (2010, p. 203), noted that "financial accounting is, and always will be, something of hybrid discipline" that can only be understood through incorporation of other disciplines like finance and economics. This idea of hybrid theory have important implication to researchers especially when faced with high level of variables interaction such that single theory may only explain partial or limited level of variables connections as discussed in section 2.3 and 2.4 of this thesis. I have shown that it is possible to hybridise two or more theory and come-up with *usually* or *more often than not* adequate explanation on how causal variable can be connected for better outcome.

Generally, the implication of the empirical results and the theoretical framework presented in this thesis is not limited to corporate diversifications and financial performance practice and research (see table 3.6), but also other areas like corporate governance when researchers or practitioners are interested to identify bundles of corporate governance for enhancing financial performances (e.g., García-Castro et al., 2013), Macroeconomics for identification of factors associated with macroeconomic performance variations across countries (e.g., Vis et al., 2013), Management accounting in dealing with multi-criteria decision making as recently have been used in business economics (e.g., Greco et al., 2013; Serrano-Cinca and Gutiérrez-Nieto, B., 2013), business research (e.g., Ahmad and Richard, 2013; Leischnig et al., 2013), operational research (e.,g Luhandjula and Rangoaga, 2013; Merad et al., 2013), and in production research (Wang et al., 2013; Kahraman et al., 2010) to deal with multi-criteria decision associated problems which are common in management accounting.

9.3: KEY CONCLUSIONS

The empirical evidence has shown that corporate diversification-financial performance relationships are complex and cannot be fully understood through linear relationship frameworks. The configuration approach, grounded in set-theoretic framework and hybridisation of theories provides relatively better insights into how corporate diversifications and other corporate attributes are connected, and synergistically support one another to provide indicators of favourable financial performance.

Table 9.1 specifically highlights that there is no simple answer to the question of ***how does corporate diversification necessarily and sufficiently lead to favourable financial performance.*** It appears that diversification strategy per se is neither necessary nor sufficient for favourable firm value, profitability, and risk-return performance. The results show that configurations leading to favourable firm value, profitability, and risk-return performance across different diversification strategies are in most cases not similar. It would appear that on average very-large HGLB companies with high memberships in internal fund and intangible asset sets is the configuration most likely to create favourable firm value, profitability, and risk-return performance. However, there are also a number of other configurations that produce favourable financial outcomes.

The results from this application of FSA imply that a configuration approach reduced the problems of inconsistent conclusions about the impact of geographic and business diversification on firm value, profitability, and business risk-return performance. This potentially reduces the levels of uncertainty associated with a range of decisions related to diversification strategies and provides better understanding of the causal links between corporate strategy, firm characteristics, and financial outcomes.

FSA techniques were seen to offer valuable complementary insights to conventional finance research methods. FSA provided a bigger picture of the research question which helped integrate the theoretical and empirical results of past research in order to better understand the financial impact of corporate diversification strategies. This thesis identified the potential usefulness of FSA in addressing other finance research problems or paradoxes that are characterised by large numbers of inter-connected variables, complex causality and where different configurations lead to similar outcomes.

I conclude that the multiple configurations presented in this thesis are a guide to corporate decision makers like CEOs in making diversification strategy decisions. When CEOs want to position firms in a particular diversification strategy would require understanding the current firm characteristics and the target financial performance. Likewise, analysts can use the configurations for providing advice to CEOs/managers and investors on how diversification strategies would usually or more often than not enhance financial performance. Investors also use the configurations to choose best firms for their desired financial performance. Finally, It is hoped that the results of this research can act as a "foundation stone" that other accounting and finance researchers interested in helping understand and improve decision making processes that rely on complex financial or numeric information about corporations can build on.

9.4: CONTRIBUTIONS OF THE THESIS

The theoretical framework, the method, and the empirical findings of this thesis provide enormous contributions to practice, literature, and methodology in accounting and finance and related fields as discussed below.

9.4.1: CONTRIBUTION TO PRACTICE

The results provide insights to managers on how to choose an appropriate mix of asset structure, financing choice, and corporate diversification strategies to lead to optimal financial performance. In principle, the results presented in table 5.3, 6.3, 7.4, and 8.4 (linear regression analysis), are important for predicting average impact of diversification on financial performance. However, the tables have shown that the impact of diversification is conflicting and more confusing. Managers would not be able to use these results to predict impact diversification strategy on financial performance: why, because the causal variables are highly interactive to handle using linear regression. FSA equips managers with a tool beyond simple linear relationships by considering necessity and sufficiency of causal conditions (configurations) for an outcome. FSA would enable manager to answer questions like how diversification strategy is necessary or sufficient for favourable financial performance. Which firm characteristics appear necessary or sufficient for making a particular diversification enhance or destroy financial performance, and given firm characteristics, how can firms diversify to increase profitability, firm value, or risk-return performance. These questions are easily answered through FSA configuration approach than net-effect models as clearly summarised in table 9.1.

Furthermore, FSA provides an alternative tool to management accountants to evaluate the potential consequences of strategic decision alternatives associated with corporate diversification alternatives. As presented in table 3.6 and discussed in section 3.5, FSA appears to have potentials in solving multi-criteria decision making related problems like outsourcing, resource allocations, and other cost-benefits analysis that requires inclusion of alternative constraints. These decisions are important to management accounting accountants. Furthermore, different from net-effect models, FSA techniques can help most decision makers identify the core and supporting attributes in configurations that lead to a positive outcome. The results of this thesis will help investors and investment analysts make investment decisions based on configuration rather than relying solely on individual factors to predict outcomes as suggested by regression analysis models.

9.4.2: CONTRIBUTION TO LITERATURE

This thesis provides alternative theoretical framework (set-theoretic framework) for examining cause-outcome relationship. This is important in uncovering complex and highly interactive causality that net-effect models cannot (Greckhamer et al., 2008; Crilly, 2011; Fiss; 2011). In addition, complex cause-effect relationships like that of corporate diversification-financial performance require an application of *hybridisation of theories* to complement standalone theories in order to sufficiently explain the relationship.

The theoretical framework developed in this thesis makes an important contribution to the growing literature on "hybridisation" in an accounting and finance context. Hybridisation has been examined in regards to: combination of accounting profession and other professions (see for example Kurunmaki, 2004; Jacobs, 2005), formulating accounting theories (Nesbakk and Mellemvik, 2011), and accounting sustainability in public sector (Thomson et al., 2012). However this thesis demonstrates that it can be applied to understand how financial information indicators on factors such as corporate diversification, financing choice, asset structure, and firm size, hybridise to provide good indicators of favourable financial performance. Ory and Lemzeri, (2012), noted that degrees of corporate diversification and size hybridised to create economies of scale and scope that reduced credit risk and enhanced benefits in corporate banks. Likewise, Thomson et al., (2012), concluded that the intersection of key hybridization episodes shapes accounting sustainability in the public sector. Additionally, Thomson and others noted that the hybridisation process is in fact complex, and it is difficult to identify the influence of one attribute in the process. This implies that hybridisation studies need to consider configuration rather than standalone factors involved in the hybridisation process.

Finally, although application of FSA on financial performance studies has recently appeared in the research literature (Crilly, 2011; Fiss, 2011; Garcia-Castrol et al., 2013 see table 3.6 for more references), there are relatively few studies that have applied this innovative approach especially in relation to corporate diversification strategy and financial performance. This research is therefore one of first studies to use FSA in an accounting and finance context.

9.4.3: CONTRIBUTION TO METHODOLOGY

This thesis has made a contribution to accounting and finance research methodologies by justifying and familiarising the research community with the concept of a ***fuzzy paradigm.*** This will enable researchers interested in complex causality, equifinality, asymmetric causality, and hybridisation to apply fuzzy set analysis. It will aid the understanding of necessary and sufficient configurations of causal attributes that lead to outcomes of interest. Furthermore, a configuration approach like FSA reduces the *long-standing* problem of multidimensional concept misrepresentation (Ragin, 2000; 2008). The contributions to methodology include:

- Application of macrovariables which are important in addressing problems of variable selection biases for representing multidimensional concepts (Ragin, 2000; 2008). Misrepresentations of multidimensional concepts appear to lead to biased and misleading results (Sullivan, 1994, Ramaswamy et al., 1996).

- Complementing relationships studies with necessity and sufficiency studies. This is important because, it is not always true that when the relationship between cause and outcome is significantly positive it guarantees necessity or sufficiency of an outcome to occur (Fiss, 2011, p. 411).
- The findings show that it is possible and plausible to apply fuzzy set analysis in accounting and finance research. This is because most accounting and finance concepts are fuzzy in nature; they are not precisely defined and represented, and most of them are multi-valued and require the application of configuration approaches such as fuzzy sets analysis.

9.5: REFLECTIONS: LIMITATIONS AND OPPORTUNITIES FOR FUTURE RESEARCH

9.5.1: LIMITATIONS OF THE STUDY

Crilly, (2011) and Fiss, (2011), noted that studies that examines complex causality, and employ configuration approach usually "select a representative set" of variables to represent others in the configuration (Fiss, 2011, p.412). This means some variables might be left out in the analysis. This thesis faces similar challenges. The thesis is focused on geographic and business diversification, level of leverage, internal funds, firm size, asset tangibility and intangibility as important indicators of firm value, profitability, and risk-return performance. However, these are not the only indicators of favourable financial performance. Other variables could have been worthy to include or to consider for future research, but were left to reduce complexity in analysing results. These variables include but not limited to corporate governance (see for example Garcia-Castrol et al 2013) and industry (see for example Greckhamer et al., 2008; Meuer, 2011). In reality, it is hard to accommodate all variables/indicators (Fiss, 2011), so this becomes a challenge not only to the current researcher but also to other researchers. In other words, *limited diversity* is a universal problem for researchers.

This research assumed that industry differences are reflected in firms' asset structures and sales volumes. Consequently, corporate diversification, firm size, and non-market based financial performance measures were captured by macrovariables that use assets and sales attributes. This was assumed to reduce the effect of industry differences. However, as macrovariables may not fully deal with industry effect on financial performance, future research is needed to further explore industry context as well as the optimal configurations of geographic and business diversification and other firm characteristics for favourable financial performance.

Some variables that have been used in this research were so multidimensional in nature that they might be misrepresented (Sullivan, 1994). However, the variables and the measures selected for this study to represent the multi-dimensional concepts were relatively comprehensive. They went beyond simple single measure representation. Macrovariables were specifically used to overcome the challenges of many variables measuring the same concept (Ragin, 2000). Thus, variable selection bias and misrepresentation problems have been relatively reduced in this thesis.

Furthermore, as noted in Greckhamer et al., (2008) FSA uses probabilistic criteria to identify configurations. It is possible that the configurations identified in emperical chapters may happen by chance, therefore a generalisation cannot be made when different samples and variables are constructed with the similar set-theoretic framework. However, this concern has been reduced in the current research due to robustness testing of the truth table results. These tests included: adjusting the three benchmarks for calibrating original variables to fuzzy sets (Fiss, 2011), application of post hoc analysis (Greckhamer et al., 2008), and adjusting consistency cut-offs (Crilly, 2011). Traditional methods like cluster analysis (Fiss, 2011), independent sample mean comparison analysis, and linear regression analysis have also been used on the same sample to support the FSA results.

It was only the robust configurations that were presented, analysed, and discussed. In this context, I am confident that the empirical findings presented in this thesis are robust and as objective as possible Other limitations of this study are associated with the FSA methods as presented in section 4.2.5

9.5.2: OPPORTUNITIES FOR FUTURE RESEARCH

The results, conclusions, and contributions of the thesis that have been presented in this chapter indicate that FSA is a useful tool for future research. FSA allows researchers to deal with a high level of variable interactions that cannot easily be handled in linear models. Consequently, as noted in Fiss, (2011), FSA appears to complement net-effect and other standard methods of analysis in financial performance studies. This implies that although this research has focussed specifically on geographic and business diversification, leverage, internal funds, firm size, asset tangibility and intangibility; future research should extend FSA to other cause-effect studies and in hybridisation studies in an accounting and finance context. Future research could use data from other stock exchanges to examine if similar configurations exist.

This research adopted a cross-sectional approach to identifying case configurations that were associated with different financial outcomes. Another feature of FSA is the notion of pathways to outcomes of interest. It would therefore be interesting to extend this study to include a longitudinal dimension to examine the evolution over time of individual company's configurations and the related financial outcomes. This could identify corporate configuration trajectories and then look for relationships with these configurations and configuration trajectories with different financial outcomes. Whilst there are a number of difficulties in designing such a study, it would appear to offer insights into the dynamics of these relationships to complement the results of this study.

This thesis identified the possible configurations of corporate diversification strategies and other firm attributes for favourable firm value, profitability, and risk-return performance using secondary data. These configurations lay a foundation for future research to consider qualitative research to understand if the decisions of corporate managers on diversification strategies consider the configurations observed in this research. It is interesting to identify two or three cases on every configuration and then interview the corporate managers and find whether their reasoning about decisions on corporate diversification strategies seem to be similar to the identified configurations, and if they aware about the influences of other firm attributes on diversification strategies when it comes to enhancing firm values, profitability, and favourable balance of risk-return performance. This proposed qualitative research would enable to compare results from quantitative - statistical analysis (previous research), fuzzy set analysis (this research), and qualitative - case study analysis (future research).

APPENDICES

APPENDIX 1: Definition of key terms

This appendix provides definitions and illustrations of some of the key terms used in this thesis. The table also indicate key references from which the definitions were borrowed.

Asymmetric causality (Fiss, 2011)	Asymmetric causality occurs when a set of the attributes in the configurations leading to the presence of an outcome may frequently be different from those leading to the absence of the outcome (Fiss, 2011, p.394).
Business diversification (Sullivan, 1994).	Business diversification is defined as firm's expansion beyond its main business activity that is across different line of business. And, it is usually determined using segmental assets or segmental sales (Sullivan, 1994). Segmental assets and segmental sales define business diversification in terms of structure and performance respectively. Since diversification is determined by any of the two attributes (segmental assets or segmental sales), then any of these attributes can be used to represent business diversification. However, this leads to variable section biased results (ibid). In order to avoid the variable biased results noted by Sullivan. In this research, business diversification was represented by macrovariables as discussed in chapter 5.
Cases	The term cases in this research is used as an alternative term to firms. However, the term "cases" is used when firms are defined using 3 and 4year average attributes. This means one case is defined by 3 or 4year averages across the variables used in this research as determined by the three groups (2003, 2006 and 2010). The term firms implies corporations listed in the London stock market All share index between year 2001 and 2010 inclusive.
Complex causality (Fiss, 2007)	Complex causality implies nonlinear relationships amongst causal variables. Fiss, (2007, p. 1181), noted that complex causality happen when "variables found to be causally related in one configuration may be unrelated or even inversely related in another" this means in complex relationships causal variables tend to have synergistic effect rather than net-effects on a desired outcome.
Configuration (Fiss, 2007, 2011)	A configuration is defined as a cluster of systematically interconnected firm characteristics/attributes (sets) that define firms (cases) that have similar memberships in different set. Under configuration approach cases are viewed as having different or similar memberships in their attributes like firm size, financing choices, asset structures, and diversification strategies. In this thesis, these attributes are

	referred to as ***sets***. Cases that possess similar memberships in different sets are referred to as a configuration.
Consistency (Ragin, 2006),	Set-theoretic consistency assesses the degree to which cases sharing same attributes (configurations) agree in displaying similar memberships in the outcome set of interest. Under fuzzy set analysis, a configuration appears to be consistency to an outcome of interest if the causal combination (configuration) appears to be subset of an outcome of interest. That is the fuzzy set value of the configuration is less than or equal to that of outcome as discussed in Ragin, (2006, p.292-298 see also section 3.3.3.5 of this thesis).
Coverage (Ragin, 2006).	Set-theoretic coverage, refers to the degree to which a configuration accounts for instances of an outcome of interest. When the numbers of configurations to the same outcome of interest are many, then every configuration will account for small proportion in the outcome. Thus, coverage measure empirical relevance or importance of every configuration in the outcome of interest. The basic idea behind set-theoretic coverage is to assess the degree to which a configuration physically covers the outcome set. A configuration that covers relatively large proportion of the instances of an outcome is empirically more important than the one that covers a small proportion (Ragin, 2006, p.299-304 see also section 3.3.3.5 of this thesis). This mean the large the coverage the more important the configuration for achieving the desired outcome.
Equifinality, (Fiss, 2007, p.1181)	Equifinality is the idea that a system can reach the same final state from different initial conditions and by a variety of different paths/configurations. In this research, the concept of equifinality is associated with the saying which goes "there are many roads to Rome" which imply that travellers going to Rome can use different routes still they will all arrive in Rome. This saying was used to show that two or more different configurations can equally and effectively enable firms achieve favourable firm value, profitability, or risk-return performance.
Favourable financial performance.	Financial performance in this research is referred to firm value (MTB), profitability, and risk-return performance. Favourable financial performance is determined when a case has above 0.5 memberships in the respective financial performance sets.
Fuzzy paradigm (Morgan and Smircich, 1980),	Fuzzy paradigm is a research philosophy term used in this research. It is the view that ***social reality*** is a matter of degree. ***Social Reality*** is neither purely objective nor subjective. According to Morgan and Smircich (1980), there are four mediating camps between objectivists and subjectivists these mediating camps implies fuzzy paradigm as it is similar to the idea of fuzzy sets used in this research.

Fuzzy sets (Ragin, 2000)	Fuzzy sets are sets that permit partial memberships that ranges between 0 (full nonmembership) to 1 (full membership). In this research, all the original measures of the variables are transformed to fuzzy set values which are used to assign cases with memberships in different sets. This implies that calibration of the original measures to fuzzy set was necessary. The fuzzy set values of 0.05, 0.5 and 0.95 were used to benchmark full nonmembership, cross-over point, and full membership in different sets respectively. Where by fsQCA software was used to help the calibration process.
Fuzzy set values	Fuzzy set values the values which defines memberships of cases in the fuzzy sets. Fuzzy set values are the result of calibrating the original measures basing on the three benchmarks: full nonmembership, cross-over point, and full membership respectively.
Geographic diversification	Geographic diversification is defined as firm's expansion beyond its home country that is across different geographic areas. It is usually determined using segmental assets or segmental sales (Sullivan, 1994). Segmental assets and segmental sales define geographic diversification in terms of structure and performance. Since diversification is determined by any of the two attributes (segmental assets and segmental sales), then any of these attributes can be used to represent the concept. However, this leads to variable selection biased results. In order to avoid the variable biased results, this research uses macrovariables to proxy geographic diversification.
Hybridisation	Hybridization is the term that is common in hard science which means the process of interacting or combining two or more complementary elements of nucleic acids (**Deoxyribonucleic acid – DNA)** to produce a new and different organism. In this research, hybridisation means combining two or more corporate attributes or theories and conceptualises or theorise the resulting attribute/configuration as having different impact on financial performance.
Hybridisation of theories	Hybridisation of theories in this research means combining two or more theories that they synergistically help one another in explaining cause-effect relationship.
Intermediate solution (Fiss, 2011)	Intermediate solution is a solution that provides theoretical links among elements of a configuration and between a configuration and a desired outcome. This solution is usually explained by theories that the researcher uses in constructing truth tables. This solution is commonly used to make theoretical sense of the results. Furthermore, this solution includes both core and supporting conditions that are found in configurations leading to a desired outcome.
Macrovariable (Ragin, 2000)	Macrovariable is a variable that shows the *strongest-link* among the many variables defining a multidimensional concept. For example, business diversification is usually defined using segmental

	assets or sales. Assume that firm "A" has 0.8 and 0.3 memberships in high business diversified-firms when segmental assets and sales respectively are used to determine degree of business diversification. The strongest-link of firm "A" in business diversified-firms is segmental asset. Thus, segmental asset (memberships 0.8) is used as ***macrovariable*** to represent degree of business diversification of firm "A". The logic behind the term ***macrovariable*** is that highly correlated causal variables that defines same concept are "jointly necessary or sufficient for an ***outcome***"; these variables can be combined using fuzzy set logical "or" such that the variable with higher membership in a multidimensional variable set substitutes the other variables and "reconceptualise" the resulting *variable* as "macrovariable" (Ragin, 2000, p.321).
Membership	The term membership in this research refers to fuzzy set value that a case appears to have in different sets. There are two memberships used in this research: high membership and not-high membership. A case is classified as having high membership in a particular set when its fuzzy set value is higher than 0.5 otherwise the case is classified as having not-high membership.
Necessary and sufficient condition (Ragin, 2000; 2008)	A causal condition or a configuration is considered necessary if it must be present for an outcome to occur, while a configuration is defined as sufficient if, by itself, it can produce an outcome Ragin, (2000, p. 203; 2008, p. 42). Illustrations for necessary and sufficient condition see section 3.3.3.6 of this thesis.
Net effect	Net effect is the contribution of a standalone causal variable in an outcome of interest. Therefore the models that seek to understand cause-effect relationships usually fall in this category. A good example of net effect models is regression analysis.
Parsimonious solution (Ragin, 2000; Fiss, 2011)	Parsimonious solution is a solution which considers all the simplified assumptions regardless of the effects of either easy or difficult counterfactuals. In other words it assumes that easy and difficult counterfactuals are all considered in the solution (Ragin, 2000). Thus, parsimonious solution provides configurations that have lowest number of causal conditions and is used to determine core condition in the intermediate solution (Fiss, 2011).
Set-theoretic framework (Ragin, 2000; Fiss, 2007; 2011)	Set-theoretic framework is a framework that conceptualise cases as *configurations.* That is made of combination of attributes that give the firms unique nature. Under set-theoretic framework, cases are viewed as having different memberships in their attributes. The cases with similar memberships in different attributes are treated as a configuration. In this context, set-theoretic framework allows for the expression of complex causal relationship that provides new insights on how different causes combine to

	influence an outcome of interest. This translates that set-theoretic framework is particularly important for examining nonlinear (complex) relationship, synergistic-effect, and equifinality. These facts are hardly covered in econometric methods as these embrace linearity, net-effect, and unifinality.
Truth table (Ragin, 2000)	A truth table is a table that lists all possible configurations that might be associated with the outcome of interest. The table also shows three solutions: complex, parsimonious, and intermediate solution of Parsimonious and intermediate solutions are regularly used in presenting the truth table results. Furthermore, the truth table calculates number of configurations as 2^k; where k stands for number of variables applied in the research. That is when causal variables used in the analysis are seven (7), then the truth table will display 128 (2^7) possible configurations. In every configuration the number of cases is indicated and consistency of the configuration for an outcome of interest to occur is shown.

APPENDIX 2: SENSITIVITY ANALYSIS - CONFIGURATIONS FOR FAVOURABLE MTB

Appendices 2, 3 and 4 save two purposes; first they show the original truth table solutions. These solutions are then used to prepare the configuration tables. That is the configuration tables presented in chapter 6, 7, and 8 are produced from the two important truth table solutions: parsimonious and intermediate solutions. These solutions are combined to construct the configuration tables as they appear in the mentioned chapters. Second, appendices 2 and 3 are used as additional robustness test of the FSA results through sensitivity analysis, and appendix 4 tests robustness of FSA results presented in chapter 8. The configurations from the robust tests are the one which are used to analyse the results.

Appendix 2 present sensitivity analysis performed to test the robustness of the truth table outputs which showed configurations that lead to favourable *firm value (MTB).* In specific this appendix shows results after adjusting the thresholds for calibrating original measures to fuzzy set by *adding 20%* and *reducing 20%* as in Fiss, (2011). **Parsimonious solution** is a simplified solution which presents configurations containing only core attributes for achieving favourable *MTB*. **Intermediate solution represents** configurations containing both core and supporting attributes that were theoretically argued to lead firms to favourable *MTB*. * and ~ represent fuzzy set logical operational "*and*" and "negation" respectively. The logical *and* is used to determine a minimum membership score of a firm in the sets that make the configuration. Fuzzy set operational *"and"* works in similar way as intersection in classical set theory. When the sets are joined by operational "*" it implies that the resultant from the combined sets will be the lowest membership. The "*negation"* implies level of exclusion in the set, that to what extent the firm is excluded from the set. This indicates cases with 0.5 or lower membership in the respective set. In other words, a case is classified as having not-high memberships in a set in question by using a negation sign (see Ragin, 2000; 2008 for further discussion). *Coverage* is a proportional measure of the extent to which the solution 'explains' the outcome. This includes raw and unique coverage: raw coverage is the percentage that the solution covers (explains) the outcome (*favourable MTB*). While unique coverage is a unique proportion that the solution explain the outcome of interest. *Consistency* refers to percentage of cases sharing same configurations that consistently appear to display outcome of interest (favourable MTB). dg and db represents geographic and business diversification sets respectively; *tdta* represents leverage set; *reta* represents retained earnings (internal fund) set*; inta* and *tang* represent intangibility and tangibility sets respectively; and *size* stand for firm size set. *Frequency cut-off* is the minimum number of cases required in the analysis and *consistency cut-off* stand for minimum consistency that is required to determine configurations for further analysis

```
**********************
*TRUTH TABLE ANALYSIS* when thresholds added by 20%.
**********************
File:  C:/Users/Mabonesho/Desktop/Chapter 6/csv
Model 3: mtb = f(dg, db, tdta, reta, inta, tang, size)Thresholds added 20%
Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 7.000000 = 82% of cases were involved in the analysis
consistency cutoff: 0.844198
                            raw       unique
                          coverage    coverage   consistency
                         ----------  ----------  ----------
~db*reta*inta            0.184667    0.065413    0.821168
dg*tdta*~tang*size       0.202329    0.070550    0.810088
~db*tdta*~tang*size      0.164118    0.012060    0.791715
dg*reta*tang*~size       0.101446    0.004917    0.803683
solution coverage: 0.383743
solution consistency: 0.760583
```

--- INTERMEDIATE SOLUTION ---

	raw coverage	unique coverage	consistency
size*~tang*inta*tdta*~db	0.139534	0.031923	0.831002
~size*~tang*inta*reta*~tdta*~db	0.122116	0.022114	0.866968
~size*tang*reta*~tdta*~db*dg	0.085741	0.031141	0.853839
~tang*inta*reta*~tdta*~db*dg	0.120820	0.000563	0.851112
size*~tang*inta*reta*~db*dg	0.106485	0.000049	0.863348

solution coverage: 0.327014
solution consistency: 0.807052

****
TRUTH TABLE ANALYSIS ***when thresholds reduced by 20%.***
****
File: C:/Users/Mabonesho/Desktop/Chapter 6/robust-20%.csv
Model 5: mtb = f(dg, db, tdta, reta, inta, tang, size)

Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 7.000000 = 76% of cases were involved in the analysis
consistency cutoff: 0.841439

	raw coverage	unique coverage	consistency
dg*~db*~tdta*reta*~size	0.090560	0.058294	0.825419
~db*tdta*inta*size	0.138359	0.045745	0.748545
dg*~db*tdta*~tang*size	0.088456	0.004672	0.793331

solution coverage: 0.201888
solution consistency: 0.749523

--- INTERMEDIATE SOLUTION ---

	raw coverage	unique coverage	consistency
~size*tang*reta*~tdta*~db*dg	0.059126	0.017955	0.855878
~size*inta*reta*~tdta*~db*dg	0.064826	0.020793	0.846375
size*~tang*inta*tdta*~db*dg	0.083221	0.060911	0.823730

solution coverage: 0.143692
solution consistency: 0.817309

APPENDIX 3: SENSITIVITY ANALYSIS – CONFIGURATIONS FOR FAVOURABLE PROFITABILITY

This appendix present sensitivity analysis performed to test the robustness of the truth table outputs which showed configurations that lead to favourable profitability. In specific this appendix shows results after adjusting the thresholds for calibrating original measures to fuzzy set by adding 20% and reducing 20% as in Fiss, (2011). **Parsimonious solution** is a simplified solution which presents configurations containing only core attributes for achieving favourable *profitability*. **Intermediate solution** represents configurations containing both core and supporting attributes that were theoretically argued to lead firms to favourable *profitability*. * and ~ represent fuzzy set logical operational "*and*" and "negation" respectively. The logical *and* is used to determine a minimum membership score of a firm in the sets that make the configuration. Fuzzy set operational *"and"* works in similar way as intersection in classical set theory. When the sets are joined by operational "*" it implies that the resultant from the combined sets will be the lowest membership. The "*negation"* implies level of exclusion in the set, that to what extent the firm is excluded from the set. This indicates cases with 0.5 or lower membership in the respective set. In other words, a case is classified as having not-high memberships in a set in question by using a negation sign (see Ragin, 2000; 2008 for further discussion). *Coverage* is a proportional measure of the extent to which the solution 'explains' the outcome. This includes raw and unique coverage: raw coverage is the percentage that the solution covers (explains) the outcome (*favourable profitability*). While unique coverage is a unique proportion that the solution explain the outcome of interest. *Consistency* refers to percentage of cases sharing same configurations that consistently appear to display outcome of interest (favourable profitability). dg and db represents geographic and business diversification sets respectively; tdta represents leverage set; *reta* represents retained earnings (internal fund) set*; inta* and *tang* represent intangibility and tangibility sets respectively; and *size* stand for firm size set. *Frequency cut-off* is the minimum number of cases required in the analysis and *consistency cut-off* stand for minimum consistency that is required to determine configurations for further analysis

TRUTH TABLE ANALYSIS ***when thresholds added by 20%.***

```
File:  C:/Users/Mabonesho/Desktop/Chapter 7/csv
Model 4: prof = f(dg, db, tdta, reta, inta, tang, size)
Algorithm: Quine-McCluskey
--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 7.000000 = 82% of cases
consistency cutoff: 0.858175
                          raw        unique
                        coverage    coverage   consistency
                       ----------  ----------  ----------
~dg*reta               0.341481    0.052689    0.839137
~db*reta*~size         0.263974    0.021217    0.882137
~db*reta*inta          0.155979    0.015037    0.862069
~dg*~db*tdta*size      0.154286    0.045407    0.850955
solution coverage: 0.530212
solution consistency: 0.827162

--- INTERMEDIATE SOLUTION ---
                                    raw        unique
                                  coverage    coverage   consistency
                                 ----------  ----------  ----------
~inta*reta*~db*~dg               0.242855    0.016710    0.869189
~size*~tang*reta*~tdta*~dg       0.141474    0.017438    0.873814
size*~inta*tdta*~db*~dg          0.134959    0.021749    0.863493
~tang*inta*reta*~tdta*~db*dg     0.098232    0.023559    0.860073
solution coverage: 0.487541
solution consistency: 0.837791
```

TRUTH TABLE ANALYSIS ***when thresholds reduced by 20%.***

Model 6: prof = f(dg, db, tdta, reta, inta, tang, size)

Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---

frequency cutoff: 7.000000 = 76% of cases

consistency cutoff: 0.852110

	raw coverage	unique coverage	consistency
~db*reta*~tang	**0.165604**	**0.021729**	**0.841315**
dg*~db*reta	**0.189576**	**0.064320**	**0.831994**
~dg*tdta*reta	**0.177118**	**0.067175**	**0.826051**
~dg*~tdta*~size	**0.131908**	**0.022595**	**0.805723**

solution coverage: 0.444044

solution consistency: 0.799695

--- INTERMEDIATE SOLUTION ---

	raw coverage	unique coverage	consistency
~size*~inta*reta*~tdta*~dg	0.086600	0.033735	0.905909
~size*~tang*reta*~tdta*~dg	0.057235	0.011671	0.870138
~size*~tang*reta*~tdta*~db	0.079712	0.000964	0.903212
~tang*reta*~tdta*~db*dg	0.078649	0.000590	0.869263

solution coverage: 0.354648

solution consistency: 0.850836

APPENDIX 4: Post hoc analysis - configurations for favourable RRP

This appendix present post hoc analysis performed to test the robustness of the truth table outputs as in Greckhamer et al., (2008). This analysis showed robust configurations for favourable *risk-return performance (RRP).* **Parsimonious solution** is a simplified solution which presents configurations containing only core attributes for achieving favourable *RRP*. **Intermediate solution** represents configurations containing both core and supporting attributes that were theoretically argued to lead firms to favourable *RRP*. * and ~ represent fuzzy set logical operational "*and*" and "negation" respectively. The logical *and* is used to determine a minimum membership score of a firm in the sets that make the configuration. Fuzzy set operational *"and"* works in similar way as intersection in classical set theory. When the sets are joined by operational "*" it implies that the resultant from the combined sets will be the lowest membership. The "*negation"* implies level of exclusion in the set, that to what extent the firm is excluded from the set. This indicates cases with 0.5 or lower membership in the respective set. In other words, a case is classified as having not-high memberships in a set in question by using a negation sign (see Ragin, 2000; 2008 for further discussion). *Coverage* is a proportional measure of the extent to which the solution 'explains' the outcome. This includes raw and unique coverage: raw coverage is the percentage that the solution covers (explains) the outcome (*favourable RRP*). While unique coverage is a unique proportion that the solution explain the outcome of interest. *Consistency* refers to percentage of cases sharing same configurations that consistently appear to display outcome of interest (favourable profitability). dg and db represents geographic and business diversification sets respectively; tdta represents leverage set; *reta* represents retained earnings (internal fund) set*; inta* and *tang* represent intangibility and tangibility sets respectively; and *size* stand for firm size set. *Frequency cut-off* is the minimum number of cases required in the analysis and *consistency cut-off* stand for minimum consistency that is required to determine configurations for further analysis.

****

***TRUTH TABLE ANALYSIS in cases with HGHB diversification strategy**

****

File: C:/Users/xqb09222/Desktop/Chapter 8 test data/HGHB .csv

Model: rrp = f(dg, db, tdta, reta, inta, tang, size)in HGHB Firms

Algorithm: Quine-McCluskey

--- PARSIMONIOUS SOLUTION ---

```
frequency cutoff: 7.000000 = 82% of cases were involved in the analysis
consistency cutoff: 0.809205
                        raw       unique
                      coverage    coverage   consistency
                     ----------  ----------  ----------
tdta*reta*~tang      0.316706    0.014288    0.789629
tdta*reta*inta       0.340802    0.038384    0.773408
solution coverage: 0.355090
solution consistency: 0.769936
```

--- INTERMEDIATE SOLUTION ---

```
                                        raw       unique
                                      coverage    coverage   consistency
                                     ----------  ----------  ----------
size*~tang*inta*reta*tdta*db*dg      0.285425    0.285425    0.809205
solution coverage: 0.285425
solution consistency: 0.809205
```

```
**********************
```

***TRUTH TABLE ANALYSIS* in cases with HGLB diversification strategy**

```
**********************
File:  C:/Users/xqb09222/Desktop/Chapter 8 test data/HGLB.csv
```

Model: rrp = f(dg, db, tdta, reta, inta, tang, size)in HGLB Firms

--- PARSIMONIOUS SOLUTION ---

```
frequency cutoff: 7.000000 = 77%
consistency cutoff: 0.788725
                             raw       unique
                           coverage    coverage   consistency
                          ----------  ----------  ----------
~tdta*reta*inta*size      0.242178    0.242178    0.774707
solution coverage: 0.242178
solution consistency: 0.774707
```

--- INTERMEDIATE SOLUTION ---

```
                                          raw       unique
                                        coverage    coverage   consistency
                                       ----------  ----------  ----------
size*~tang*inta*reta*~tdta*~db*dg      0.203299    0.203299    0.788725
solution coverage: 0.203299
solution consistency: 0.788725
```

****

***TRUTH TABLE ANALYSIS* in cases with LGLB diversification strategy**

****

```
File:  C:/Users/xqb09222/Desktop/Chapter 8 test data/LGLB.csv
```

Model: riskrp = f(dg, db, tdta, reta, inta, tang, size) in LGLB Firms

--- PARSIMONIOUS SOLUTION ---

```
frequency cutoff: 7.000000
consistency cutoff: 0.774783
                         raw       unique
                       coverage    coverage   consistency
                      ----------  ----------  ----------
~tdta*~tang*size      0.260168    0.260168    0.700398
solution coverage: 0.260168
solution consistency: 0.700398
```

--- INTERMEDIATE SOLUTION ---

```
                                      raw       unique
                                    coverage    coverage   consistency
                                   ----------  ----------  ----------
size*~tang*reta*~tdta*~db*~dg      0.236875    0.236875    0.766959
solution coverage: 0.236875
solution consistency: 0.76695
```

APPENDIX 5: TRUTH TABLE OF CONFIGURATIONS FOR UNFAVOURABLE PROFITABILITY

This appendix presents a distribution of configurations with seven or more cases that may lead to unfavourable profitability **(PROF)**. **Yes** = means the cases have high membership in their respective sets (membership higher than 0.5). **No** = means the cases have not-high membership in the respective sets (membership 0.5 or less). **NO** = means cases within the respective configuration that do not display unfavourable **PROF**.

Diversification:

DG = Membership in geographic diversification set; **DB** represents membership in business diversification sets. Membership of corporate diversification is commonly calculated using segmental assets ***or*** segmental sales and usually represented by entropy measures of diversification (Palepu, 1985; Hitt et al., 1997; Qian et al., 2008, Chiao and Ho, 2012), which are then calibrated to fuzzy sets.

Financing choice:

TDTA = membership in leverage *sets* as defined by total debts to total assets. **RETA** = membership in internal funds *set* as defined by total retained earnings to total assets.

Asset structure and firm size:

TANG = membership in asset tangibility *set*, it is measured as the percentage of total property, plant, and equipment (PPE) on total assets. **INTA** = membership in asset intangibility *set* refers to as percentage of total intangible assets on total assets (Rocca et al., 2009). **SIZE** = membership in firm size set; firm size is usually reflected in a firm's structure (assets) ***or*** performance (sales) (Gooding and Wagner III., 1985). Thus assets and sales volumes are used to identify firm's membership in firm size as represented by macrovariable. All the sets are defined using fuzzy set values.

Number = numbers of cases in each configuration.

Raw consist. = raw consistency is the proportion that the configurations agree in displaying favourable profitability.

Row	Diversification		Financing Choice		Firm Size and Asset Structures			Cases	Profitability	Raw consist
	DG	DB	TDTA	RETA	SIZE	INTA	TANG	Number	PROF	Raw consist.
1	Yes	No	No	No	Yes	No	No	15	NO	74.50%
2	Yes	Yes	No	No	Yes	No	No	15	NO	72.90%
3	Yes	Yes	Yes	No	Yes	No	No	16	NO	71.20%
4	Yes	Yes	Yes	No	No	No	Yes	7	NO	70.20%
5	Yes	No	No	No	Yes	No	Yes	9	NO	70.10%
6	Yes	No	Yes	No	Yes	No	No	13	NO	69.30%
7	Yes	Yes	No	No	Yes	No	Yes	15	NO	68.30%
8	Yes	Yes	No	No	No	No	Yes	18	NO	68.30%
9	Yes	No	Yes	No	No	Yes	No	10	NO	67.20%
10	Yes	Yes	No	No	No	Yes	Yes	9	NO	65.50%
11	Yes	No	No	Yes	No	No	Yes	11	NO	64.70%
12	Yes	Yes	No	Yes	No	No	No	18	NO	64.60%
13	Yes	No	No	Yes	No	No	No	12	NO	64.30%
14	Yes	Yes	No	Yes	Yes	No	No	22	NO	64.20%
15	No	Yes	Yes	No	Yes	No	Yes	9	NO	63.80%
16	Yes	No	Yes	No	Yes	No	Yes	7	NO	63.80%
17	No	Yes	No	Yes	Yes	No	No	9	NO	63.80%
18	No	No	No	No	No	No	No	9	NO	63.10%

Row	Diversification		Financing Choice		Firm Size and Asset Structures			Cases	Profitability	Raw consist
	DG	DB	TDTA	RETA	SIZE	INTA	TANG	Number	PROF	Raw consist.
19	No	No	No	No	No	Yes	No	7	NO	63.00%
20	No	No	Yes	Yes	No	No	Yes	7	NO	63.00%
21	Yes	Yes	Yes	No	Yes	No	Yes	34	NO	62.90%
22	No	Yes	Yes	Yes	No	Yes	No	7	NO	62.70%
23	Yes	No	Yes	No	No	Yes	Yes	11	NO	62.40%
24	Yes	Yes	No	Yes	No	No	Yes	16	NO	61.20%
25	Yes	Yes	Yes	No	No	Yes	Yes	14	NO	61.00%
26	Yes	Yes	Yes	Yes	Yes	No	Yes	19	NO	60.30%
27	Yes	No	No	Yes	Yes	No	Yes	12	NO	60.30%
28	Yes	No	No	Yes	Yes	No	No	10	NO	60.30%
29	No	Yes	No	No	No	No	Yes	8	NO	59.10%
30	Yes	Yes	No	Yes	Yes	No	Yes	25	NO	58.20%
31	Yes	No	Yes	Yes	Yes	No	Yes	8	NO	56.70%
32	No	Yes	No	Yes	No	Yes	No	8	NO	56.70%
33	Yes	Yes	Yes	Yes	No	Yes	Yes	11	NO	56.50%
34	Yes	No	No	Yes	No	Yes	No	8	NO	56.40%
35	No	Yes	Yes	No	No	Yes	Yes	16	NO	56.30%
36	Yes	No	Yes	Yes	No	Yes	Yes	9	NO	56.20%
37	No	No	No	Yes	No	No	No	11	NO	54.60%
38	No	No	No	Yes	No	No	Yes	16	NO	54.20%
39	Yes	Yes	No	Yes	No	Yes	Yes	25	NO	51.60%
40	No	No	No	Yes	No	Yes	Yes	15	NO	51.40%
41	No	No	Yes	No	No	Yes	No	13	NO	50.30%
42	No	No	Yes	No	No	Yes	Yes	16	NO	48.70%
43	No	No	No	Yes	No	Yes	No	19	NO	48.70%
44	No	Yes	Yes	Yes	No	Yes	Yes	20	NO	46.20%
45	No	No	Yes	Yes	No	Yes	Yes	12	NO	45.60%
46	No	No	Yes	Yes	No	Yes	No	11	NO	42.90%

APPENDIX 6: DATA IN FUZZY SET VALUES

This appendix presents data for the 836 cases after been transformed to fuzzy set values. These values show memberships of the cases in their respective sets. The benchmarks that were used to transform the original variable measures to fuzzy set values were presented in chapter 5 as summarised in table 5.11 (see also table 1.3). The definitions of the sets are found in section 5.3 of this thesis (see also table 4.4 for definitions of the variables).

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
1	A.G. BARR PLC	2003	0.22	0.89	0.35	0.8	0.52	0.01	0.01	0.01	0.01	0.01	1	0.06	0.08	0.03	0.94
2	AEGIS GROUP PLC	2003	0.44	0.01	0.22	0.98	0.92	0.75	0.74	0.14	0.03	0.11	0	0.76	0.51	0.63	0.02
3	AGA RANGEMASTER	2003	0.05	0.12	0.06	0.93	0.85	0.32	0.7	0.84	0.88	0.03	0.93	0.25	0.25	0.83	0.08
4	AGGREKO PLC	2003	0.97	0.88	0.89	0.62	0.05	0.97	0.97	0.01	0.01	0.84	0.92	0.22	0.22	0.04	1
5	AMEC PLC	2003	0.07	0.05	0.03	0.96	0.99	0.99	0.99	0.82	0.88	0.2	0.03	0.86	0.99	0.16	0.04
6	ANGLO AMERICAN PLC	2003	0.11	0.67	0.64	0.26	0.21	1	0.99	1	1	0.38	0.98	1	1	0.1	0.95
7	ANITE PLC	2003	0.9	0	0	0	0	0.07	0.85	0.88	0.98	0.05	0.04	0.15	0.12	1	0.02
8	ANTOFAGASTA PLC	2003	0.54	0.38	1	0.75	0	0.01	0.01	0.11	0.08	0.96	0.77	0.74	0.51	0.04	1
9	ARENA LEISURE PLC	2003	0.93	0	0	0	0	0.01	0.01	0.03	0.26	0.02	0	0.07	0.05	0.08	0.98
10	ASHTEAD GROUP PLC	2003	0.05	0.16	0.34	0.34	0.08	0.54	0.63	0.01	0.01	1	0.09	0.6	0.5	0.32	1
11	ASSOCIATED BRITISH	2003	0.16	0.58	0.18	0.97	0.97	0.93	0.96	1	1	0.04	1	0.99	1	0.12	0.49
12	ASTRAZENECA PLC	2003	1	0.99	0.98	0.88	0.74	0.98	0.97	0.01	0.01	0.01	0.98	1	1	0.25	0.44
13	BABCOCK INT'L GROUP	2003	0.08	0	0.03	0.26	0.85	0.79	0.96	0.74	0.83	0.06	0	0.16	0.32	0.75	0.04
14	BAE SYSTEMS	2003	0.05	0	0.02	0.71	0.98	0.97	0.78	0.99	1	0.22	0.84	1	1	0.97	0.05
15	BARRATT DEVELOPMENTS	2003	0.07	0.94	0.58	0.98	0.93	0.04	0.06	0.01	0.01	0.01	0.94	0.75	0.88	0.03	0.01
16	BBA AVIATION	2003	0.14	0.04	0.17	0.97	0.58	0.95	0.93	0.66	0.63	0.9	0.36	0.79	0.77	0.49	0.89
17	BERENDSEN PLC	2003	0.27	0.49	0.39	0.19	0.34	0.01	0.01	0.01	0.01	0.87	0.36	0.57	0.59	0.53	0.97
18	BERKELEY GROUP	2003	0.05	0.88	0.93	0.98	0.98	0.01	0.01	0.01	0.01	0.14	0.94	0.73	0.66	0.04	0.02
19	BG GROUP PLC	2003	0.91	0.82	1	0.62	0.53	0.99	0.99	0.96	0.99	0.14	0.64	1	0.98	0.21	0.99
20	BHP BILLITON PLC	2003	0.83	0.71	0.92	0.78	0.81	1	1	1	1	0.7	0.81	1	1	0.04	1
21	BIG YELLOW PLC	2003	0.65	0	0	0.83	0	0.01	0.01	0.01	0.01	0.24	0.01	0.07	0.04	0.05	1

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
22	BODYCOTE	2003	0.05	0.03	0.35	0.37	0.1	0.7	0.96	0.9	0.91	0.87	0.29	0.55	0.36	0.43	0.99
23	BOVIS HOMES GROUP	2003	0.08	0.97	0.99	0.96	0.45	0.01	0.01	0.01	0.01	0.06	0.9	0.48	0.33	0.03	0.02
24	BP PLC	2003	0.65	0.33	0.12	0.97	0.72	0.99	0.99	0.98	0.93	0.1	0.98	1	1	0.09	0.98
25	BRAMMER PLC	2003	0.12	0	0.02	0.02	0.47	0.5	0.59	0.63	0.21	0.94	0.31	0.12	0.21	0.5	0.19
26	BRITISH AMERICAN TOB	2003	0.44	0.43	0.94	0.83	0.96	1	1	0.01	0.01	0.94	0.63	1	1	0.97	0.09
27	BRITISH LAND COMPANY	2003	0.01	0.13	0.97	0.98	0.52	0.01	0.01	0.01	0.03	1	0.12	1	0.34	0.03	1
28	BRITISH POLYTHENE	2003	0.08	0.34	0.07	0.93	0.97	0.3	0.3	0.01	0.01	0.85	0.21	0.1	0.25	0.04	0.91
29	BSKYB GROUP PLC	2003	1	0	0.07	0	0.29	0.01	0.01	0.01	0.96	1	0	0.91	0.97	0.76	0.08
30	BT GROUP PLC	2003	0.54	0.41	0.63	0.04	0.94	0.34	0.11	0.85	0.98	1	0.07	1	1	0.2	0.96
31	BUNZL PLC	2003	0.98	0.89	0.14	0.98	0.99	0.9	0.82	0.85	0.46	0.38	0.7	0.67	0.97	0.58	0.1
32	BURBERRY GROUP	2003	0.05	0.99	0.83	0.14	0.27	0.66	0.66	0.02	0.12	0.01	0	0.28	0.43	0.61	0.34
33	CABLE & WIRELESS	2003	0.1	0	0	0	0	1	1	0.01	0.01	0.14	0.79	1	1	0.24	0.39
34	CAMELLIA PLC	2003	0.01	0.07	0.02	0.7	0.12	1	1	0.9	0.97	0.08	0.86	0.31	0.1	0.04	0.53
35	CAPITA GROUP PLC	2003	1	0.6	0.24	0.96	0.95	0.01	0.01	0.98	0.99	0.25	0.11	0.52	0.62	1	0.06
36	CAPITAL & REGIONAL	2003	0.01	0.08	0.03	0.88	0	0.01	0.01	0.22	0.48	0.94	0.08	0.43	0.05	0.04	0.72
37	CAPITAL SHOPPING	2003	0.01	0.09	0.99	0.98	0.48	0.04	0.07	0.06	0.09	0.97	0.03	0.99	0.22	0.03	1
38	CARCLO PLC	2003	0.02	0	0.07	0.02	0.32	0.77	0.71	0.43	0.35	0.94	0.08	0.08	0.09	0.25	0.62
39	CARILLION PLC	2003	0.11	0.03	0.02	0.93	0.98	0.7	0.37	0.96	0.71	0.03	0.06	0.56	0.87	0.07	0.03
40	CARNIVAL PLC	2003	0.07	0.55	0.88	0.76	0.23	0.57	0.75	0.01	0.02	0.9	0.96	1	0.95	0.11	1
41	CARPETRIGHT PLC	2003	1	1	0.61	0.66	0.85	0.06	0.03	0.01	0.01	0.05	0.67	0.1	0.26	0.05	1
42	CENTRICA PLC	2003	0.84	0.38	0.06	0.98	0.96	0.68	0.1	1	1	0.18	0.51	1	1	0.52	0.43
43	CLARKSON PLC	2003	0.54	0.99	0.82	0.06	0.05	0.37	0.32	0.04	0.02	0.03	0.65	0.05	0.05	0.07	0.09
44	COBHAM PLC	2003	0.79	0.49	0.73	0.29	0.94	0.98	0.99	0.95	0.97	0.67	0.86	0.58	0.58	0.84	0.19
45	COMPASS GROUP PLC	2003	0.69	0.06	0.07	0.98	0.96	0.93	0.98	0.01	0.01	0.88	0.84	1	1	0.99	0.23
46	COMPUTACENTER PLC	2003	0.51	0.32	0.03	0.82	0.98	0.26	0.56	0.01	0.01	0.02	0.79	0.5	0.92	0.04	0.09
47	COOKSON GROUP PLC	2003	0.05	0	0.02	0.2	0.97	1	1	0.94	0.97	0.84	0	0.77	0.87	0.92	0.25

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
48	COSTAIN GROUP PLC	2003	0.43	0.23	0.01	0.95	0.94	0.02	0.09	0.01	0.01	0.01	0	0.11	0.46	0.03	0.02
49	CRODA INTERNATIONAL	2003	0.51	0.34	0.55	0.24	0.76	0.98	1	0.11	0.14	0.34	0.94	0.18	0.2	0.05	0.88
50	DAEJAN HOLDINGS PLC	2003	0.01	0.15	1	0.97	0.94	0.1	0.22	0.01	0.01	0.66	0.89	0.5	0.07	0.03	1
51	DAILY MAIL & GENERAL	2003	0.96	0.3	0.24	0.89	0.98	0.95	0.61	1	1	1	0.14	0.81	0.9	0.92	0.28
52	DAIRY CREST GROUP	2003	0.17	0.33	0.1	0.96	0.94	0.01	0.01	0.3	0.63	0.97	0.63	0.53	0.75	0.12	0.87
53	DE LA RUE PLC	2003	0.88	0.77	0.32	0.01	0.16	0.99	1	0.93	0.93	0.03	1	0.37	0.51	0.09	0.44
54	DEBENHAMS PLC	2003	0.62	0.82	0.3	0.98	0.99	0.01	0.01	0.01	0.01	0.07	1	0.66	0.85	0.03	1
55	DECHRA PHARMA	2003	0.98	0.83	0.06	0.92	0.96	0.01	0.01	0.01	0.01	0.56	0	0.06	0.1	0.1	0.05
56	DEVRO PLC	2003	0.16	0.01	0.69	0	0.81	0.92	0.94	0.01	0.01	0.73	0.09	0.09	0.09	0.03	0.99
57	DIALIGHT PLC	2003	0.54	0.96	0.1	0.01	0.39	0.81	0.98	0.93	0.93	0.07	0.94	0.07	0.09	0.44	0.17
58	DIPLOMA PLC	2003	0.17	0.87	0.44	0.49	0.94	0.88	0.92	0.01	0.01	0.01	1	0.06	0.06	0.1	0.08
59	DIXONS RETAIL PLC	2003	0.54	0.93	0.08	0.02	0.95	0.35	0.25	0.04	0.02	0.16	0.55	0.97	1	0.38	0.1
60	DS SMITH PLC	2003	0.05	0.12	0.08	0.86	0.95	0.61	0.61	0.3	0.61	0.31	0.64	0.64	0.8	0.06	0.94
61	ELECTROCOMPONENTS	2003	1	0.86	0.6	0.96	0.81	0.97	0.99	0.01	0.01	0.07	0.99	0.5	0.58	0.84	0.21
62	ELEMENTIS PLC	2003	0.01	0.01	0.02	0.3	0.69	0.7	0.88	0.74	0.92	0.11	0.98	0.36	0.26	0.93	0.47
63	EUROMONEY INSTL INV	2003	1	0.99	0.42	0.01	0.69	0.87	0.94	0.99	1	1	0	0.07	0.11	0.78	0.04
64	EXPERIAN PLC	2003	0.35	0.18	0.13	0.98	0.98	0.95	0.78	1	1	0.74	0.94	1	1	0.88	0.08
65	FINDEL PLC	2003	0.38	0.76	0.34	0.98	0.97	0.11	0.05	0.75	0.88	0.93	0.75	0.14	0.21	0.15	0.14
66	FIRSTGROUP PLC	2003	0.43	0.6	0.22	0.96	0.97	0.32	0.41	0.95	0.98	0.98	0.15	0.78	0.92	0.87	0.89
67	FORTUNE OIL PLC	2003	0.15	0.02	0.53	0.6	0.08	0.01	0.01	0.92	0.71	0.89	0	0.06	0.05	0.04	0.41
68	FRENCH CONNECTION GR	2003	0.63	0.98	0.37	0.85	0.92	0.57	0.63	0.63	0.65	0.03	0.98	0.08	0.13	0.09	0.34
69	GALLIFORD TRY PLC	2003	0.06	0.1	0.03	0.88	0.99	0.01	0.01	0.25	0.39	0.05	0.32	0.14	0.52	0.04	0.02
70	GAME GROUP PLC (THE)	2003	0.79	0.22	0.05	0.61	0.82	0.16	0.08	0.01	0.01	0.01	0.98	0.11	0.34	0.99	0.08
71	GENUS PLC	2003	0.03	0.03	0.06	0.92	0.97	0.75	0.82	0.91	0.96	0.3	0.18	0.07	0.1	0.86	0.12
72	GKN PLC	2003	0.18	0.06	0.06	0.98	0.98	0.87	0.91	0.34	0.26	0.74	0.56	0.96	0.99	0.25	0.82
73	GLAXOSMITHKLINE	2003	1	1	1	0.37	0.91	0.99	0.99	0.27	0.22	0.5	0.84	1	1	0.16	0.62

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
74	GO-AHEAD GROUP PLC	2003	0.63	0.49	0.1	0.36	0.87	0.01	0.01	0.25	0.95	0.71	0.31	0.3	0.61	0.59	0.84
75	GOODWIN PLC	2003	0.03	0.76	0.18	0.96	0.96	0.01	0.01	0.01	0.01	0.07	0.98	0.05	0.05	0.04	0.69
76	GRAINGER PLC	2003	0.03	0.5	1	0.85	0	0.01	0.01	0.57	0.61	1	0.41	0.44	0.06	0.03	0.04
77	GREAT PORTLAND	2003	0.04	0.03	1	0.89	0.01	0.01	0.01	0.01	0.01	0.93	0.22	0.67	0.07	0.03	1
78	GREENE KING PLC	2003	0.06	0.48	0.91	0.98	0.93	0.01	0.01	0.94	0.96	0.96	0.41	0.59	0.4	0.17	1
79	HALMA PLC	2003	0.99	0.98	0.86	0.76	0.9	0.93	0.99	1	1	0.03	0.99	0.12	0.16	0.58	0.15
80	HAMMERSON PLC	2003	0.02	0.06	1	0.98	0.96	0.12	0.54	0.01	0.01	0.98	0.29	0.98	0.12	0.03	1
81	HAYS PLC	2003	1	0	0.23	0	0.43	0.81	0.82	0.82	0.92	0.74	0.01	0.7	0.95	0.29	0.51
82	HEADLAM GROUP PLC	2003	0.5	0.44	0.16	0.28	0.97	0.17	0.3	0.01	0.01	0.02	0.43	0.13	0.31	0.08	0.15
83	HILL & SMITH HOLDING	2003	0.09	0.1	0.06	0.97	0.92	0.02	0.02	0.5	0.34	0.9	0.11	0.09	0.13	0.42	0.31
84	HOMESERVE PLC	2003	0.35	0.73	0.9	0.94	0.04	0.01	0.01	0.63	0.98	0.19	0.88	0.17	0.1	0.35	0.99
85	HORNBY PLC	2003	0.49	0.96	0.55	0.07	0.18	0.02	0.11	0.01	0.01	0.01	0.86	0.05	0.05	0.04	0.12
86	HOWDEN JOINERY	2003	0.5	0.78	0.09	0.83	0.65	0.12	0.1	0.01	0.01	0.01	0.94	0.52	0.75	0.04	0.94
87	HUNTING PLC	2003	0.02	0.18	0.77	0.32	0	0.96	0.81	0.95	0.79	0.44	0.09	0.31	0.05	0.12	0.43
88	IMI PLC	2003	0.34	0.34	0.19	0.98	0.99	0.99	0.99	0.97	0.98	0.36	0.69	0.68	0.83	0.65	0.27
89	IMPERIAL TOBACCO GRP	2003	1	0.99	1	0.01	0.02	0.86	0.97	0.01	0.01	1	0	0.99	0.94	0.98	0.06
90	INCHCAPE PLC	2003	0.12	0.41	0.03	0.28	0.98	1	1	0.93	0.59	0.02	0.18	0.68	0.99	0.08	0.16
91	INFORMA PLC	2003	0.8	0.03	0.26	0.87	0.96	0.99	0.99	1	1	0.99	0	0.17	0.18	1	0.04
92	INNOVATION GROUP	2003	0.08	0	0	0	0	0.93	0.78	0.03	0.94	0.08	0	0.12	0.06	1	0.07
93	INTERCONTINENTAL	2003	0.21	0.21	0.83	0.49	0.19	0.98	0.97	0.78	0.9	0.17	0.84	1	0.99	0.05	1
94	INTERSERVE PLC	2003	0.17	0.04	0.03	0.31	0.81	1	0.07	1	0.99	0.05	0.19	0.44	0.72	0.76	0.1
95	INTERTEK GROUP	2003	1	1	0.8	0.16	0.94	0.97	0.98	0.99	1	1	0	0.13	0.36	0.08	0.41
96	INVENSYS PLC	2003	0.75	0	0.13	0	0.19	0.99	0.99	0.99	0.99	1	0	1	1	0.53	0.23
97	J SAINSBURY PLC	2003	0.09	0.1	0.05	0.97	0.98	0.21	0.26	0.07	0.05	0.12	0.82	1	1	0.05	0.99
98	JARDINE LLOYD	2003	0.37	0.04	0.93	0.98	0.36	0.98	1	0.01	0.11	0.01	0.07	0.89	0.28	0.05	0.02
99	JD SPORTS FASHION	2003	0.4	0.99	0.14	0.12	0.41	0.01	0.01	0.01	0.01	0.11	0.98	0.07	0.19	0.05	0.91

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
100	JOHN MENZIES PLC	2003	0.27	0	0.02	0.14	0.97	0.98	0.19	0.57	0.44	0.55	0.41	0.21	0.71	0.11	0.42
101	JOHN WOOD GROUP PLC	2003	0.24	0.3	0.09	0.75	0.94	0.88	0.94	0.98	0.95	0.66	0.54	0.5	0.65	0.45	0.1
102	JOHNSON MATTHEY PLC	2003	0.63	0.69	0.04	0.91	0.93	0.91	1	0.96	0.85	0.19	0.88	0.78	1	0.16	0.37
103	KCOM GROUP PLC	2003	0.06	0	0	0.88	0.17	0.01	0.04	0.98	0.97	0.11	0.01	0.33	0.18	0.09	1
104	KELLER GROUP PLC	2003	0.17	0.16	0.09	0.44	0.97	0.84	0.99	0.26	0.14	0.6	0.3	0.16	0.42	0.54	0.24
105	KEWILL PLC	2003	0.1	0	0	0	0	0.54	0.39	0.01	0.01	0.05	0	0.06	0.04	0.85	0.03
106	KIER GROUP PLC	2003	0.1	0.08	0.02	0.99	0.98	0.04	0.06	0.79	0.18	0.01	0.17	0.41	0.77	0.04	0.04
107	KINGFISHER PLC	2003	0.11	0.02	0.07	0.22	0.97	0.96	0.97	0.54	0.01	0.42	0.55	1	1	0.24	0.87
108	KOFAX PLC	2003	0.15	0.09	0.79	0.55	0	0.81	0.52	0.01	0.18	0.02	0.23	0.07	0.09	0.94	0.02
109	LADBROKES PLC	2003	0.09	0.07	0.07	0.98	0.41	0.98	0.77	0.07	0.46	0.81	0.07	0.99	1	0.89	0.96
110	LAIRD PLC	2003	0.12	0	0.07	0.01	0.47	0.85	0.89	0.88	0.96	0.64	0.44	0.29	0.42	0.97	0.11
111	LAND SECURITIES	2003	0.01	0.1	1	0.99	0	0.01	0.01	0.12	0.74	0.47	0.52	1	0.62	0.04	1
112	LAURA ASHLEY	2003	0.25	0.02	0.02	0	0.26	0.41	0.25	0.41	0.18	0.03	0	0.08	0.17	0.03	0.34
113	LAVENDON GROUP PLC	2003	0.03	0.06	0.35	0.91	0.44	0.56	0.84	0.01	0.01	0.99	0.13	0.12	0.07	0.04	1
114	LOGICA PLC	2003	0.99	0	0.11	0	0.16	1	1	0.01	0.01	0.13	0	0.66	0.82	0.88	0.03
115	LONMIN PLC	2003	0.72	0.96	1	0.09	0	0.02	0.04	0.46	0.04	0.05	0.77	0.59	0.44	0.03	0.99
116	LOOKERS PLC	2003	0.02	0.31	0.02	0.98	0.99	0.01	0.01	0.02	0.02	0.28	0.49	0.11	0.6	0.07	0.83
117	LOW & BONAR PLC	2003	0.01	0.01	1	0.31	0	0.94	0.93	0.61	0.61	0.09	0.02	0.1	0.04	0.05	0.55
118	MANAGEMENT CON	2003	0.54	0.01	0.01	0.19	0.07	0.75	0.92	0.01	0.01	0.01	0	0.07	0.07	1	0.02
119	MARSHALLS PLC	2003	0.6	0.94	0.75	0.99	0.97	0.01	0.01	0.88	0.71	0.03	0.99	0.16	0.23	0.11	0.99
120	MARSTON'S PLC	2003	0.04	0.16	0.93	0.87	0.88	0.01	0.01	0.93	0.95	0.99	0.14	0.63	0.44	0.17	1
121	MEARS	2003	0.95	0.75	0.05	0.98	0.98	0.01	0.01	0.19	0.19	0.01	0.51	0.05	0.07	0.41	0.03
122	MEGGITT PLC	2003	0.59	0.2	0.78	0.83	0.97	0.97	0.92	0.25	0.32	0.73	0.31	0.41	0.3	1	0.05
123	MELROSE RESOURCES	2003	0.04	0.03	0.44	0.39	0	0.61	0.26	0.02	0.06	0.98	0.03	0.06	0.04	0.12	1
124	MICHAEL PAGE	2003	1	1	0.28	0	0.11	0.95	0.96	0.01	0.01	0.01	0	0.08	0.3	0.04	0.16
125	MILLENNIUM	2003	0.01	0.04	0.71	0.98	0.17	1	1	0.04	0.04	0.77	0.07	0.89	0.5	0.03	1

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
126	MISYS PLC	2003	1	0.98	0.19	0.01	0.34	0.97	0.99	0.97	0.97	0.74	0	0.34	0.65	0.97	0.03
127	MITIE GROUP PLC	2003	1	0.85	0.08	0.97	0.98	0.01	0.01	0.65	0.65	0.01	0.63	0.1	0.42	0.11	0.22
128	MORGAN CRUCIBLE CO	2003	0.04	0	0.04	0.31	0.75	0.99	0.99	1	1	0.84	0.54	0.6	0.63	0.23	0.86
129	MORGAN SINDALL	2003	0.13	0.18	0.02	0.95	0.98	0.01	0.01	0.99	1	0.01	0.23	0.17	0.67	0.32	0.03
130	MOTHERCARE PLC	2003	0.09	0	0.01	0.12	0.18	0.01	0.01	0.01	0.01	0.01	0.99	0.1	0.32	0.03	0.92
131	MUCKLOW (A & J)	2003	0.02	0.22	1	0.99	0.11	0.01	0.01	0.02	0.06	0.53	0.48	0.14	0.05	0.03	1
132	MWB GR	2003	0.03	0	0	0.11	0	0.01	0.05	0.99	0.99	1	0.01	0.54	0.12	0.05	1
133	N BROWN GROUP PLC	2003	0.91	0.92	0.67	0.9	0.94	0.01	0.01	0.01	0.03	0.51	0.99	0.25	0.33	0.05	0.12
134	NATIONAL EXPRESS GRP	2003	0.25	0.04	0.04	0.04	0.94	0.66	0.52	0.06	0.86	0.73	0.52	0.7	0.95	0.89	0.47
135	NATIONAL GRID PLC	2003	0.19	0.18	0.93	0.07	0.1	0.66	0.65	1	1	1	0.59	1	1	0.17	0.99
136	NEXT PLC	2003	1	1	0.62	0.77	0.99	0.15	0.04	0.9	0.13	0.04	1	0.57	0.89	0.04	0.51
137	NORTHGATE PLC	2003	0.2	0.58	0	0.99	0.1	0.01	0.01	0.01	0.01	1	0.58	0.27	0.18	0.04	1
138	OXFORD INSTRUMENTS	2003	0.04	0.03	0.02	0.42	0.48	0.65	0.32	0.97	0.97	0.02	0.94	0.09	0.11	0.05	0.26
139	PEARSON PLC	2003	0.22	0	0.04	0.79	0.77	0.59	0.94	0.57	0.92	0.82	0.13	1	1	1	0.03
140	PENNON GROUP PLC	2003	0.03	0.29	1	0.94	0.97	0.01	0.07	0.54	0.94	0.99	0.88	0.86	0.29	0.04	1
141	PERSIMMON PLC	2003	0.1	0.96	0.84	0.93	0.25	0.01	0.01	0.01	0.01	0.35	0.97	0.8	0.85	0.17	0.02
142	PREMIER FARNELL PLC	2003	0.99	0.95	0.45	0.25	0.72	0.93	0.94	0.27	0.35	0.99	0	0.37	0.6	0.09	0.17
143	PREMIER FOODS PLC	2003	0.43	0.98	0.2	0.96	0.9	0.04	0.04	0.01	0.99	1	0	0.36	0.61	0.44	0.28
144	PREMIER OIL PLC	2003	0.5	0.2	1	0.76	0	0.54	0.63	0.01	0.01	0.88	0.61	0.5	0.11	0.06	0.97
145	PSION PLC	2003	0.63	0	0	0	0.12	0.89	0.99	0.01	0.02	0.02	0	0.12	0.09	1	0.04
146	R.E.A. HOLDINGS PLC	2003	0.03	0.04	0.42	0.82	0	0.19	0.08	0.01	0.12	1	0.06	0.06	0.04	0.03	1
147	RANDGOLD RESOURCES	2003	1	1	1	0	0	0.01	0.01	0.03	0.04	0.95	0	0.07	0.06	0.03	0.93
148	RANK GROUP PLC (THE)	2003	0.46	0.78	0.62	0.9	0.41	0.93	0.93	0.98	0.98	0.86	0.86	0.78	0.83	0.06	0.89
149	RECKITT BENCKISER	2003	1	0.97	0.81	0.95	0.49	0.97	1	0.06	0.05	0.13	0.86	0.97	0.99	0.99	0.09
150	REDROW PLC	2003	0.18	0.99	0.91	0.99	0.9	0.01	0.01	0.06	0.03	0.28	0.9	0.35	0.46	0.03	0.02
151	REGUS PLC	2003	0.93	0	0	0	0.19	0.98	0.99	0.01	0.01	0.13	0	0.16	0.29	0.04	0.8

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
152	RENOLD PLC	2003	0.01	0.03	0.03	0.47	0.49	1	1	0.25	0.22	0.23	0.91	0.1	0.12	0.28	0.42
153	RENTOKIL INITIAL PLC	2003	1	1	0.95	0.99	0.96	0.97	0.99	1	1	1	0	0.79	0.93	0.15	0.59
154	REXAM PLC	2003	0.24	0.04	0.18	0.39	0.91	0.99	0.98	0.26	0.34	0.96	0	0.97	0.98	0.9	0.51
155	RIO TINTO PLC	2003	0.94	0.32	0.97	0.75	0.06	0.99	1	1	1	0.73	0.75	1	1	0.08	0.99
156	RM PLC	2003	0.62	0.04	0.03	0.1	0.29	0.01	0.02	0.01	0.65	0.01	0.52	0.08	0.13	0.11	0.11
157	ROBERT WALTERS PLC	2003	0.97	0.07	0.02	0.32	0.77	0.85	0.84	0.01	0.01	0.01	0	0.06	0.13	0.29	0.04
158	ROLLS-ROYCE	2003	0.06	0.02	0.02	0.97	0.84	0.66	0.63	1	0.99	0.21	0.36	1	1	0.18	0.25
159	ROTORK PLC	2003	1	1	0.94	0.99	0.81	0.95	0.96	0.75	0.84	0.01	1	0.07	0.08	0.39	0.07
160	RPC GROUP PLC	2003	0.08	0.2	0.09	0.85	0.93	0.61	0.57	0.01	0.01	0.84	0.38	0.17	0.27	0.06	0.98
161	RPS GROUP PLC	2003	0.93	0.56	0.6	0.98	0.95	0.01	0.88	0.01	0.01	0.01	0.44	0.09	0.07	0.99	0.04
162	SABMILLER PLC	2003	0.1	0.5	0.84	0.52	0.08	0.99	0.98	0.99	1	0.56	0.65	0.99	0.97	0.91	0.49
163	SAINT IVES PLC	2003	0.4	0.55	0.22	0.36	0.33	0.88	0.79	0.01	0.26	0.03	0.99	0.21	0.37	0.18	0.97
164	SAVILLS PLC	2003	0.12	0.61	0.33	0.47	0.39	0.46	0.78	1	1	0.08	0.64	0.11	0.17	0.31	0.06
165	SCOTTISH & SOUTHERN	2003	0.85	0.9	0.76	0.98	0.92	0.01	0.01	0.88	0.34	0.6	0.79	0.99	0.99	0.07	1
166	SEGRO PLC	2003	0.02	0.06	1	0.97	0.22	0.82	0.95	0.05	0.52	0.95	0.1	0.99	0.19	0.03	1
167	SENIOR PLC	2003	0.04	0.04	0.06	0.98	0.71	0.97	0.97	0.94	0.97	0.88	0.7	0.17	0.29	0.79	0.38
168	SERCO GROUP PLC	2003	0.9	0.26	0.03	0.95	0.98	0.98	0.93	1	1	0.66	0.14	0.55	0.7	0.56	0.04
169	SEVERFIELD ROWEN PLC	2003	0.17	0.46	0.07	0.97	0.94	0.01	0.02	0.01	0.01	0.02	0.92	0.06	0.09	0.04	0.49
170	SEVERN TRENT PLC	2003	0.05	0.15	0.97	0.86	0.8	0.04	0.35	0.48	1	0.98	0.92	1	0.87	0.11	1
171	SHANKS GROUP PLC	2003	0.18	0.09	0.29	0.95	0.59	0.9	0.96	0.01	0.01	0.99	0.06	0.49	0.45	0.82	0.92
172	SIG PLC	2003	0.17	0.77	0.06	0.94	0.97	0.86	0.84	0.01	0.01	0.64	0.88	0.3	0.71	0.34	0.08
173	SMITH & NEPHEW PLC	2003	1	0.96	0.75	0.87	0.94	0.96	0.99	0.98	0.99	0.36	0.66	0.65	0.71	0.57	0.18
174	SMITHS INDUSTRIES	2003	0.97	0.05	0.62	0.11	0.91	0.97	1	1	0.99	0.81	0.59	0.94	0.98	0.65	0.14
175	SPECTRIS PLC	2003	0.62	0.52	0.24	0.33	0.86	0.88	1	0.95	0.97	0.93	0.01	0.36	0.46	0.93	0.1
176	SPEEDY HIRE PLC	2003	0.17	0.02	0.08	0.07	0.01	0.01	0.01	0.08	0.95	0.69	0.53	0.1	0.13	0.05	1
177	SPIRAX-SARCO ENGIN.	2003	0.65	0.89	0.7	0.99	0.98	1	1	0.01	0.01	0.31	0.91	0.15	0.19	0.06	0.46

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
178	SPIRENT COMM	2003	0.66	0	0.03	0	0.18	0.65	0.82	0.59	0.93	0.69	0	0.54	0.52	0.96	0.12
179	STAGECOACH GROUP PLC	2003	0.13	0	0.02	0	0.89	0.59	0.92	0.98	1	0.96	0.13	0.86	0.88	0.59	0.92
180	SYNERGY HEALTH PLC	2003	0.05	0.58	0.46	0.9	0.86	0.01	0.01	0.01	0.01	0.1	0.22	0.05	0.05	0.16	0.94
181	TARSUS GROUP PLC	2003	0.91	0	0	0	0.06	0.9	0.89	0.35	0.39	1	0	0.05	0.05	1	0.02
182	TATE & LYLE PLC	2003	0.13	0.04	0.07	0.04	0.63	0.99	1	0.04	0.15	0.78	0.52	0.92	0.98	0.09	0.94
183	TAYLOR WIMPEY PLC	2003	0.01	0.59	0.47	0.99	0.49	0.52	0.83	0.48	0.56	0.27	0.63	0.93	0.94	0.16	0.04
184	TED BAKER PLC	2003	1	1	0.68	0.68	0.63	0.02	0.03	0.43	0.82	0.06	0.95	0.05	0.06	0.03	0.7
185	TELECOM PLUS PLC	2003	1	1	0.29	0.85	0.65	0.01	0.01	0.13	0.09	0.03	0.11	0.05	0.05	0.08	0.05
186	TESCO PLC	2003	0.76	0.62	0.08	0.98	0.99	0.63	0.37	0.01	0.01	0.8	0.74	1	1	0.05	1
187	TOPPS TILES PLC	2003	1	1	0.79	0.79	0.98	0.01	0.01	0.01	0.01	0.02	0.94	0.06	0.07	0.04	0.65
188	TOWN CENTRE SECS	2003	0.01	0.35	1	0.8	0.44	0.01	0.01	0.01	0.01	0.98	0.21	0.17	0.05	0.03	1
189	TRINITY MIRROR PLC	2003	0.08	0.01	0.91	0.97	0.89	0.01	0.01	0.79	0.94	0.76	0.04	0.88	0.7	1	0.11
190	TT ELECTRONICS PLC	2003	0.04	0.03	0.04	0.59	0.69	0.99	0.98	0.52	0.57	0.19	0.81	0.24	0.5	0.14	0.62
191	UK COAL PLC	2003	0.02	0	0.01	0.07	0.21	0.05	0.06	0.97	0.83	0.02	0.14	0.5	0.52	0.03	1
192	UK MAIL GROUP	2003	1	1	0.35	0.9	0.95	0.01	0.01	0.01	0.07	0.01	0.99	0.06	0.09	0.04	0.92
193	ULTRA ELECTRONICS	2003	0.99	0.94	0.43	0.99	0.98	0.65	0.57	0.01	0.14	0.63	0.25	0.1	0.16	0.97	0.04
194	UMECO	2003	0.1	0.25	0.09	0.68	0.65	0.7	0.35	0.91	0.89	0.47	0.09	0.08	0.11	0.82	0.03
195	UNILEVER PLC	2003	0.98	0.47	0.52	0.84	0.89	0.99	1	1	1	0.99	0.32	1	1	0.99	0.12
196	UNITE GROUP PLC	2003	0.02	0.01	0	0.72	0	0.01	0.01	0.21	0.08	1	0.05	0.53	0.05	0.04	1
197	UNITED UTILITIES PLC	2003	0.05	0.49	1	0.9	0.33	0.02	0.05	0.16	0.99	0.99	0.5	1	0.86	0.04	1
198	VITEC GROUP PLC	2003	0.6	0.56	0.03	0.4	0.17	0.97	0.96	0.98	0.98	0.38	0.95	0.08	0.11	0.11	0.4
199	VP PLC	2003	0.02	0.34	0.11	0.87	0.36	0.01	0.01	0.95	0.95	0.13	0.96	0.06	0.06	0.1	1
200	WETHERSPOON (J.D.)	2003	0.35	0.37	0.43	0.98	0.88	0.01	0.01	0.01	0.01	0.97	0.58	0.53	0.52	0.03	1
201	WHITBREAD PLC	2003	0.04	0.08	0.67	0.46	0.57	0.01	0.03	0.97	1	0.74	0.88	0.98	0.92	0.06	1
202	WILMINGTON GROUP PLC	2003	0.83	0.05	0.16	0.31	0.11	0.01	0.25	0.9	0.9	0.01	0.27	0.07	0.06	1	0.06
203	WM. MORRISON SUPERMT	2003	0.91	0.8	0.07	0.99	0.99	0.01	0.01	0.01	0.01	0.01	1	0.79	0.99	0.03	1

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
204	WPP PLC	2003	0.23	0.04	0.46	0.94	0.89	0.97	1	0.59	0.99	0.15	0.85	1	1	1	0.02
205	WS ATKINS PLC	2003	0.95	0	0.02	0.01	0.42	0.99	0.77	1	1	0.17	0.16	0.24	0.59	0.35	0.08
206	WSP GROUP PLC	2003	0.07	0.03	0.05	0.72	0.63	0.95	0.99	0.91	0.91	0.6	0.06	0.12	0.15	0.98	0.04
207	XSTRATA PLC	2003	0.01	0.21	0.55	0.96	0.23	0.96	0.97	0.96	0.99	0.49	0.53	0.96	0.74	0.27	1
208	YULE CATTO & CO PLC	2003	0.23	0.11	0.29	0.82	0.62	0.41	0.88	0.95	0.96	0.92	0.7	0.42	0.41	0.97	0.38
209	A.G. BARR PLC	2006	0.92	0.92	0.47	0.97	0.72	0.01	0.01	0.01	0.01	0.01	1	0.07	0.08	0.03	0.67
210	AEGIS GROUP PLC	2006	0.5	0.05	0.48	0.96	0.43	0.87	0.88	0.29	0.32	0.19	0.01	0.89	0.62	0.71	0.02
211	AGA RANGEMASTER	2006	0.19	0.39	0.1	0.95	0.8	0.94	0.97	0.95	0.99	0.03	0.94	0.32	0.4	0.9	0.11
212	AGGREKO PLC	2006	0.98	0.68	0.74	0.75	0.83	0.99	0.99	0.19	0.18	0.66	0.94	0.31	0.32	0.06	1
213	AMEC PLC	2006	0.27	0.1	0.03	0.2	0.98	0.98	0.98	0.96	0.98	0.09	0.07	0.91	1	0.23	0.03
214	ANGLO AMERICAN PLC	2006	0.51	0.82	0.93	0.38	0	1	1	1	1	0.16	0.98	1	1	0.07	0.99
215	ANITE PLC	2006	0.99	0	0.03	0	0.18	0.85	0.95	0.98	0.99	0.01	0	0.08	0.11	0.86	0.04
216	ANTOFAGASTA PLC	2006	0.94	1	1	0.13	0.05	0.01	0.34	0.29	0.07	0.08	0.99	0.85	0.81	0.06	0.96
217	ARENA LEISURE PLC	2006	0.98	0.56	0.69	0.95	0.97	0.01	0.01	0.03	0.02	0.14	0.99	0.07	0.05	0.09	1
218	ASHTEAD GROUP PLC	2006	0.23	0.08	0.37	0.14	0.05	0.5	0.56	0.06	0.22	1	0.07	0.55	0.49	0.39	1
219	ASSOCIATED BRITISH	2006	0.35	0.41	0.21	0.95	0.98	0.98	0.99	1	1	0.07	1	1	1	0.42	0.63
220	ASTRAZENECA PLC	2006	1	1	0.99	0.36	0.09	0.99	0.98	0.01	0.01	0.02	0.99	1	1	0.22	0.37
221	AVEVA GROUP PLC	2006	1	0.86	0.78	0.82	0.8	0.98	0.99	0.01	0.01	0.01	0.82	0.06	0.06	0.78	0.04
222	BABCOCK INT'L GROUP	2006	0.43	0.39	0.07	0.99	0.96	0.32	0.44	0.99	0.99	0.2	0	0.3	0.55	0.82	0.03
223	BAE SYSTEMS	2006	0.35	0.14	0.06	0.09	0.35	0.95	0.99	1	1	0.2	0.43	1	1	0.97	0.05
224	BALFOUR BEATTY PLC	2006	0.5	0.53	0.02	0.4	0.97	0.95	0.23	0.99	0.98	0.02	0.01	0.87	0.99	0.27	0.06
225	BARRATT DEVELOPMENTS	2006	0.13	0.94	0.82	0.93	0.9	0.01	0.01	0.01	0.01	0.01	0.98	0.91	0.95	0.03	0.01
226	BBA AVIATION	2006	0.49	0.13	0.23	0.77	0.66	0.93	0.93	0.71	0.65	0.97	0.06	0.76	0.75	0.67	0.59
227	BELLWAY PLC	2006	0.13	0.97	1	0.95	0	0.01	0.01	0.01	0.01	0.1	0.99	0.69	0.32	0.04	0.02
228	BERENDSEN PLC	2006	0.41	0.66	0.48	0.13	0.86	0.01	0.01	0.01	0.01	0.92	0.17	0.59	0.56	0.86	0.81
229	BERKELEY GROUP	2006	0.17	0.96	0.89	0.33	0.9	0.01	0.01	0.01	0.01	0.11	1	0.71	0.69	0.03	0.01

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
230	BG GROUP PLC	2006	0.98	0.99	1	0.8	0.12	1	1	0.97	0.99	0.09	0.92	1	1	0.17	0.95
231	BHP BILLITON PLC	2006	1	1	1	0.06	0.05	1	1	1	1	0.39	0.96	1	1	0.04	1
232	BIG YELLOW PLC	2006	0.51	0.73	1	0.01	0	0.01	0.01	0.01	0.01	0.99	0.25	0.15	0.05	0.04	1
233	BLOOMSBURY	2006	0.98	0.84	0.63	0.1	0	0.5	0.22	0.15	0.08	0.01	0.97	0.07	0.07	0.26	0.02
234	BODYCOTE	2006	0.18	0.22	0.51	0.89	0.34	0.07	0.5	0.78	0.82	0.54	0.2	0.56	0.41	0.48	0.96
235	BOVIS HOMES GROUP	2006	0.38	0.95	0.99	0.84	0.52	0.01	0.01	0.01	0.01	0.03	0.99	0.56	0.5	0.03	0.02
236	BP PLC	2006	0.7	0.87	0.29	0.93	0.35	1	1	0.99	0.81	0.06	0.96	1	1	0.1	0.89
237	BRAEMAR SHIPPING	2006	0.88	0.85	0.74	0.61	0.48	0.02	0.03	0.16	0.52	0.01	0.92	0.06	0.05	0.97	0.05
238	BRAMMER PLC	2006	0.6	0.16	0.05	0.4	0.97	0.99	0.99	0.74	0.12	0.96	0.02	0.09	0.19	0.7	0.03
239	BRITISH AMERICAN TOB	2006	0.97	0.87	0.99	0.62	0.03	1	1	0.01	0.01	0.96	0.78	1	1	0.97	0.07
240	BRITISH LAND COMPANY	2006	0.03	0.45	0.65	0.23	0	0.01	0.01	0.09	0.09	0.99	0.41	1	0.52	0.04	1
241	BRITISH POLYTHENE	2006	0.22	0.38	0.06	0.86	0.82	0.34	0.34	0.12	0.13	0.57	0.09	0.11	0.28	0.04	0.76
242	BRITVIC PLC	2006	0.19	0.69	0.36	0.96	0.97	0.01	0.01	0.01	0.01	0.95	0.03	0.3	0.55	0.35	0.96
243	BSKYB GROUP PLC	2006	1	1	0.87	0.89	0.12	0.1	0.02	0.01	0.94	1	0	0.92	0.99	0.43	0.12
244	BT GROUP PLC	2006	0.59	0.77	0.66	0.96	0.79	0.5	0.16	0.66	0.93	0.99	0.11	1	1	0.06	0.99
245	BTG PLC	2006	1	0	0	0	0	0.05	0.82	0.3	0.03	0.01	0	0.07	0.05	0.17	0.06
246	BUNZL PLC	2006	0.96	0.76	0.11	0.98	0.97	0.98	0.95	0.06	0.03	0.7	0.5	0.76	0.98	0.97	0.03
247	BURBERRY GROUP	2006	1	1	0.97	0.96	0.82	0.91	0.98	0.02	0.12	0.02	0.95	0.48	0.56	0.43	0.26
248	BWIN.PARTY DIGI	2006	1	1	1	0	0	0.44	0.56	0.23	0.21	1	1	0.1	0.4	0.45	0.05
249	CABLE & WIRELESS	2006	0.13	0.03	0.12	0.18	0.31	1	1	0.17	0.07	0.18	0	0.99	0.98	0.08	0.34
250	CAMELLIA PLC	2006	0.03	0.03	0.03	0.85	0.3	1	1	0.99	0.97	0.03	0.91	0.35	0.1	0.04	0.37
251	CAPITA GROUP PLC	2006	1	0.94	0.48	0.82	0.72	0.02	0.02	1	1	0.49	0.11	0.62	0.81	1	0.08
252	CAPITAL & REGIONAL	2006	0.04	0.6	1	0.01	0.21	0.04	0.06	0.08	0.68	0.66	0.59	0.64	0.07	0.04	0.27
253	CAPITAL SHOPPING	2006	0.05	0.92	1	0.01	0.78	0.04	0.08	0.17	0.3	0.97	0.64	1	0.34	0.03	1
254	CARCLO PLC	2006	0.03	0.01	0.04	0.45	0.34	0.9	0.74	0.34	0.37	0.86	0.08	0.07	0.07	0.42	0.49
255	CARILLION PLC	2006	0.4	0.04	0.02	0.31	0.97	0.63	0.26	0.92	0.68	0.05	0.09	0.66	0.94	0.23	0.04

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
256	CARPETRIGHT PLC	2006	1	1	0.62	0.56	0.92	0.57	0.14	0.01	0.01	0.21	0.29	0.12	0.36	0.14	0.99
257	CENTAUR MEDIA PLC	2006	0.04	0.03	0.22	0.37	0.02	0.01	0.01	0.29	0.99	0.01	0.99	0.1	0.06	1	0.02
258	CENTRICA PLC	2006	0.83	0.8	0.2	0.02	0.31	0.57	0.46	1	1	0.28	0.24	1	1	0.23	0.46
259	CHIME COMMUNICATIONS	2006	0.34	0.75	0.16	0.54	0.95	0.01	0.21	0.93	0.85	0.05	0	0.07	0.08	1	0.02
260	CINEWORLD GROUP PLC	2006	0.09	0.07	0.05	0.07	0.09	0.01	0.01	0.01	0.01	1	0	0.23	0.13	1	0.58
261	CLARKSON PLC	2006	0.86	1	0.91	0.1	0.19	0.7	0.68	0.93	0.79	0.07	0.71	0.08	0.07	0.29	0.06
262	CLS HOLDINGS PLC	2006	0.05	0.74	0.69	0.16	0.31	0.97	0.79	0.01	0.01	1	0.34	0.66	0.06	0.04	1
263	COBHAM PLC	2006	0.92	0.82	0.72	0.8	0.51	0.99	1	0.99	0.99	0.58	0.95	0.69	0.66	0.92	0.1
264	COLT GROUP	2006	0.02	0	0	0	0.14	1	1	0.13	0.15	0.88	0	0.86	0.87	0.05	1
265	COMPASS GROUP PLC	2006	0.27	0.04	0.05	0.7	0.95	0.97	0.99	0.03	0.03	0.78	0.77	1	1	0.99	0.12
266	COMPUTACENTER PLC	2006	0.17	0.08	0.02	0.83	0.92	0.87	0.95	0.01	0.25	0.03	0.84	0.54	0.94	0.04	0.05
267	CONSORT MEDICAL PLC	2006	0.82	0.38	0.67	0.43	0.96	0.25	0.32	0.85	0.87	0.07	0.96	0.07	0.06	0.22	0.96
268	COOKSON GROUP PLC	2006	0.23	0.02	0.15	0.32	0.39	0.99	1	0.94	0.96	0.48	0	0.7	0.84	0.9	0.15
269	COSTAIN GROUP PLC	2006	0.82	0	0.01	0	0.04	0.26	0.11	0.74	0.56	0.01	0	0.14	0.55	0.04	0.02
270	CRANSWICK PLC	2006	0.75	0.84	0.15	0.81	0.97	0.01	0.02	0.08	0.1	0.67	0.74	0.11	0.23	0.97	0.32
271	CRODA INTERNATIONAL	2006	0.97	0.62	0.72	0.17	0.32	0.96	0.99	0.43	0.56	0.56	0.38	0.33	0.26	0.13	0.76
272	CSR PLC	2006	1	1	0.98	0	0.52	0.06	0.22	0.01	0.01	0.01	1	0.1	0.16	0.46	0.03
273	DAEJAN HOLDINGS PLC	2006	0.02	0.38	1	0.3	0.12	0.12	0.22	0.01	0.01	0.21	0.98	0.57	0.07	0.03	1
274	DAILY MAIL & GENERAL	2006	0.96	0.7	0.37	0.31	0.93	0.96	0.75	1	1	0.97	0.44	0.86	0.92	0.97	0.23
275	DAIRY CREST GROUP	2006	0.31	0.44	0.09	0.96	0.86	0.01	0.01	0.27	0.61	0.93	0.75	0.54	0.76	0.27	0.82
276	DE LA RUE PLC	2006	0.92	0.29	0.23	0.45	0.36	0.99	0.99	0.52	0.78	0.21	0.95	0.43	0.53	0.07	0.3
277	DEBENHAMS PLC	2006	0.85	0.51	0.5	0.94	0.59	0.01	0.01	0.01	0.01	1	0.6	0.9	0.83	0.99	0.52
278	DECHRA PHARMA	2006	0.98	0.9	0.07	0.99	0.98	0.01	0.01	0.04	0.02	0.29	0	0.06	0.12	0.12	0.03
279	DERWENT LONDON PLC	2006	0.12	0.93	1	0.07	0	0.01	0.01	0.01	0.01	0.77	0.94	0.63	0.06	0.03	1
280	DEVRO PLC	2006	0.9	0.91	0.64	0.6	0.52	0.9	0.94	0.07	0.19	0.34	0.03	0.09	0.09	0.04	1
281	DEV'T SECURITIES PLC	2006	0.06	0.45	0	0.3	0	0.01	0.01	0.73	0.95	0.8	0.14	0.17	0.05	0.03	0.97

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
282	DIAGEO PLC	2006	1	0.97	1	0.48	0.96	1	1	0.97	0.99	0.93	0.02	1	1	0.88	0.09
283	DIALIGHT PLC	2006	0.95	1	0.17	0	0.93	0.93	0.98	0.65	0.66	0.01	0.99	0.06	0.06	0.33	0.08
284	DIGNITY PLC	2006	0.99	0.69	1	0.09	0.25	0.01	0.01	0.66	0.52	1	0	0.14	0.09	0.98	0.51
285	DIXONS RETAIL PLC	2006	0.35	0.47	0.05	0.96	0.96	0.56	0.7	0.44	0.07	0.05	0.61	0.98	1	0.76	0.1
286	DOMINO PRINTING	2006	0.99	0.98	0.64	0.95	0.98	0.73	0.94	0.01	0.01	0.01	0.98	0.09	0.11	0.64	0.1
287	DRAX GROUP PLC	2006	0.94	1	0.94	0	0	0.01	0.01	0.01	0.01	0.87	0	0.73	0.66	0.03	1
288	DS SMITH PLC	2006	0.07	0.05	0.06	0.68	0.82	0.71	0.77	0.66	0.88	0.4	0.42	0.69	0.83	0.26	0.81
289	DUNELM GROUP PLC	2006	0	1	0.56	0.44	0.97	0.01	0.01	0.01	0.01	0.01	1	0.07	0.17	0.04	0.89
290	E2V TECHNOLOGIES	2006	0.82	0.56	0.44	0.29	0.71	0.34	0.93	0.66	0.66	0.95	0.12	0.07	0.07	0.35	0.27
291	EASYJET PLC	2006	0.11	0.11	0.07	0.9	0.65	0.01	0.46	0.01	0.01	0.12	0.23	0.77	0.77	0.45	0.34
292	ELECTROCOMPONENTS	2006	0.99	0.81	0.46	0.88	0.45	0.98	0.99	0.01	0.01	0.24	0.97	0.5	0.59	0.66	0.2
293	ELEMENTIS PLC	2006	0.12	0.01	0.06	0.03	0.08	0.86	0.95	0.86	0.95	0.44	0.63	0.29	0.28	0.91	0.45
294	EMBLAZE LTD	2006	0.27	0	0	0.79	0	0.52	0.32	0.56	0.13	0.04	0	0.68	0.59	0.13	0.02
295	EURASIAN NATURAL	2006	0	1	1	0.46	0	0.65	0.98	1	0.99	0.13	0.03	0.82	0.84	0.05	0.99
296	EUROMONEY INSTL INV	2006	1	1	0.83	0.45	0.4	0.71	0.95	1	1	0.94	0	0.09	0.12	0.96	0.03
297	EXPERIAN PLC	2006	0.87	0.61	0.23	0.95	0.97	0.98	0.73	1	0.99	0.68	0.97	1	1	0.97	0.09
298	FENNER PLC	2006	0.41	0.16	0.15	0.44	0.39	0.99	0.99	0.63	0.5	0.73	0.12	0.14	0.2	0.39	0.23
299	FERREXPO PLC	2006	0	1	0.99	0.03	0.16	0.41	0.34	0.01	0.01	0.97	0.52	0.16	0.16	0.12	0.95
300	FIBERWEB PLC	2006	0	0	0.1	0.11	0.55	0.95	0.95	0.46	0.56	0.1	0.08	0.52	0.51	0.29	0.98
301	FILTRONA PLC	2006	0.72	0.83	0.4	0.98	0.98	0.97	0.97	0.63	0.66	0.36	0.93	0.23	0.43	0.29	0.86
302	FINDEL PLC	2006	0.75	0.89	0.48	0.92	0.98	0.04	0.03	0.81	0.96	0.99	0.72	0.23	0.37	0.34	0.09
303	FIRSTGROUP PLC	2006	0.53	0.52	0.14	0.98	0.98	0.82	0.46	0.98	0.98	0.98	0.06	0.82	0.97	0.69	0.87
304	FORTUNE OIL PLC	2006	0.99	0.26	0.31	0.93	0.66	0.01	0.01	0.96	0.93	0.09	0.01	0.06	0.05	0.05	0.65
305	FRENCH CONNECTION GR	2006	0.97	0.95	0.22	0.11	0.03	0.77	0.48	0.57	0.65	0.01	1	0.1	0.16	0.1	0.11
306	FULLER, SMITH	2006	0.09	0.3	0.68	0.92	0.74	0.01	0.02	0.12	0.48	0.26	0.98	0.14	0.09	0.05	1
307	G4S PLC	2006	0.33	0.02	0.06	0.26	0.9	1	1	0.83	0.66	0.85	0.6	0.93	0.99	0.99	0.06

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
308	GALLIFORD TRY PLC	2006	0.14	0.36	0.05	0.98	0.97	0.01	0.01	0.54	0.46	0.01	0.44	0.23	0.57	0.06	0.02
309	GAME GROUP PLC (THE)	2006	0.3	0.11	0.04	0.59	0.59	0.5	0.3	0.01	0.01	0.04	0.89	0.15	0.52	0.88	0.33
310	GENUS PLC	2006	0.37	0.22	0.07	0.61	0.99	0.91	0.94	0.78	0.96	0.45	0.1	0.09	0.12	0.94	0.08
311	GKN PLC	2006	0.17	0.81	0.08	0.02	0.72	0.95	0.98	0.75	0.59	0.38	0.64	0.97	0.99	0.12	0.72
312	GLAXOSMITHKLINE	2006	1	1	1	0.97	0.48	0.97	0.98	0.19	0.19	0.55	0.92	1	1	0.29	0.37
313	GO-AHEAD GROUP PLC	2006	0.93	0.34	0.12	0.04	0.96	0.01	0.01	0.9	0.96	0.49	0.17	0.5	0.77	0.2	0.93
314	GOLDENPORT HLDGS	2006	0.25	1	1	0	0.11	0.01	0.01	0.01	0.01	1	0.1	0.07	0.06	0.03	1
315	GOODWIN PLC	2006	0.47	0.85	0.26	0.95	0.99	0.03	0.22	0.01	0.01	0.09	0.96	0.05	0.05	0.04	0.57
316	GRAINGER PLC	2006	0.19	0.27	1	0.96	0	0.02	0.02	0.71	0.61	1	0.29	0.68	0.08	0.03	0.08
317	GREAT PORTLAND	2006	0.06	0.73	1	0.07	0	0.01	0.01	0.01	0.01	0.86	0.89	0.59	0.06	0.03	1
318	HALFORDS GROUP PLC	2006	0.8	0.92	0.53	0.93	0.9	0.01	0.01	0.01	0.23	1	0.09	0.32	0.53	0.99	0.14
319	HALMA PLC	2006	1	0.91	0.84	0.69	0.43	0.98	1	1	1	0.05	0.99	0.16	0.19	0.9	0.1
320	HAMMERSON PLC	2006	0.04	0.92	1	0.07	0.96	0.52	0.65	0.01	0.48	0.91	0.93	1	0.15	0.03	1
321	HAYS PLC	2006	1	1	0.28	0	0.88	0.95	0.92	0.01	0.01	0.04	0	0.34	0.84	0.5	0.03
322	HEADLAM GROUP PLC	2006	0.93	0.86	0.21	0.99	0.98	0.12	0.21	0.01	0.01	0.01	0.79	0.16	0.4	0.07	0.27
323	HELICAL BAR PLC	2006	0.09	0.64	0.65	0.26	0.08	0.01	0.01	0.23	0.88	0.84	0.72	0.26	0.07	0.04	1
324	HIKMA PHARMACEUTICAL	2006	0.97	0.99	0.99	0.66	0.22	0.96	0.91	0.99	0.98	0.19	0.97	0.11	0.09	0.06	0.34
325	HILL & SMITH HOLDING	2006	0.4	0.61	0.08	0.68	0.86	0.1	0.09	0.85	0.82	0.7	0.11	0.11	0.18	0.33	0.21
326	HOCHSCHILD MIN	2006	0.93	0.99	0.95	0.01	0	0.06	0.99	0.01	0.01	0.94	0.14	0.1	0.07	0.04	0.25
327	HOGG ROBINSON	2006	0.33	0.06	0.38	0.87	0.29	0.99	0.99	0.01	0.01	1	0.03	0.22	0.15	0.99	0.02
328	HOME RETAIL GROUP	2006	0	0.08	0.08	0.96	0.97	0.01	0.01	0.96	0.65	0.57	0.03	0.99	1	0.94	0.07
329	HOMESERVE PLC	2006	0.99	0.32	0.75	0.31	0.81	0.01	0.01	0.65	0.78	0.07	0.97	0.2	0.15	0.99	0.17
330	HORNBY PLC	2006	1	1	0.86	0.99	0.85	0.27	0.27	0.01	0.01	0.01	0.98	0.05	0.05	0.67	0.1
331	HOWDEN JOINERY	2006	0.98	0	0.05	0	0.14	0.1	0.06	0.91	0.74	0.15	0	0.49	0.75	0.04	0.6
332	HUNTING PLC	2006	0.37	0.24	1	0.49	0	0.97	0.52	0.97	0.59	0.67	0.13	0.46	0.07	0.14	0.38
333	IG GROUP HLDGS	2006	0.87	0.91	1	0.94	0	0.03	0.11	0.06	0.32	0.26	0.07	0.14	0.06	0.99	0.02

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
334	IMAGINATION TECH GRP	2006	1	0	0	0.09	0.04	0.01	0.93	0.04	0.06	0.01	0	0.05	0.05	0.31	0.1
335	IMI PLC	2006	0.96	0.14	0.32	0.55	0.85	1	1	0.74	0.89	0.16	0.5	0.64	0.83	0.59	0.14
336	IMPERIAL TOBACCO GRP	2006	1	0.94	1	0.49	0.04	0.98	1	0.01	0.01	1	0	1	0.98	1	0.04
337	INCHCAPE PLC	2006	0.85	0.77	0.05	0.96	0.98	1	1	0.95	0.84	0.04	0.58	0.77	1	0.08	0.17
338	INFORMA PLC	2006	0.87	0.02	0.58	0.71	0.84	0.97	0.99	0.93	0.97	0.94	0.06	0.79	0.58	1	0.02
339	INMARSAT PLC	2006	0.84	0.82	1	0.94	0.05	0.01	0.98	0.03	0.29	1	0.03	0.63	0.16	0.68	0.99
340	INNOVATION GROUP	2006	0.99	0	0	0	0	0.9	0.93	0.23	0.65	0.06	0	0.06	0.06	0.91	0.1
341	INTERCONTINENTAL	2006	0.97	0.98	0.96	0.13	0.04	0.98	0.97	0.02	0.05	0.23	1	0.95	0.75	0.13	0.99
342	INTERSERVE PLC	2006	0.4	0.03	0.03	0.87	0.98	1	0.15	0.99	0.99	0.08	0.03	0.51	0.75	0.76	0.09
343	INTERTEK GROUP	2006	1	1	0.78	0.97	0.85	0.97	0.98	0.99	1	0.99	0	0.22	0.51	0.37	0.36
344	INTL POWER PLC	2006	0.12	0.27	0.59	0.89	0.01	1	0.99	0.01	0.01	1	0.08	1	0.86	0.06	0.97
345	INVENSYS PLC	2006	0.67	0	0.09	0	0.46	1	1	1	1	1	0	0.91	0.98	0.25	0.12
346	ITE GROUP PLC	2006	1	1	0.99	0.38	0.3	0.44	0.94	0.01	0.01	0.05	0.88	0.07	0.06	0.95	0.02
347	ITV PLC	2006	0.13	0.13	0.71	0.99	0.38	0.03	0.05	0.02	0.03	0.3	0.97	1	0.92	1	0.02
348	J SAINSBURY PLC	2006	0.07	0.02	0.03	0.91	0.81	0.01	0.01	0.1	0.02	0.24	0.62	1	1	0.04	0.99
349	JAMES FISHER & SONS	2006	0.76	0.12	0.72	0.1	0.42	0.29	0.56	0.99	0.98	0.88	0.84	0.1	0.07	0.53	0.97
350	JARDINE LLOYD	2006	0.88	0.22	0.58	0.53	0.21	0.97	0.99	0.34	0.3	0.01	0.08	0.67	0.38	0.46	0.02
351	JD SPORTS FASHION	2006	0.27	0.03	0.03	0.95	0.89	0.01	0.01	0.01	0.01	0.47	0.85	0.09	0.38	0.21	0.68
352	JKX OIL & GAS PLC	2006	1	1	1	0.01	0	0.85	0.05	0.01	0.71	0.09	1	0.07	0.05	0.03	0.99
353	JOHN MENZIES PLC	2006	0.83	0.85	0.03	0.98	0.99	0.97	0.27	0.46	0.32	0.38	0.06	0.17	0.78	0.17	0.73
354	JOHN WOOD GROUP PLC	2006	0.75	0.23	0.07	0.63	0.76	0.95	0.97	0.98	0.95	0.4	0.5	0.57	0.81	0.47	0.06
355	JOHNSON MATTHEY PLC	2006	0.79	0.54	0.05	0.9	0.97	0.9	1	0.96	0.89	0.52	0.88	0.82	1	0.5	0.46
356	KAZAKHMYS PLC	2006	0.56	1	1	0.02	0	0.48	0.54	0.01	0.01	0.01	1	0.82	0.84	0.04	0.97
357	KCOM GROUP PLC	2006	0.2	0	0.04	0	0.32	0.01	0.04	0.92	0.74	0.76	0	0.3	0.26	0.8	0.9
358	KELLER GROUP PLC	2006	0.51	0.79	0.15	0.21	0.38	0.96	0.98	0.01	0.01	0.21	0.47	0.22	0.57	0.3	0.25
359	KESA ELECTRICALS PLC	2006	0.6	0.4	0.04	0.96	0.97	0.77	0.92	0.99	0.99	0.62	0	0.82	0.99	0.15	0.32

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
360	KIER GROUP PLC	2006	0.21	0.19	0.03	0.98	0.98	0.03	0.03	0.98	0.83	0.02	0.27	0.55	0.83	0.05	0.04
361	KINGFISHER PLC	2006	0.17	0.1	0.18	0.69	0.84	0.98	0.97	0.1	0.01	0.12	0.51	1	1	0.89	0.77
362	KOFAX PLC	2006	0.85	0.13	0.1	0.96	0.92	0.77	0.59	0.02	0.39	0.01	0.42	0.08	0.1	0.97	0.02
363	LADBROKES PLC	2006	1	0.94	0.38	0.02	0	0.85	0.44	0.04	0.32	1	0	0.98	1	0.84	0.33
364	LAIRD PLC	2006	0.57	0.26	0.43	0.53	0.41	0.97	0.99	0.37	0.63	0.48	0.42	0.48	0.45	1	0.07
365	LAND SECURITIES	2006	0.04	0.5	0.96	0.05	0.89	0.01	0.01	0.32	0.86	0.63	0.95	1	0.83	0.04	1
366	LAURA ASHLEY	2006	0.15	0.06	0.02	0.96	0.91	0.52	0.18	0.43	0.15	0.02	0	0.07	0.15	0.03	0.35
367	LAVENDON GROUP PLC	2006	0.05	0.01	0.15	0.28	0.35	0.97	0.96	0.85	0.88	0.98	0.05	0.11	0.07	0.07	1
368	LAW DEBENTURE CORP	2006	0.05	0.08	1	0.99	0.19	0.01	0.01	0.06	0.57	0.05	0.07	0.23	0.05	0.03	0.01
369	LOGICA PLC	2006	0.71	0.08	0.1	0.81	0.9	1	1	0.05	0.06	0.37	0	0.85	0.91	0.94	0.03
370	LONDON STOCK EXCH	2006	1	1	1	0.59	0.07	0.01	0.01	0.98	0.99	0.01	1	0.24	0.15	0.13	0.33
371	LONMIN PLC	2006	0.99	0.94	1	0.69	0	0.01	0.01	0.01	0.01	0.31	0.84	0.66	0.57	0.09	1
372	LOOKERS PLC	2006	0.16	0.24	0.02	0.63	0.93	0.01	0.01	0.21	0.09	0.17	0.36	0.26	0.74	0.12	0.41
373	LOW & BONAR PLC	2006	0.18	0	1	0	0	0.77	0.73	0.46	0.52	0.04	0.15	0.11	0.04	0.39	0.42
374	MANAGEMENT CON	2006	0.24	0.55	0.28	0.78	0.44	0.63	0.89	0.01	0.01	0.02	0	0.08	0.08	1	0.02
375	MARKS & SPENCER	2006	0.97	0.91	0.31	0.76	0.87	0.05	0.06	0.03	0.12	0.99	1	1	1	0.05	1
376	MARSHALLS PLC	2006	0.86	0.96	0.62	0.26	0.89	0.01	0.01	0.03	0.02	0.23	0.41	0.2	0.25	0.23	0.99
377	MARSTON'S PLC	2006	0.08	0.3	0.97	0.99	0.35	0.01	0.01	0.9	0.95	0.99	0.11	0.78	0.5	0.11	1
378	MCBRIDE PLC	2006	0.69	0.56	0.1	0.98	0.96	0.73	0.74	0.37	0.25	0.05	0	0.15	0.45	0.06	0.88
379	MEARS	2006	1	0.95	0.06	0.69	0.95	0.01	0.01	0.54	0.39	0.02	0.9	0.06	0.12	0.4	0.04
380	MECOM GROUP PLC	2006	0.99	0	0.01	0	0.98	0.57	0.59	0.01	0.01	1	0	0.2	0.61	0.48	0.04
381	MEGGITT PLC	2006	0.75	0.45	0.92	0.86	0.17	0.91	0.98	0.65	0.86	0.79	0.17	0.66	0.51	1	0.05
382	MELROSE	2006	0.25	0	0.3	0	0.98	0.91	0.93	0.99	1	0.83	0.05	0.26	0.28	0.96	0.04
383	MELROSE RESOURCES	2006	0.95	0.51	1	0.08	0.01	0.94	0.96	0.01	0.01	0.94	0.18	0.11	0.05	0.21	1
384	MICHAEL PAGE	2006	1	1	0.53	0.25	0.25	0.99	0.99	0.01	0.01	0.03	0.99	0.09	0.47	0.05	0.07
385	MICRO FOCUS INTL	2006	0.87	0.99	0.99	0.46	0.24	0.95	0.95	0.01	0.01	0.99	0	0.06	0.06	0.91	0.02

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
386	MILLENNIUM	2006	0.04	0.14	0.85	0.96	0.93	1	1	0.05	0.03	0.42	0.19	0.87	0.51	0.03	1
387	MISYS PLC	2006	1	1	0.1	0	0.36	0.9	0.98	0.88	0.98	1	0	0.36	0.63	0.97	0.02
388	MITCHELLS & BUTLERS	2006	0.1	0.31	0.9	0.94	0.97	0.01	0.01	0.68	0.68	1	0.86	0.98	0.84	0.04	1
389	MITIE GROUP PLC	2006	0.92	0.57	0.07	0.91	0.99	0.01	0.01	0.78	0.81	0.01	0.88	0.2	0.6	0.59	0.05
390	MONDI PLC	2006	0	0.01	0.14	0.87	0.77	1	1	0.9	0.92	0.77	0.44	0.99	0.99	0.09	0.99
391	MONEYSUPERMARKE	2006	0.01	1	0.93	0.05	0	0.01	0.01	0.06	0.23	0.01	0.85	0.05	0.06	0.03	0.08
392	MORGAN CRUCIBLE CO	2006	0.75	0.03	0.19	0.01	0.35	0.98	0.98	0.99	0.99	0.31	0.03	0.51	0.55	0.15	0.7
393	MORGAN SINDALL	2006	0.57	0.36	0.03	0.96	0.96	0.01	0.01	0.98	1	0.01	0.49	0.31	0.77	0.22	0.02
394	MOTHERCARE PLC	2006	0.41	0.89	0.04	0.09	0.98	0.03	0.03	0.01	0.01	0.01	1	0.11	0.37	0.04	0.8
395	MUCKLOW (A & J)	2006	0.07	0.41	1	0.22	0	0.01	0.01	0.01	0.16	0.05	0.97	0.14	0.05	0.03	1
396	MWB GR	2006	0.03	0.1	0	0.98	0.26	0.01	0.02	0.93	1	1	0	0.5	0.14	0.05	1
397	N BROWN GROUP PLC	2006	0.37	0.31	0.49	0.66	0.96	0.01	0.01	0.01	0.08	0.83	0.98	0.33	0.38	0.04	0.08
398	NATIONAL EXPRESS GRP	2006	0.76	0.1	0.08	0.5	0.63	0.84	0.3	0.98	0.96	0.86	0.22	0.74	0.95	0.94	0.4
399	NATIONAL GRID PLC	2006	0.51	0.87	0.99	0.14	0.72	0.61	0.66	1	1	1	0.72	1	1	0.12	1
400	NCC GROUP PLC	2006	0.95	0.78	1	0.27	0.06	0.14	0.3	0.52	0.97	0.89	0.13	0.05	0.05	1	0.02
401	NEXT PLC	2006	1	1	0.74	0.92	0.97	0.5	0.04	0.96	0.27	0.74	1	0.67	0.97	0.05	0.52
402	NORTHGATE PLC	2006	0.4	0.61	0	0.95	0	0.09	0.1	0.01	0.01	1	0.7	0.53	0.28	0.05	1
403	OPTOS PLC	2006	0.73	0	0	0	0	0.13	0.05	0.01	0.01	1	0	0.06	0.05	0.05	1
404	OXFORD INSTRUMENTS	2006	0.2	0.03	0.04	0.2	0.94	0.75	0.93	0.83	0.91	0.01	0.8	0.08	0.1	0.1	0.16
405	PACE PLC	2006	0.69	0	0.01	0	0.01	0.05	0.02	0.01	0.01	0.01	0.06	0.07	0.13	0.22	0.03
406	PEARSON PLC	2006	0.27	0.48	0.21	0.29	0.17	0.66	0.93	0.99	1	0.65	0.26	1	1	0.99	0.03
407	PENDRAGON PLC	2006	0.15	0.3	0.03	0.92	0.98	0.07	0.06	0.61	0.34	0.35	0.13	0.75	0.99	0.31	0.24
408	PENNON GROUP PLC	2006	0.11	0.11	1	0.96	0.85	0.01	0.01	0.56	0.84	1	0.56	0.91	0.5	0.05	1
409	PERSIMMON PLC	2006	0.59	0.99	0.98	0.98	0.55	0.01	0.01	0.01	0.01	0.08	1	0.93	0.95	0.14	0.02
410	PETROFAC LIMITED	2006	0.94	0.74	0.14	0.7	0.83	0.94	0.97	0.88	0.83	0.1	0.25	0.38	0.58	0.09	0.07
411	PHOENIX IT	2006	0.99	1	0.89	0.36	0.88	0.01	0.02	0.01	0.01	0.68	0	0.06	0.06	0.99	0.04

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
412	PHOTO-ME INT'L PLC	2006	1	0.9	0.5	0.89	0.42	0.41	0.98	0.06	0.61	0.16	0.97	0.11	0.13	0.23	0.63
413	PREMIER FARNELL PLC	2006	0.99	0.84	0.25	0.97	0.98	0.96	0.97	0.11	0.16	0.99	0.01	0.37	0.59	0.17	0.11
414	PREMIER FOODS PLC	2006	0.94	0.94	0.49	0.2	0.95	0.02	0.05	0.03	0.65	1	0	0.58	0.62	0.99	0.2
415	PREMIER OIL PLC	2006	0.96	0.38	1	0.9	0	0.92	0.93	0.01	0.01	0.02	0.98	0.28	0.1	0.16	0.99
416	PSION PLC	2006	0.05	0.99	0.01	0	0	0.98	1	0.01	0.11	0.01	0.68	0.13	0.1	0.95	0.03
417	PV CRYSTALOX SOLA	2006	0	1	0.88	0.92	0.44	0.96	0.87	0.07	0.15	0.6	0.99	0.06	0.08	0.04	0.11
418	PZ CUSSONS PLC	2006	0.41	0.58	0.35	0.92	0.97	0.96	0.97	0.03	0.3	0.01	1	0.3	0.42	0.11	0.41
419	QINETIQ GROUP	2006	0.06	0.54	0.16	0.92	0.83	0.22	0.12	0.95	0.66	0.34	0.31	0.61	0.63	0.33	0.74
420	R.E.A. HOLDINGS PLC	2006	0.31	0.58	1	0.82	0.25	0.1	0.3	0.01	0.01	0.88	0.61	0.07	0.05	0.05	1
421	RANDGOLD RESOURCES	2006	1	0.86	0.99	0.95	0.01	0.01	0.01	0.22	0.18	0.11	0.94	0.12	0.07	0.03	0.91
422	RANK GROUP PLC (THE)	2006	0.97	0	0.58	0	0.26	0.74	0.66	0.99	0.98	1	0.02	0.69	0.7	0.23	0.54
423	RECKITT BENCKISER	2006	1	1	0.95	0.93	0.89	0.93	0.96	0.03	0.04	0.04	0.86	0.99	1	0.99	0.05
424	REDROW PLC	2006	0.2	0.96	0.93	0.87	0.65	0.01	0.01	0.03	0.02	0.15	0.99	0.55	0.57	0.03	0.02
425	REGUS PLC	2006	1	0.87	0.21	0.01	0.02	0.95	0.99	0.01	0.01	0.08	0.04	0.3	0.4	0.95	0.15
426	RENOLD PLC	2006	0.04	0	0.03	0.11	0.73	1	1	0.18	0.08	0.23	0.45	0.1	0.11	0.15	0.28
427	RENTOKIL INITIAL PLC	2006	1	1	0.64	0.35	0.25	0.98	0.98	1	1	1	0.92	0.77	0.93	0.42	0.52
428	RESTAURANT GROUP PLC	2006	1	0.88	0.32	0.48	0.91	0.01	0.01	0.25	0.82	0.08	0.03	0.1	0.17	0.06	1
429	REXAM PLC	2006	0.47	0.45	0.39	0.89	0.68	1	1	0.74	0.75	0.92	0	0.97	0.99	0.95	0.47
430	RICARDO PLC	2006	0.46	0.21	0.05	0.25	0.23	0.95	0.97	0.02	0.04	0.35	0.67	0.08	0.1	0.2	0.61
431	RIO TINTO PLC	2006	0.99	1	1	0.1	0	0.98	0.99	1	1	0.09	0.97	1	1	0.07	0.99
432	RM PLC	2006	0.84	0.09	0.04	0.44	0.34	0.01	0.02	0.01	0.96	0.01	0.26	0.08	0.16	0.35	0.11
433	ROBERT WALTERS PLC	2006	1	0.97	0.08	0.18	0.52	0.88	0.86	0.09	0.02	0.03	0	0.06	0.14	0.16	0.03
434	ROLLS-ROYCE	2006	0.47	0.43	0.2	0.3	0.15	0.44	1	0.99	0.99	0.17	0.41	1	1	0.2	0.14
435	ROTORK PLC	2006	1	1	0.97	0.48	0.9	0.93	0.97	0.96	0.82	0.01	0.99	0.08	0.1	0.33	0.06
436	RPC GROUP PLC	2006	0.12	0.19	0.08	0.96	0.97	0.56	0.57	0.14	0.14	0.77	0.82	0.26	0.44	0.05	0.96
437	RPS GROUP PLC	2006	0.9	0.64	0.47	0.9	0.75	0.37	0.95	0.54	0.7	0.07	0.76	0.14	0.13	1	0.03

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
438	SABMILLER PLC	2006	0.75	0.59	0.8	0.88	0.2	1	1	0.98	0.99	0.55	0.92	1	1	0.99	0.29
439	SAFESTORE HOLD	2006	0.03	0.76	1	0.19	0	0.14	0.15	0.01	0.01	1	0.08	0.19	0.05	0.04	0.99
440	SAGE GROUP PLC (THE)	2006	0.98	0.86	1	0.96	0.8	0.98	0.99	0.05	0.05	0.24	0.72	0.77	0.59	1	0.04
441	SAINT IVES PLC	2006	0.3	0.03	0.17	0.63	0.4	0.65	0.7	0.12	0.99	0.03	0.99	0.18	0.3	0.25	0.95
442	SAVILLS PLC	2006	0.99	0.98	0.65	0.97	0.74	0.68	0.81	1	1	0.01	0.75	0.2	0.3	0.5	0.02
443	SCOTTISH & SOUTHERN	2006	0.9	0.86	0.3	0.98	0.45	0.01	0.01	0.97	0.17	0.61	0.7	1	1	0.08	1
444	SDL PLC	2006	0.93	0.06	0.09	0.18	0.07	0.99	1	0.26	0.1	0.06	0.01	0.06	0.06	1	0.02
445	SEGRO PLC	2006	0.05	0.9	1	0.09	0	0.71	0.94	0.21	0.71	0.96	0.15	1	0.26	0.03	1
446	SENIOR PLC	2006	0.22	0.11	0.08	0.26	0.82	0.98	0.98	0.87	0.91	0.52	0.4	0.16	0.24	0.84	0.3
447	SERCO GROUP PLC	2006	0.78	0.23	0.04	0.96	0.84	0.91	0.88	1	1	0.92	0.16	0.75	0.91	0.85	0.03
448	SEVERFIELD ROWEN PLC	2006	0.97	0.97	0.18	0.36	0.44	0.01	0.01	0.01	0.01	0.01	0.96	0.07	0.15	0.07	0.5
449	SEVERN TRENT PLC	2006	0.12	0.14	0.95	0.97	0.86	0.04	0.29	0.37	1	0.99	0.73	1	0.92	0.12	1
450	SHAFTESBURY PLC	2006	0.04	0.45	1	0.09	0.13	0.01	0.01	0.01	0.01	0.96	0.38	0.61	0.05	0.03	1
451	SHANKS GROUP PLC	2006	0.2	0.45	0.13	0.26	0.75	0.84	0.97	0.01	0.01	0.97	0.18	0.47	0.43	0.71	0.78
452	SHIRE PLC	2006	0.62	0	0.98	0.68	0.09	0.63	0.65	0.27	0.27	0.01	0	0.92	0.62	1	0.02
453	SIG PLC	2006	0.89	0.81	0.09	0.98	0.96	0.66	0.71	0.86	0.84	0.4	0.88	0.54	0.84	0.72	0.07
454	SMITH & NEPHEW PLC	2006	1	0.99	0.92	0.02	0.9	0.99	1	0.99	0.98	0.05	0.97	0.74	0.78	0.68	0.16
455	SMITHS INDUSTRIES	2006	0.97	0.26	0.57	0.29	0.74	0.96	0.99	1	0.99	0.61	0.79	0.96	0.98	0.91	0.08
456	SOCO INT'L PLC	2006	1	0.77	1	0.81	0.03	0.18	0.02	0.01	0.01	0.97	0.98	0.1	0.05	0.99	0.1
457	SPECTRIS PLC	2006	0.87	0.66	0.38	0.48	0.43	0.96	1	0.96	0.97	0.58	0.05	0.45	0.54	0.93	0.08
458	SPEEDY HIRE PLC	2006	0.66	0.79	0.5	0.96	0.98	0.01	0.01	0.23	0.79	0.83	0.8	0.15	0.12	0.07	1
459	SPIRAX-SARCO ENGIN.	2006	1	0.97	0.81	0.9	0.98	1	1	0.07	0.07	0.07	0.97	0.17	0.24	0.1	0.34
460	SPIRENT COMM	2006	0.98	0.92	0.05	0	0.34	0.77	0.87	0.23	0.44	0.25	0.89	0.2	0.22	0.54	0.07
461	SPORTS DIRECT INTER	2006	0	0.98	0.2	0.89	0.84	0.27	0.21	0.48	0.19	0.03	0.98	0.35	0.64	0.2	0.46
462	ST. MODWEN PROPS.	2006	0.22	0.78	0.72	0.82	0	0.01	0.01	0.01	0.01	0.9	0.88	0.51	0.08	0.03	1
463	STAGECOACH GROUP PLC	2006	0.71	0.79	0	0.88	0.48	0.59	0.39	0.93	0.98	0.8	0	0.69	0.81	0.12	0.95

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
464	STHREE PLC	2006	1	0.05	0.06	0	0	0.23	0.05	0.01	0.01	0.35	0	0.07	0.2	0.04	0.02
465	SYNERGY HEALTH PLC	2006	0.87	0.56	0.44	0.96	0.88	0.25	0.26	0.01	0.01	0.04	0.18	0.07	0.06	0.63	0.91
466	TARSUS GROUP PLC	2006	1	0.9	0.97	0.17	0.01	0.41	0.52	0.01	0.01	0.65	0	0.05	0.05	1	0.01
467	TATE & LYLE PLC	2006	0.47	0.29	0.15	0.36	0.77	0.96	1	0.22	0.23	0.78	0.42	0.9	0.98	0.11	0.88
468	TAYLOR WIMPEY PLC	2006	0.06	0.77	0.58	0.98	0.96	0.63	0.77	0.07	0.34	0.19	0.81	0.97	0.99	0.15	0.01
469	TED BAKER PLC	2006	1	1	0.58	0.96	0.97	0.14	0.05	0.39	0.57	0.01	0.98	0.06	0.07	0.04	0.38
470	TELECOM PLUS PLC	2006	1	1	0.13	0	0.01	0.01	0.01	0.12	0.03	0.01	0.14	0.05	0.07	0.17	0.03
471	TESCO PLC	2006	0.77	0.61	0.08	0.98	0.97	0.81	0.61	0.01	0.01	0.53	0.69	1	1	0.08	1
472	TOPPS TILES PLC	2006	1	1	0.97	0.96	0.98	0.01	0.01	0.03	0.03	0.03	0	0.07	0.1	0.04	0.67
473	TOWN CENTRE SECS	2006	0.03	0.73	1	0.04	0.49	0.01	0.01	0.01	0.01	0.9	0.58	0.25	0.05	0.03	1
474	TRAVIS PERKINS PLC	2006	0.78	0.85	0.33	0.82	0.94	0.01	0.01	0.66	0.5	0.68	0.85	0.85	0.95	0.99	0.16
475	TRINITY MIRROR PLC	2006	0.3	0.25	0.97	0.33	0.49	0.01	0.01	0.81	0.92	0.29	0	0.85	0.7	1	0.13
476	TT ELECTRONICS PLC	2006	0.3	0.27	0.07	0.78	0.96	0.99	0.99	0.48	0.56	0.22	0.83	0.23	0.51	0.31	0.42
477	TULLOW OIL PLC	2006	0.95	0.91	1	0.5	0	0.88	0.87	0.01	0.01	0.17	0.83	0.67	0.31	0.64	0.99
478	UK COAL PLC	2006	0.29	0	0	0.03	0.69	0.01	0.02	0.96	0.27	0.1	0.09	0.4	0.26	0.03	1
479	UK MAIL GROUP	2006	1	0.95	0.15	0.06	0.31	0.01	0.01	0.13	0.98	0.05	0.96	0.07	0.14	0.17	0.61
480	ULTRA ELECTRONICS	2006	1	0.95	0.57	0.92	0.69	0.66	0.95	0.96	0.97	0.2	0.66	0.15	0.23	0.99	0.03
481	UMECO	2006	0.21	0.1	0.08	0.95	0.75	0.9	0.75	0.89	0.9	0.26	0.07	0.11	0.14	0.88	0.04
482	UNILEVER PLC	2006	0.99	0.9	0.68	0.33	0.88	0.98	0.99	1	1	0.81	0.81	1	1	0.99	0.12
483	UNITE GROUP PLC	2006	0.07	0.43	0	0.32	0.04	0.01	0.01	0.14	0.25	1	0.25	0.65	0.07	0.04	1
484	UNITED UTILITIES PLC	2006	0.1	0.3	1	0.9	0.48	0.02	0.02	0.12	0.99	1	0.16	1	0.93	0.05	1
485	VECTURA GROUP PLC	2006	1	0	0	0	0	0.01	0.46	0.01	0.01	0.02	0	0.05	0.04	0.28	0.18
486	VEDANTA RESOURCES	2006	0.29	0.22	0.95	0.76	0.12	0.09	0.93	0.99	0.98	0.84	0.7	0.9	0.75	0.04	0.9
487	VICTREX PLC	2006	1	1	1	0.96	0.35	0.13	0.95	0.02	0.03	0.01	1	0.08	0.07	0.1	0.96
488	VITEC GROUP PLC	2006	0.71	0.61	0.27	0.77	0.75	0.99	0.98	0.95	0.95	0.17	0.98	0.08	0.12	0.27	0.24
489	VODAFONE GROUP PLC	2006	0.02	0	0.01	0.08	0	1	1	0.01	0.04	0.06	0.1	1	1	1	0.06

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
490	VOLEX GROUP PLC	2006	0.13	0	0.02	0.87	0.95	0.99	1	0.12	0.95	0.88	0.05	0.07	0.15	0.05	0.08
491	VP PLC	2006	0.34	0.64	0.29	0.98	0.99	0.01	0.01	1	1	0.14	0.97	0.07	0.07	0.26	0.98
492	WEIR GROUP PLC (THE)	2006	0.78	0.52	0.13	0.4	0.82	1	1	0.59	0.9	0.2	0.91	0.53	0.6	0.51	0.09
493	WETHERSPOON (J.D.)	2006	0.31	0.29	0.31	0.94	0.91	0.01	0.01	0.01	0.01	0.99	0.24	0.54	0.6	0.04	1
494	WHITBREAD PLC	2006	0.12	0.41	0.74	0.94	0.96	0.01	0.03	0.97	0.98	0.71	0.99	0.97	0.87	0.06	1
495	WILMINGTON GROUP PLC	2006	0.67	0.07	0.32	0.45	0.18	0.01	0.27	0.98	1	0.06	0.16	0.07	0.07	1	0.06
496	WINCANTON PLC	2006	0.47	0.11	0.03	0.96	0.98	0.65	0.61	0.01	0.01	0.23	0.02	0.48	0.86	0.11	0.68
497	WM. MORRISON SUPERMT	2006	0.41	0.1	0.04	0.09	0.28	0.01	0.01	0.01	0.01	0.08	0.99	1	1	0.03	1
498	WOLFSON MICROELECTRO	2006	1	1	0.95	0.88	0.05	0.01	0.9	0.01	0.84	0.09	0.99	0.06	0.07	0.04	0.16
499	WOLSELEY PLC	2006	0.7	0.71	0.08	0.99	0.99	0.98	0.99	0.7	0.68	0.73	0.86	1	1	0.3	0.08
500	WPP PLC	2006	0.2	0.07	0.52	0.99	0.98	0.99	0.99	0.88	0.99	0.14	0.83	1	1	0.99	0.02
501	WS ATKINS PLC	2006	0.98	0.79	0.06	0.95	0.74	0.74	0.46	1	1	0.02	0.04	0.38	0.66	0.09	0.04
502	WSP GROUP PLC	2006	0.62	0.28	0.08	0.56	0.59	0.99	0.99	0.88	0.93	0.31	0.05	0.13	0.24	0.96	0.03
503	XCHANGING PLC	2006	0.01	0.29	0.2	0.96	0.74	0.66	0.63	0.97	0.97	0.05	0	0.11	0.22	0.62	0.03
504	XSTRATA PLC	2006	0.37	0.88	1	0.5	0.05	0.99	1	1	1	0.43	0.55	1	1	0.23	0.99
505	YELL GROUP PLC	2006	0.85	0.42	0.99	0.44	0.12	0.65	0.66	0.08	0.04	1	0.01	0.92	0.78	1	0.02
506	YULE CATTO & CO PLC	2006	0.56	0.05	0.12	0.63	0.66	0.98	0.96	0.94	0.9	0.96	0.08	0.37	0.48	0.91	0.27
507	A.G. BARR PLC	2010	0.99	0.95	0.66	0.88	0.89	0.01	0.01	0.12	0.04	0.22	1	0.09	0.1	0.68	0.67
508	AEGIS GROUP PLC	2010	0.16	0.04	0.38	0.96	0.42	0.9	0.89	0.32	0.63	0.18	0.05	0.98	0.76	0.83	0.02
509	AFREN PLC	2010	0.77	0	0	0.01	0	0.77	0.15	0.01	0.01	0.89	0	0.43	0.09	0.5	0.96
510	AFRICAN BARRICK GOLD	2010	0.02	0.01	0.98	0.01	0	0.04	0.1	0.01	0.01	0.99	0.04	0.69	0.29	0.19	1
511	AGA RANGEMASTER	2010	0.01	0.26	0.03	0.15	0.15	0.26	0.97	0.01	0.01	0.02	0.37	0.19	0.16	0.76	0.09
512	AGGREKO PLC	2010	1	0.99	0.98	0.8	0.25	0.98	0.98	0.65	0.63	0.37	0.98	0.63	0.65	0.09	0.99
513	AMEC PLC	2010	0.89	0.96	0.11	0.2	0.7	0.98	0.99	0.99	0.97	0.01	0.94	0.82	0.96	0.54	0.02
514	ANGLO AMERICAN PLC	2010	0.65	0.92	1	0.2	0.04	0.99	1	1	1	0.41	0.97	1	1	0.07	0.99
515	ANITE PLC	2010	0.47	0.8	0.49	0.01	0.2	0.84	0.99	0.91	0.89	0.15	0.16	0.1	0.08	0.99	0.03

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
516	ANTOFAGASTA PLC	2010	0.95	1	1	0.02	0	0.01	0.88	0.15	0.08	0.06	1	1	0.92	0.06	0.94
517	AQUARIUS PLATINUM	2010	1	0.98	1	0	0	0.81	0.34	0.77	0.12	0.09	0.62	0.66	0.55	0.09	0.97
518	ARENA LEISURE PLC	2010	0.22	0.19	0.13	0.9	0.91	0.01	0.01	0.04	0.01	0.77	0.96	0.08	0.06	0.07	1
519	ASHTEAD GROUP PLC	2010	0.07	0.27	0.64	0.43	0.09	0.3	0.35	0.34	0.37	1	0.6	0.77	0.64	0.51	1
520	ASSOCIATED BRITISH	2010	0.18	0.3	0.14	0.97	0.95	0.99	0.99	1	1	0.09	1	1	1	0.58	0.8
521	ASTRAZENECA PLC	2010	0.92	0.99	1	0.93	0.07	0.98	0.98	0.01	0.01	0.45	0.86	1	1	0.98	0.09
522	AVEVA GROUP PLC	2010	1	1	1	0.22	0.12	0.98	0.99	0.01	0.01	0.01	0.99	0.1	0.08	0.36	0.02
523	AZ ELECTRONIC	2010	0.4	0	0.52	0	0.19	1	0.97	0.5	0.82	1	0	0.62	0.23	1	0.05
524	BABCOCK INT'L GROUP	2010	0.82	0.65	0.14	0.96	0.94	0.15	0.26	1	1	0.86	0.01	0.66	0.83	0.96	0.04
525	BAE SYSTEMS	2010	0.29	0.19	0.2	0.4	0.95	0.96	1	1	1	0.08	0.42	1	1	0.99	0.05
526	BALFOUR BEATTY PLC	2010	0.17	0.18	0.02	0.94	0.99	0.95	0.77	1	0.92	0.02	0.11	0.99	1	0.74	0.03
527	BARRATT DEVELOPMENTS	2010	0.01	0.01	0.23	0.13	0	0.01	0.01	0.04	0.03	0.51	0.99	1	0.97	0.35	0.01
528	BBA AVIATION	2010	0.15	0.54	0.28	0.39	0.93	0.44	0.52	0.85	0.63	0.94	0.01	0.7	0.7	0.96	0.27
529	BELLWAY PLC	2010	0.03	0.1	0.92	0.14	0	0.01	0.01	0.01	0.01	0.04	1	0.73	0.6	0.06	0.01
530	BERENDSEN PLC	2010	0.12	0.15	0.35	0.81	0.95	0.01	0.01	0.01	0.01	0.98	0.23	0.71	0.64	0.93	0.69
531	BERKELEY GROUP	2010	0.47	0.71	0.93	0.4	0.58	0.01	0.01	0.01	0.01	0.01	1	0.71	0.59	0.04	0.01
532	BETFAIR GROUP	2010	0.57	0.94	0.49	0.02	0.07	0.01	0.91	0.01	0.96	0.01	1	0.13	0.18	0.71	0.05
533	BG GROUP PLC	2010	0.98	0.93	1	0.33	0.41	1	0.99	0.94	0.98	0.1	0.95	1	1	0.31	0.96
534	BHP BILLITON PLC	2010	1	1	1	0.03	0.19	1	1	1	1	0.24	1	1	1	0.04	1
535	BIG YELLOW PLC	2010	0.04	0.94	1	0	0.24	0.01	0.01	0.01	0.01	0.89	1	0.56	0.06	0.04	0.06
536	BODYCOTE	2010	0.04	0.21	0.25	0.02	0.03	0.7	0.79	0.63	0.54	0.25	0.2	0.56	0.46	0.4	0.99
537	BOOKER GROUP PLC	2010	0.17	0.21	0.02	0.8	0.98	0.01	0.01	0.01	0.01	0.04	0.49	0.53	0.98	1	0.04
538	BOVIS HOMES GROUP	2010	0.02	0.02	0.39	0.08	0	0.01	0.01	0.01	0.01	0.02	1	0.57	0.24	0.04	0.02
539	BP PLC	2010	0.25	0.32	0.08	0.19	0.01	0.98	0.99	0.9	0.18	0.11	0.97	1	1	0.12	0.86
540	BRAMMER PLC	2010	0.22	0.18	0.06	0.65	0.96	1	1	0.97	0.96	0.64	0.16	0.14	0.34	0.84	0.02
541	BRITISH AMERICAN TOB	2010	0.99	0.96	1	0.97	0.57	1	1	0.01	0.01	0.97	0.86	1	1	0.99	0.06

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
542	BRITISH LAND COMPANY	2010	0.04	0	1	0	0.02	0.01	0.01	0.92	0.87	0.97	0.96	1	0.5	0.04	1
543	BRITISH POLYTHENE	2010	0.07	0.19	0.04	0.8	0.93	0.7	0.68	0.96	0.96	0.69	0.06	0.11	0.35	0.04	0.81
544	BRITVIC PLC	2010	0.92	0.25	0.45	0.13	0.93	0.3	0.19	0.01	0.1	1	0	0.55	0.64	0.92	0.36
545	BT GROUP PLC	2010	0.53	0.71	0.27	0.17	0.06	0.65	0.56	1	0.99	0.98	0.1	1	1	0.22	0.98
546	BTG PLC	2010	0.96	0.04	0.21	0.05	0	0.35	0.82	0.73	0.15	0.01	0	0.11	0.06	0.91	0.02
547	BUNZL PLC	2010	0.7	0.53	0.09	0.97	0.98	0.99	0.98	0.01	0.01	0.89	0.66	0.9	1	0.99	0.02
548	BURBERRY GROUP	2010	1	0.89	0.9	0.02	0.25	0.99	1	0.01	0.08	0.28	0.74	0.59	0.69	0.19	0.2
549	BWIN.PARTY DIGI	2010	1	0.54	0.41	0.02	0	0.97	0.99	0.99	0.95	0.02	1	0.18	0.16	0.99	0.02
550	CABLE & WIRELESS	2010	0.33	0.2	0.51	0.97	0.01	1	0.99	0.98	0.89	0.27	0	0.98	0.97	0.4	0.74
551	CAIRN ENERGY PLC	2010	0.99	1	0	0	0	0.21	0.66	0.23	0.03	0.04	0.98	0.88	0.09	0.31	0.26
552	CAMELLIA PLC	2010	0.02	0.08	0.54	0.79	0.02	1	1	0.96	0.96	0.01	0.91	0.51	0.12	0.04	0.32
553	CAPITA GROUP PLC	2010	1	0.92	0.55	0.75	0.98	0.04	0.03	1	1	0.97	0.02	0.86	0.95	0.99	0.06
554	CAPITAL & COUNTIES	2010	0.01	0	0.14	0	0	0.01	0.01	0.99	0.99	0.99	0.14	0.77	0.08	0.04	1
555	CAPITAL & REGIONAL	2010	0.01	0	0	0	0	0.12	0.08	0.08	0.96	0.84	0.33	0.43	0.05	0.04	0.09
556	CAPITAL SHOPPING	2010	0.05	0	0.85	0	0.09	0.04	0.04	0.35	0.41	1	0.54	1	0.47	0.03	1
557	CARCLO PLC	2010	0.23	0.31	0.13	0.55	0.96	0.96	0.92	0.87	0.56	0.4	0.89	0.07	0.06	0.9	0.34
558	CARILLION PLC	2010	0.12	0.19	0.02	0.98	0.91	0.3	0.27	0.93	0.77	0.08	0.59	0.93	1	0.94	0.03
559	CARPETRIGHT PLC	2010	1	0.91	0.19	0.05	0.17	0.59	0.25	0.01	0.01	0.33	0.37	0.17	0.42	0.43	0.92
560	CENTAUR MEDIA PLC	2010	0.01	0.06	0.49	0.47	0	0.01	0.01	1	1	0.01	1	0.1	0.06	1	0.02
561	CENTRICA PLC	2010	0.67	0.6	0.32	0.08	0.62	0.73	0.82	1	1	0.3	0.62	1	1	0.29	0.44
562	CHEMRING GROUP PLC	2010	0.96	0.94	0.98	0.91	0.52	0.97	1	0.5	0.87	0.9	0.53	0.47	0.32	0.96	0.15
563	CHIME COMMUNICATIONS	2010	0.05	0.4	0.14	0.98	0.94	0.04	0.94	0.96	0.92	0.01	0.09	0.11	0.16	1	0.02
564	CINEWORLD GROUP PLC	2010	0.13	0.65	0.43	0.65	0.45	0.01	0.01	0.01	0.01	0.88	0.01	0.2	0.2	1	0.43
565	CLARKSON PLC	2010	0.15	0.53	0.77	0.46	0.69	0.48	0.66	1	1	0.22	0.66	0.14	0.12	0.26	0.03
566	CLS HOLDINGS PLC	2010	0.03	0.03	0.08	0.23	0	0.99	0.95	0.01	0.01	1	0.36	0.64	0.06	0.04	1
567	COBHAM PLC	2010	0.79	0.65	0.68	0.88	0.74	0.98	0.99	1	1	0.8	0.93	0.87	0.83	0.97	0.07

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
568	COMPASS GROUP PLC	2010	0.73	0.77	0.1	0.97	0.93	0.99	0.99	0.05	0.83	0.36	0.77	1	1	1	0.04
569	COMPUTACENTER PLC	2010	0.05	0.13	0.02	0.97	0.98	0.83	0.96	0.01	0.75	0.05	0.79	0.57	0.95	0.1	0.06
570	CONSORT MEDICAL PLC	2010	0.59	0.23	0.71	0.79	0.97	0.9	0.5	0.84	0.48	0.49	0.75	0.09	0.08	0.95	0.47
571	COOKSON GROUP PLC	2010	0.09	0.16	0.25	0.29	0.41	1	1	0.77	0.94	0.37	0.93	0.87	0.91	0.97	0.11
572	COSTAIN GROUP PLC	2010	0.27	0.2	0.02	0.95	0.97	0.74	0.05	0.99	0.95	0.01	0.02	0.21	0.63	0.04	0.02
573	CPPGROUP PLC	2010	0.97	1	0.38	0.32	0.28	0.7	0.88	0.01	0.15	1	0	0.07	0.17	0.65	0.07
574	CRANSWICK PLC	2010	0.56	0.72	0.11	0.83	0.98	0.01	0.02	0.03	0.03	0.38	0.91	0.18	0.52	0.94	0.35
575	CRODA INTERNATIONAL	2010	0.97	0.78	0.7	0.15	0.09	0.92	0.92	0.63	0.66	0.96	0.16	0.59	0.64	0.56	0.65
576	DAEJAN HOLDINGS PLC	2010	0.01	0.02	0.99	0	0.18	0.29	0.37	0.01	0.01	0.07	1	0.67	0.07	0.03	1
577	DAILY MAIL & GENERAL	2010	0.71	0.05	0.29	0.01	0.21	0.98	0.9	1	1	0.98	0.15	0.89	0.92	1	0.14
578	DAIRY CREST GROUP	2010	0.16	0.42	0.08	0.97	0.98	0.57	0.09	0.78	0.66	0.97	0.54	0.65	0.82	0.97	0.27
579	DE LA RUE PLC	2010	1	1	0.86	0	0.24	0.95	0.95	0.84	0.85	0.05	0.59	0.3	0.53	0.08	0.47
580	DEBENHAMS PLC	2010	0.2	0.46	0.28	0.98	0.92	0.01	0.03	0.01	0.02	0.99	0.98	0.83	0.89	0.98	0.54
581	DECHRA PHARMA	2010	0.98	0.7	0.07	0.84	0.96	0.37	0.12	0.66	0.26	0.27	0.08	0.1	0.21	0.93	0.02
582	DERWENT LONDON PLC	2010	0.03	0.01	1	0	0	0.01	0.01	0.01	0.03	0.92	0.22	0.88	0.08	0.03	1
583	DEVRO PLC	2010	0.51	0.94	0.58	0.12	0.4	0.94	1	0.17	0.57	0.1	0.15	0.11	0.12	0.04	1
584	DEV'T SECURITIES PLC	2010	0.03	0	0	0.08	0	0.01	0.01	0.77	0.66	0.91	0.19	0.26	0.06	0.03	0.78
585	DIAGEO PLC	2010	0.99	0.97	1	0.97	0.98	1	1	0.98	1	0.99	0.07	1	1	0.92	0.07
586	DIGNITY PLC	2010	0.97	0.94	1	0.98	0.94	0.01	0.01	0.74	0.66	1	0	0.21	0.11	0.98	0.39
587	DIXONS RETAIL PLC	2010	0.1	0	0.02	0.28	0.85	0.97	0.97	0.96	0.82	0.1	0.61	0.97	1	0.89	0.08
588	DOMINO PRINTING	2010	0.96	0.93	0.67	0.4	0.45	0.39	0.92	0.01	0.01	0.02	0.99	0.12	0.16	0.92	0.05
589	DOMINO'S PIZZA UK	2010	1	1	0.9	0.02	0.68	0.05	0.11	0.52	0.08	0.98	0.54	0.06	0.09	0.05	0.68
590	DRAX GROUP PLC	2010	0.57	0.99	0.99	0.02	0	0.01	0.01	0.01	0.01	0.12	0.29	0.82	0.82	0.04	0.99
591	DS SMITH PLC	2010	0.07	0.1	0.06	0.64	0.91	0.94	0.96	0.99	0.99	0.26	0.31	0.72	0.9	0.29	0.79
592	DUNELM GROUP PLC	2010	1	1	0.61	0.52	0.68	0.01	0.01	0.01	0.01	0.03	0.99	0.1	0.31	0.05	0.93
593	E2V TECHNOLOGIES	2010	0.23	0.04	0.17	0.08	0.22	0.94	1	0.98	0.95	0.97	0.17	0.13	0.12	0.97	0.09

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
594	EASYJET PLC	2010	0.1	0.14	0.07	0.77	0.18	0.01	0.01	0.01	0.01	0.52	0.44	0.96	0.95	0.22	0.81
595	ELECTROCOMPONENTS	2010	0.93	0.86	0.32	0.9	0.76	0.99	0.99	0.01	0.01	0.56	0.87	0.51	0.64	0.85	0.11
596	ELEMENTIS PLC	2010	0.19	0.27	0.54	0.01	0.21	0.86	0.98	0.81	0.94	0.11	0.73	0.29	0.27	0.98	0.22
597	ENTERPRISE INNS PLC	2010	0.04	0.2	1	0.61	0.35	0.01	0.92	0.9	0.04	1	0.05	1	0.61	0.1	1
598	EURASIAN NATURAL	2010	0.82	1	1	0	0	0.54	0.99	1	1	0.05	0.99	1	0.99	0.09	0.95
599	EUROMONEY INSTL INV	2010	0.82	0.8	0.96	0.13	0.16	0.89	0.97	0.98	1	0.88	0.01	0.38	0.21	1	0.02
600	EXILLON ENERGY	2010	0.19	1	0	0	0	0.01	0.01	0.01	0.01	0.02	0.72	0.68	0.12	0.03	1
601	EXPERIAN PLC	2010	0.98	0.71	0.94	0.96	0.92	0.98	0.98	0.99	0.99	0.93	0.17	0.98	0.92	1	0.04
602	FENNER PLC	2010	0.44	0.39	0.25	0.56	0.58	0.97	0.99	0.7	0.54	0.79	0.32	0.31	0.37	0.72	0.49
603	FERREXPO PLC	2010	1	1	1	0	0	0.05	0.06	0.01	0.01	0.78	1	0.44	0.49	0.22	0.93
604	FIBERWEB PLC	2010	0.01	0	0.04	0.01	0.85	0.92	0.99	0.83	0.63	0.91	0.01	0.31	0.38	0.11	0.96
605	FILTRONA PLC	2010	0.53	0.73	0.59	0.31	0.69	0.95	0.95	0.95	0.96	0.9	1	0.28	0.4	0.63	0.7
606	FINDEL PLC	2010	0.28	0.01	0.22	0.02	0.18	0.01	0.07	0.85	0.93	1	0.08	0.4	0.52	0.65	0.05
607	FIRSTGROUP PLC	2010	0.33	0.24	0.13	0.97	0.98	0.92	0.66	1	0.99	0.99	0.05	0.99	1	0.9	0.8
608	FLYBE GROUP PLC	2010	0.12	0.01	0.01	0.01	0.41	0.01	0.18	0.16	0.08	0.8	0.02	0.19	0.5	0.06	0.79
609	FORTUNE OIL PLC	2010	0.15	0.31	0.16	0.95	0.98	0.01	0.01	0.94	0.9	0.56	0.62	0.1	0.08	0.1	0.78
610	FRENCH CONNECTION GR	2010	0.06	0	0	0.01	0.35	0.82	0.77	0.43	0.57	0.01	1	0.09	0.14	0.08	0.05
611	FRESNILLO PLC	2010	1	1	1	0	0	0.01	0.01	0.79	0.5	0.99	0.91	1	1	0.03	0.77
612	FULLER, SMITH	2010	0.24	0.36	0.77	0.64	0.63	0.01	0.02	0.25	0.57	0.58	0.99	0.22	0.12	0.09	1
613	G4S PLC	2010	0.37	0.26	0.09	0.98	0.98	0.98	0.99	0.52	0.32	0.95	0.4	0.99	1	0.99	0.05
614	GALLIFORD TRY PLC	2010	0.04	0.04	0.03	0.41	0.77	0.01	0.01	0.98	0.97	0.06	0.19	0.64	0.81	0.18	0.01
615	GAME GROUP PLC (THE)	2010	0.41	0.86	0.08	0.52	0.86	0.61	0.5	0.01	0.01	0.05	0.86	0.43	0.81	0.76	0.23
616	GEM DIAMONDS	2010	0.09	0	0.63	0	0	0.97	0.59	0.46	0.01	0.01	0	0.24	0.09	0.08	1
617	GENUS PLC	2010	0.47	0.23	0.37	0.98	0.89	0.98	1	0.7	0.77	0.46	0.48	0.29	0.16	0.87	0.7
618	GKN PLC	2010	0.14	0.1	0.08	0.18	0.31	0.95	0.98	0.99	0.99	0.21	0.4	0.98	1	0.23	0.83
619	GLAXOSMITHKLINE	2010	1	0.99	1	0.06	0.01	0.95	0.94	0.17	0.25	0.97	0.49	1	1	0.71	0.26

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
620	GO-AHEAD GROUP PLC	2010	0.83	0.19	0.04	0.4	0.77	0.01	0.01	0.95	0.86	0.85	0.04	0.59	0.92	0.23	0.88
621	GOLDENPORT HLDGS	2010	0.07	0.93	0.99	0	0	0.01	0.01	0.01	0.01	0.97	0.78	0.17	0.06	0.03	1
622	GOODWIN PLC	2010	0.75	0.96	0.6	0.94	0.61	0.71	1	0.04	0.03	0.08	0.97	0.06	0.06	0.19	0.3
623	GRAINGER PLC	2010	0.08	0.04	0	0.69	0	0.77	0.41	1	0.97	1	0.14	0.83	0.08	0.04	0.39
624	GREAT PORTLAND	2010	0.07	0.08	0.81	0	0	0.01	0.01	0.01	0.01	0.73	1	0.68	0.05	0.03	1
625	GREENE KING PLC	2010	0.08	0.29	0.98	0.88	0.72	0.01	0.01	0.99	0.98	1	0.58	0.93	0.65	0.61	1
626	GREGGS PLC	2010	0.97	0.99	0.16	0.94	0.96	0.01	0.01	0.01	0.01	0.01	1	0.14	0.53	0.04	1
627	HALFORDS GROUP PLC	2010	0.91	0.96	0.62	0.96	0.81	0.01	0.01	0.02	0.01	0.86	0.33	0.43	0.59	0.99	0.13
628	HALMA PLC	2010	1	0.97	0.89	0.96	0.93	0.97	1	0.99	0.97	0.07	0.99	0.26	0.31	0.99	0.08
629	HAMMERSON PLC	2010	0.02	0	1	0	0.1	0.04	0.57	0.01	0.61	0.97	0.91	1	0.22	0.03	1
630	HANSTEEN HLDGS	2010	0.03	0.01	1	0.05	0.01	0.98	0.98	0.01	0.01	0.98	0.38	0.45	0.05	0.04	1
631	HAYS PLC	2010	1	1	0.16	0	0.18	0.99	0.66	0.01	0.01	0.19	0	0.51	0.95	0.82	0.02
632	HEADLAM GROUP PLC	2010	0.24	0.57	0.11	0.49	0.47	0.23	0.27	0.01	0.01	0.03	0.87	0.19	0.48	0.06	0.33
633	HELICAL BAR PLC	2010	0.12	0.01	0.01	0.02	0	0.01	0.04	0.61	0.65	0.97	0.86	0.38	0.06	0.03	0.95
634	HERITAGE OIL PLC	2010	0.98	1	0	0	0	1	0.04	0.01	0.01	0.65	0.01	0.24	0.04	0.8	0.08
635	HIKMA PHARMACEUTICAL	2010	0.96	0.77	0.88	0.9	0.35	0.87	0.9	0.92	0.97	0.47	0.94	0.43	0.24	0.75	0.36
636	HILL & SMITH HOLDING	2010	0.17	0.57	0.34	0.97	0.75	0.98	0.98	0.93	0.96	0.9	0.19	0.23	0.29	0.77	0.29
637	HILTON FOOD GROUP	2010	0.88	0.78	0.03	0.99	0.99	0.11	0.07	0.01	0.01	0.8	0.31	0.09	0.57	0.05	0.41
638	HOCHSCHILD MIN	2010	0.98	0.69	1	0.11	0.01	0.98	0.97	0.78	0.75	0.37	0.12	0.52	0.19	0.04	0.76
639	HOGG ROBINSON	2010	0.19	0.16	0.35	0.86	0.57	0.68	0.71	0.01	0.01	0.92	0	0.26	0.22	1	0.02
640	HOME RETAIL GROUP	2010	0.02	0.02	0.08	0.03	0.93	0.01	0.01	0.91	0.61	0.02	1	0.99	1	0.97	0.08
641	HOMESERVE PLC	2010	1	0.23	0.87	0.03	0.03	0.19	0.12	0.89	0.89	0.08	0.98	0.34	0.39	0.99	0.03
642	HORNBY PLC	2010	0.87	0.95	0.64	0.24	0.03	0.89	0.81	0.01	0.01	0.07	0.99	0.06	0.06	0.84	0.13
643	HOWDEN JOINERY	2010	1	0.82	0.43	0	0.46	0.02	0.02	0.04	0.03	0.05	0	0.18	0.61	0.05	0.28
644	HUNTING PLC	2010	0.28	0.92	1	0	0	0.99	0.99	0.94	0.94	0.05	0.97	0.56	0.1	0.13	0.17
645	HYDER CONSULTING PLC	2010	0.5	0.47	0.07	0.39	0.9	0.97	0.97	0.01	0.01	0.06	0.1	0.1	0.16	0.54	0.03

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
646	IMAGINATION TECH GRP	2010	1	0.86	0.04	0	0.01	0.01	0.97	0.39	0.66	0.01	0	0.06	0.06	0.16	0.04
647	IMI PLC	2010	0.9	0.95	0.66	0.41	0.49	1	1	0.44	0.46	0.39	0.21	0.71	0.87	0.8	0.11
648	IMPERIAL TOBACCO GRP	2010	0.75	0.53	0.99	0.24	0	0.99	0.98	0.13	0.61	0.98	0.03	1	1	1	0.03
649	INCHCAPE PLC	2010	0.07	0.17	0.04	0.55	0.97	1	1	0.65	0.65	0.3	0.62	0.94	1	0.38	0.17
650	INFORMA PLC	2010	0.15	0.15	0.72	0.97	0.98	0.98	1	0.99	1	0.89	1	0.95	0.73	1	0.01
651	INMARSAT PLC	2010	0.99	0.89	1	0.33	0.21	0.81	0.99	0.57	0.27	1	0.09	0.79	0.5	0.93	0.93
652	INNOVATION GROUP	2010	0.07	0	0.05	0.06	0.21	0.99	1	0.48	0.81	0.06	0.52	0.1	0.09	0.99	0.03
653	INTERCONTINENTAL	2010	0.99	0.92	0.99	0.39	0.42	0.99	0.99	0.01	0.01	0.97	1	0.81	0.64	0.27	0.99
654	INTERSERVE PLC	2010	0.1	0.35	0.03	0.97	0.95	1	0.35	1	0.99	0.1	0.05	0.59	0.88	0.7	0.08
655	INTERTEK GROUP	2010	1	0.99	0.79	0.92	0.97	1	1	1	1	0.96	0.03	0.57	0.7	0.87	0.23
656	INTL POWER PLC	2010	0.08	0.56	0.97	0.65	0.3	0.99	0.99	0.01	0.01	0.99	0.29	1	0.99	0.11	0.95
657	INVENSYS PLC	2010	0.91	0.95	0.4	0.08	0.84	1	1	1	0.99	0.03	0	0.82	0.94	0.45	0.09
658	ISIS PROPERTY TRUST	2010	0.03	0	1	0	0.04	0.01	0.01	0.01	0.01	0.79	1	0.08	0.04	0.03	1
659	ITE GROUP PLC	2010	1	1	1	0.59	0.11	0.94	0.98	0.01	0.01	0.03	0.97	0.08	0.07	0.97	0.02
660	J SAINSBURY PLC	2010	0.17	0.13	0.03	0.93	0.98	0.01	0.01	0.02	0.01	0.41	0.77	1	1	0.04	1
661	JAMES FISHER & SONS	2010	0.53	0.62	0.35	0.96	0.94	0.71	0.91	0.99	0.99	0.96	0.7	0.15	0.14	0.75	0.65
662	JARDINE LLOYD	2010	0.77	0.69	0.7	0.89	0.3	0.96	0.99	0.99	0.92	0.04	0.26	0.6	0.51	0.6	0.02
663	JD SPORTS FASHION	2010	0.6	0.97	0.14	0.36	0.59	0.01	0.01	0.01	0.01	0.01	0.96	0.11	0.53	0.42	0.32
664	JKX OIL & GAS PLC	2010	0.97	1	1	0.01	0.11	0.98	0.02	0.01	0.04	0.01	1	0.14	0.08	0.08	1
665	JOHN MENZIES PLC	2010	0.23	0.2	0.02	0.5	0.98	0.98	0.73	0.7	0.5	0.8	0.08	0.3	0.85	0.49	0.42
666	JOHN WOOD GROUP PLC	2010	0.82	0.62	0.13	0.9	0.97	0.97	0.97	0.98	0.92	0.07	0.87	0.77	0.97	0.65	0.04
667	JOHNSON MATTHEY PLC	2010	0.93	0.73	0.04	0.84	0.98	0.99	1	0.95	0.83	0.47	0.93	0.9	1	0.62	0.43
668	KAZAKHMYS PLC	2010	0.24	0.97	1	0.04	0.01	0.98	0.92	0.93	0.81	0.1	0.99	1	0.93	0.1	0.33
669	KCOM GROUP PLC	2010	0.34	0	0.12	0	0.5	0.01	0.02	0.82	0.82	0.98	0	0.25	0.38	0.95	0.48
670	KELLER GROUP PLC	2010	0.13	0.39	0.19	0.21	0.21	0.99	0.99	0.01	0.01	0.13	0.8	0.53	0.69	0.27	0.44
671	KENMARE RESOURCES	2010	0.43	0	0	0.76	0	0.01	0.96	0.16	0.01	1	0.01	0.28	0.05	0.16	1

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
672	KESA ELECTRICALS PLC	2010	0.43	0.03	0.03	0.13	0.89	0.98	0.97	0.98	0.77	0.03	0	0.79	1	0.14	0.34
673	KINGFISHER PLC	2010	0.05	0.1	0.06	0.97	0.98	0.99	0.99	0.01	0.01	0.24	0.55	1	1	0.76	0.69
674	KOFAX PLC	2010	0.31	0.06	0.12	0.91	0.66	0.87	0.9	0.04	0.12	0.01	0.99	0.1	0.11	0.98	0.02
675	LADBROKES PLC	2010	0.99	1	0.99	0	0.02	0.26	0.54	0.63	0.95	1	0	0.62	0.7	1	0.2
676	LAIRD PLC	2010	0.05	0.16	0.17	0.02	0.14	0.95	0.96	0.9	0.88	0.13	0.32	0.57	0.51	1	0.06
677	LAMPRELL PLC	2010	1	1	0.36	0.02	0.25	0.01	0.01	0.01	0.01	0.02	0.99	0.15	0.2	0.04	0.13
678	LAND SECURITIES	2010	0.03	0	0.96	0	0.65	0.01	0.01	0.9	0.92	0.93	0.99	1	0.73	0.04	1
679	LAVENDON GROUP PLC	2010	0.05	0.04	0.44	0.15	0.04	1	1	1	1	1	0.22	0.3	0.13	0.5	0.99
680	LAW DEBENTURE CORP	2010	0.05	0.13	1	0.98	0.32	0.01	0.01	0.05	0.5	0.04	0.1	0.25	0.05	0.04	0.01
681	LOGICA PLC	2010	0.04	0.07	0.07	0.77	0.95	1	1	1	1	0.09	0.14	0.97	0.99	1	0.02
682	LONDON & STAMFORD	2010	0.07	0.99	0	0.01	0	0.01	0.01	0.01	0.01	0.11	0.09	0.29	0.04	0.03	0.52
683	LONDON STOCK EXCH	2010	1	0.86	1	0	0	0.01	0.73	0.35	0.99	0.99	0	1	0.48	0.15	0.03
684	LONMIN PLC	2010	0.97	0.09	0.98	0.02	0	0.02	0.12	0.18	0.01	0.07	0.94	0.9	0.65	0.41	0.9
685	LOOKERS PLC	2010	0.06	0.04	0.03	0.71	0.98	0.01	0.01	0.18	0.1	0.17	0.16	0.5	0.87	0.14	0.41
686	LOW & BONAR PLC	2010	0.03	0.64	1	0.02	0	0.3	0.74	0.52	0.54	0.36	0.65	0.21	0.04	0.87	0.43
687	LSL PROPERTY	2010	0.98	0.98	0.31	0	0.17	0.01	0.01	0.81	0.83	0.52	0.9	0.08	0.11	1	0.02
688	MANAGEMENT CON	2010	0.02	0.01	0.27	0.29	0.66	0.81	0.87	0.01	0.35	0.41	0.02	0.23	0.17	1	0.02
689	MARKS & SPENCER	2010	0.87	0.94	0.3	0.43	0.46	0.08	0.1	0.01	0.78	0.95	1	1	1	0.08	1
690	MARSHALLS PLC	2010	0.06	0.06	0.12	0.29	0.13	0.01	0.01	0.01	0.01	0.42	0.53	0.21	0.24	0.21	0.98
691	MARSTON'S PLC	2010	0.03	0.13	0.98	0.94	0.85	0.01	0.01	0.93	0.94	1	0.14	0.88	0.54	0.16	1
692	MCBRIDE PLC	2010	0.34	0.21	0.06	0.93	0.83	0.85	0.85	0.34	0.29	0.28	0	0.25	0.56	0.14	0.84
693	MEARS	2010	0.51	0.66	0.05	0.92	0.96	0.01	0.01	0.89	0.85	0.02	0.77	0.11	0.32	0.95	0.03
694	MECOM GROUP PLC	2010	0.03	0	0.03	0	0.99	0.99	1	0.01	0.01	0.87	0	0.76	0.77	1	0.09
695	MEDICX FUND LTD.	2010	0.06	0.01	1	0.07	0.01	0.01	0.01	0.01	0.01	1	0.89	0.1	0.04	0.06	1
696	MEGGITT PLC	2010	0.16	0.3	0.9	0.96	0.41	0.75	0.99	0.78	0.97	0.73	0.15	0.95	0.69	1	0.03
697	MELROSE	2010	0.05	0.97	0.27	0	0.35	0.98	0.99	0.97	0.99	0.25	0.2	0.79	0.66	1	0.07

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
698	MELROSE RESOURCES	2010	0.12	0.02	1	0.15	0	0.73	0.56	0.01	0.01	1	0.12	0.36	0.09	0.35	1
699	MICHAEL PAGE	2010	1	1	0.4	0	0.01	0.99	0.99	0.01	0.01	0.04	0.95	0.19	0.61	0.07	0.04
700	MICRO FOCUS INTL	2010	1	1	1	0.34	0.71	0.85	0.96	0.01	0.04	0.04	0.08	0.11	0.1	0.99	0.02
701	MILLENNIUM	2010	0.01	0.1	0.81	0.74	0.27	1	1	0.06	0.02	0.12	0.64	0.93	0.55	0.04	1
702	MISYS PLC	2010	1	0.98	0.87	0	0.95	0.96	0.99	0.87	0.93	0.18	0.86	0.5	0.53	0.99	0.02
703	MITCHELLS & BUTLERS	2010	0.07	0.02	0.86	0.88	0.72	0.01	0.02	0.68	0.35	1	0.13	0.99	0.89	0.04	1
704	MITIE GROUP PLC	2010	0.8	0.69	0.07	0.98	0.98	0.01	0.01	0.92	0.94	0.03	0.93	0.49	0.8	0.95	0.03
705	MONDI PLC	2010	0.02	0.03	0.12	0.49	0.61	1	1	1	1	0.55	0.92	1	1	0.08	1
706	MORGAN CRUCIBLE CO	2010	0.24	0.48	0.32	0.6	0.4	0.94	0.98	0.99	0.99	0.92	0.02	0.58	0.62	0.55	0.4
707	MORGAN SINDALL	2010	0.09	0.12	0.02	0.96	0.98	0.01	0.01	1	1	0.01	0.51	0.59	0.93	0.52	0.02
708	MOTHERCARE PLC	2010	0.6	0.22	0.06	0.35	0.94	0.01	0.01	0.01	0.01	0.01	0.94	0.18	0.54	0.56	0.35
709	MUCKLOW (A & J)	2010	0.03	0.01	1	0	0	0.01	0.01	0.01	0.15	0.1	1	0.13	0.05	0.03	1
710	MWB GR	2010	0.01	0.03	0	0.95	0.87	0.01	0.02	0.77	0.97	1	0.01	0.51	0.17	0.07	1
711	N BROWN GROUP PLC	2010	0.75	0.89	0.71	0.96	0.97	0.01	0.01	0.01	0.01	0.9	0.94	0.48	0.52	0.08	0.05
712	NAMAKWA DIAMONDS LTD	2010	1	0	0	0	0	0.83	0.25	1	0.01	0.03	0	0.06	0.05	0.05	0.95
713	NATIONAL EXPRESS GRP	2010	0.16	0.15	0.1	0.39	0.52	0.95	0.88	0.98	1	0.95	0.16	0.9	0.96	1	0.37
714	NATIONAL GRID PLC	2010	0.29	0.49	0.98	0.37	0.14	0.63	0.63	1	1	1	0.22	1	1	0.17	1
715	NCC GROUP PLC	2010	0.99	0.92	1	0.98	0.19	0.34	0.41	0.89	0.91	0.05	0.82	0.06	0.05	1	0.02
716	NEXT PLC	2010	1	1	0.8	0.83	0.98	0.1	0.06	0.73	0.66	0.95	1	0.77	0.99	0.05	0.6
717	NORTHGATE PLC	2010	0.08	0.03	0.79	0.02	0.03	0.65	0.61	0.01	0.03	1	0.41	0.68	0.52	0.08	1
718	OPTOS PLC	2010	0.66	0.39	0.41	0.13	0.11	0.81	0.12	0.01	0.01	1	0	0.06	0.06	0.1	0.99
719	OXFORD INSTRUMENTS	2010	0.6	0.02	0.1	0.21	0.36	0.99	1	0.63	0.75	0.08	0.56	0.09	0.11	0.67	0.08
720	PACE PLC	2010	0.51	0.86	0.09	0.06	0.48	0.01	0.97	0.01	0.01	0.21	0.53	0.35	0.63	0.76	0.02
721	PAYPOINT PLC	2010	1	1	0.76	0.32	0.45	0.01	0.04	0.01	0.01	0.01	1	0.07	0.12	0.9	0.07
722	PEARSON PLC	2010	0.14	0.52	0.39	0.22	0.97	0.9	0.99	1	1	0.41	0.63	1	1	1	0.02
723	PENDRAGON PLC	2010	0.04	0.01	0.01	0.19	0.23	0.03	0.04	0.99	0.95	0.69	0.05	0.75	0.99	0.68	0.16

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
724	PENNON GROUP PLC	2010	0.35	0.25	1	0.94	0.83	0.01	0.01	0.92	0.75	1	0.16	0.97	0.63	0.09	1
725	PERSIMMON PLC	2010	0.02	0.02	0.14	0	0	0.01	0.01	0.01	0.01	0.12	0.99	0.95	0.89	0.15	0.02
726	PETROFAC LIMITED	2010	1	0.98	0.44	0.79	0.85	0.92	0.99	0.92	0.85	0.02	0.71	0.78	0.91	0.08	0.09
727	PETROPAVLOVSK PLC	2010	0.96	0.49	1	0.24	0	0.04	0.03	0.95	0.3	0.73	0.94	0.56	0.16	0.48	0.95
728	PHOENIX IT	2010	0.29	0.55	0.65	0.46	0.48	0.01	0.01	0.79	0.81	0.57	0.66	0.16	0.13	1	0.11
729	PHOTO-ME INT'L PLC	2010	0.33	0	0.03	0.04	0.06	0.7	0.99	0.75	0.44	0.61	0.93	0.1	0.13	0.23	0.7
730	PREMIER FARNELL PLC	2010	0.99	0.91	0.36	0.88	0.82	0.95	0.96	0.12	0.1	1	0	0.3	0.59	0.22	0.06
731	PREMIER FOODS PLC	2010	0.03	0	0.29	0.22	0.81	0.03	0.09	0.97	0.96	0.97	0.06	0.98	0.95	1	0.1
732	PREMIER OIL PLC	2010	0.75	0.36	1	0.81	0	0.96	0.97	0.01	0.01	0.26	0.85	0.67	0.27	0.17	0.98
733	PROMETHEAN WORLD	2010	0.02	0.84	0.58	0.82	0.29	0.99	0.98	0.01	0.17	1	0	0.11	0.1	1	0.02
734	PSION PLC	2010	0.01	0	0.04	0.32	0.51	0.98	1	0.01	0.39	0.01	0.32	0.12	0.11	0.98	0.02
735	PV CRYSTALOX SOLA	2010	0.73	1	0.99	0	0	0.82	0.96	0.02	0.03	0.04	1	0.16	0.12	0.04	0.32
736	PZ CUSSONS PLC	2010	0.83	0.63	0.43	0.98	0.77	0.95	0.94	0.43	0.74	0.02	0.99	0.52	0.56	0.41	0.31
737	QINETIQ GROUP	2010	0.3	0.1	0.14	0.31	0.8	0.74	0.83	0.85	0.79	0.83	0.58	0.75	0.8	0.96	0.17
738	QUINTAIN ESTATES	2010	0.02	0	0	0.21	0	0.01	0.01	0.74	0.95	0.95	0.77	0.67	0.05	0.03	1
739	R.E.A. HOLDINGS PLC	2010	0.17	0.91	1	0.69	0	0.19	0.66	0.01	0.01	0.68	0.95	0.11	0.05	0.06	1
740	RANK GROUP PLC (THE)	2010	0.72	1	0.47	0	0.93	0.29	0.11	1	0.98	1	0	0.34	0.46	0.92	0.66
741	RAVEN RUSSIA LTD	2010	0.01	0	0	0	0	0.01	0.01	0.05	0.84	0.68	0.01	0.53	0.05	0.04	1
742	RECKITT BENCKISER	2010	1	1	0.99	0.94	0.48	0.98	0.98	0.01	1	0.07	0.96	1	1	1	0.03
743	REDROW PLC	2010	0.05	0	0.11	0.01	0	0.01	0.01	0.01	0.02	0.54	0.98	0.55	0.47	0.04	0.02
744	REGUS PLC	2010	0.24	0.71	0.26	0.06	0.03	1	0.99	0.01	0.01	0.01	0.97	0.6	0.67	0.85	0.23
745	RENOLD PLC	2010	0.13	0	0.03	0.08	0.13	1	1	0.25	0.03	0.46	0.02	0.09	0.1	0.25	0.34
746	RENTOKIL INITIAL PLC	2010	0.92	0.96	0.12	0	0.43	0.99	0.98	1	1	1	1	0.83	0.95	0.89	0.44
747	RESTAURANT GROUP PLC	2010	0.9	0.97	0.57	0.98	0.97	0.01	0.01	0.12	0.34	0.48	0.22	0.16	0.31	0.13	1
748	REXAM PLC	2010	0.07	0.12	0.24	0.76	0.83	1	1	0.61	0.44	0.93	0.03	1	1	0.97	0.33
749	RICARDO PLC	2010	0.59	0.7	0.21	0.75	0.91	0.41	0.99	0.05	0.05	0.14	0.76	0.09	0.1	0.23	0.46

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
750	RIO TINTO PLC	2010	0.66	0.77	1	0.2	0.01	0.99	1	0.99	1	0.84	0.67	1	1	0.57	0.93
751	RM PLC	2010	0.54	0.7	0.07	0.93	0.96	0.01	0.01	0.5	0.74	0.02	0.57	0.1	0.21	0.55	0.06
752	ROBERT WALTERS PLC	2010	0.77	0.79	0.05	0.04	0.2	0.98	0.97	0.37	0.1	0.02	0.61	0.07	0.23	0.11	0.02
753	ROLLS-ROYCE	2010	0.35	0.09	0.18	0	0.43	0.39	1	0.96	0.99	0.05	0.45	1	1	0.33	0.08
754	ROTORK PLC	2010	1	1	0.99	0.98	0.73	0.87	0.99	0.99	0.85	0.01	1	0.12	0.21	0.32	0.05
755	ROYAL DUTCH SHELL	2010	0.16	0.66	0.24	0.38	0.38	1	0.99	0.99	0.34	0.05	0.99	1	1	0.05	0.84
756	ROYAL DUTCH SHELL	2010	0.16	0.66	0.24	0.38	0.38	1	0.99	0.99	0.34	0.05	0.99	1	1	0.05	0.84
757	RPC GROUP PLC	2010	0.08	0.03	0.07	0.9	0.93	0.71	0.7	0.97	0.97	0.66	0.76	0.36	0.56	0.07	0.94
758	RPS GROUP PLC	2010	0.46	0.72	0.47	0.88	0.86	0.99	0.99	0.96	0.97	0.05	0.96	0.28	0.33	1	0.03
759	RSM TENON GROUP PLC	2010	0.1	0.18	0.31	0.76	0.29	0.01	0.01	1	0.99	0.25	0.67	0.1	0.1	1	0.02
760	SABMILLER PLC	2010	0.6	0.51	0.95	0.97	0.97	1	1	0.32	0.3	0.62	0.9	1	1	0.99	0.24
761	SAFESTORE HOLD	2010	0.05	0.49	1	0.14	0.12	0.26	0.35	0.01	0.01	0.99	0.86	0.53	0.06	0.03	0.02
762	SAGE GROUP PLC (THE)	2010	0.78	0.66	0.97	0.98	0.86	0.98	0.99	0.99	0.99	0.23	0.88	0.9	0.77	1	0.03
763	SAINT IVES PLC	2010	0.04	0.02	0.08	0.27	0.23	0.03	0.04	0.77	0.85	0.05	0.87	0.15	0.29	0.45	0.88
764	SALAMANDER ENGY	2010	0.1	0	0.51	0.02	0.26	0.86	0.59	0.41	0.05	0.12	0.28	0.33	0.07	0.59	0.96
765	SAVILLS PLC	2010	0.31	0.14	0.11	0.12	0.07	0.99	0.93	1	0.99	0.02	0.72	0.29	0.52	0.9	0.02
766	SCOTTISH & SOUTHERN	2010	0.75	0.55	0.13	0.36	0.56	0.04	0.02	0.83	0.07	0.73	0.31	1	1	0.08	0.92
767	SDL PLC	2010	0.66	0.66	0.65	0.98	0.92	0.98	1	0.95	0.78	0.01	0.51	0.11	0.1	1	0.02
768	SEGRO PLC	2010	0.02	0	1	0.01	0.03	0.37	0.56	0.06	0.19	0.99	0.67	1	0.24	0.03	1
769	SENIOR PLC	2010	0.41	0.81	0.35	0.98	0.87	0.89	0.96	0.86	0.65	0.55	0.73	0.3	0.46	0.93	0.24
770	SEPURA PLC	2010	0.24	0.99	0.77	0.65	0.33	0.26	0.61	0.01	0.01	0.24	0.99	0.06	0.06	0.81	0.03
771	SERCO GROUP PLC	2010	0.84	0.38	0.07	0.98	0.97	0.94	0.88	0.99	1	0.51	0.47	0.87	0.99	0.98	0.03
772	SEVERFIELD ROWEN PLC	2010	0.44	0.85	0.38	0.21	0.12	0.01	0.02	0.01	0.01	0.08	0.88	0.13	0.21	0.89	0.49
773	SEVERN TRENT PLC	2010	0.23	0.18	1	0.82	0.4	0.03	0.35	0.07	0.34	1	0.06	1	0.83	0.05	1
774	SHAFTESBURY PLC	2010	0.04	0.13	1	0	0	0.01	0.01	0.01	0.01	0.94	0.99	0.69	0.06	0.03	1
775	SHANKS GROUP PLC	2010	0.16	0.15	0.22	0.67	0.78	0.93	0.97	0.01	0.54	0.97	0.31	0.59	0.52	0.8	0.5

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
776	SHIRE PLC	2010	1	0.59	0.94	0.11	0.07	0.23	0.75	0.96	0.71	0.37	0	0.96	0.86	1	0.06
777	SIG PLC	2010	0.05	0.01	0.04	0.16	0.45	0.66	0.65	0.99	0.99	0.73	0.46	0.77	0.97	0.95	0.07
778	SMITH & NEPHEW PLC	2010	1	0.91	0.96	0.6	0.13	0.99	1	0.95	0.97	0.64	1	0.92	0.92	0.93	0.11
779	SMITHS INDUSTRIES	2010	0.96	1	0.75	0	0.77	0.99	1	0.99	0.99	0.79	0.51	0.94	0.95	0.99	0.05
780	SMITHS NEWS PLC	2010	1	1	0.03	0	0.97	0.01	0.01	0.03	0.02	0.98	1	0.08	0.79	0.08	0.08
781	SOCO INT'L PLC	2010	1	1	1	0	0.02	0.32	0.01	0.01	0.01	0.37	1	0.43	0.05	0.7	0.88
782	SPECTRIS PLC	2010	0.73	0.92	0.61	0.32	0.22	1	1	0.99	0.99	0.2	0.35	0.55	0.59	0.98	0.07
783	SPEEDY HIRE PLC	2010	0.1	0.02	0.18	0.06	0.07	0.02	0.01	0.39	0.37	0.96	0.35	0.37	0.3	0.31	0.99
784	SPIRAX-SARCO ENGIN.	2010	0.99	0.99	0.88	0.71	0.46	0.99	0.99	0.26	0.22	0.03	0.98	0.3	0.43	0.21	0.3
785	SPORTS DIRECT INTER	2010	0.86	0.45	0.22	0.19	0.22	0.27	0.26	0.46	0.21	0.97	0.93	0.58	0.77	0.45	0.39
786	ST. MODWEN PROPS.	2010	0.03	0.02	0.01	0.03	0	0.01	0.01	0.01	0.01	0.87	0.88	0.64	0.08	0.03	1
787	STAGECOACH GROUP PLC	2010	0.94	0.99	0.02	0.06	0.04	0.41	0.19	0.93	0.95	0.94	0	0.73	0.89	0.12	0.93
788	STANDARD LIFE INV PR	2010	0.04	0	1	0	0	0.43	0.29	0.19	0.22	1	1	0.1	0.04	0.03	1
789	STHREE PLC	2010	0.96	0.99	0.12	0.01	0.15	0.46	0.5	0.01	0.01	0.01	0.99	0.09	0.47	0.09	0.02
790	STOBART GROUP LTD	2010	0.04	0.05	0.09	0.2	0.89	0.01	0.01	0.75	0.06	0.33	0.77	0.29	0.21	0.91	0.67
791	SUPERGROUP PLC	2010	0.81	1	0.52	0	0.07	0.01	0.14	0.77	0.9	0.11	0.01	0.05	0.06	0.04	0.4
792	SYNERGY HEALTH PLC	2010	0.22	0.14	0.44	0.95	0.92	0.93	0.79	0.88	0.9	0.78	0.89	0.29	0.14	0.99	0.7
793	TALKTALK TELECOM	2010	0.12	0	0.01	0.98	0.08	0.01	0.02	0.01	0.01	1	0.11	0.65	0.79	1	0.11
794	TARSUS GROUP PLC	2010	0.37	0.3	0.97	0.31	0.03	0.97	0.95	0.01	0.01	0.79	0.27	0.08	0.05	1	0.01
795	TATE & LYLE PLC	2010	0.34	0.22	0.18	0.39	0.96	0.99	0.99	0.87	0.82	0.96	0.12	0.96	0.99	0.15	0.72
796	TAYLOR WIMPEY PLC	2010	0.02	0	0.06	0	0.12	0.57	0.66	0.04	0.09	0.52	0.57	1	0.99	0.05	0.01
797	TELECITY GROUP PLC	2010	0.99	0.54	0.89	0.11	0	0.65	0.65	0.01	0.39	0.27	0.69	0.19	0.09	0.32	1
798	TESCO PLC	2010	0.63	0.55	0.07	0.92	0.98	0.89	0.82	0.04	0.01	0.7	0.62	1	1	0.13	0.99
799	THOMAS COOK GROUP	2010	0.06	0.02	0.04	0.92	0.98	1	1	0.01	0.01	0.15	0.81	1	1	1	0.09
800	TOPPS TILES PLC	2010	1	1	0.78	0	0.06	0.01	0.01	0.19	0.27	1	0	0.07	0.11	0.04	0.71
801	TOWN CENTRE SECS	2010	0.02	0	1	0	0.38	0.01	0.01	0.02	0.06	0.99	0.98	0.23	0.05	0.03	1

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
802	TRAVIS PERKINS PLC	2010	0.06	0.34	0.19	0.85	0.81	0.01	0.01	0.96	0.57	0.73	0.93	0.95	0.98	0.99	0.1
803	TRINITY MIRROR PLC	2010	0.02	0.23	0.81	0.11	0.28	0.01	0.02	0.79	0.65	0.42	0	0.77	0.61	1	0.28
804	TT ELECTRONICS PLC	2010	0.03	0.04	0.05	0.21	0.37	0.99	1	1	1	0.3	0.86	0.24	0.49	0.51	0.33
805	TUI TRAVEL PLC	2010	0.06	0	0.03	0.96	0.99	1	1	0.92	0.39	0.16	0.67	1	1	0.99	0.06
806	TULLOW OIL PLC	2010	1	0.1	1	0.26	0	0.63	0.65	0.01	0.01	0.61	0.95	0.96	0.54	0.99	0.71
807	UK COAL PLC	2010	0.08	0	0	0	0	0.01	0.01	0.9	0.44	0.51	0	0.52	0.23	0.03	0.89
808	UK MAIL GROUP	2010	0.96	0.69	0.05	0.89	0.94	0.01	0.01	0.96	0.95	0.03	0.82	0.08	0.25	0.14	0.43
809	ULTRA ELECTRONICS	2010	1	0.86	0.54	0.1	0.96	0.98	0.99	0.99	0.97	0.08	0.75	0.36	0.5	1	0.03
810	UMECO	2010	0.07	0.17	0.13	0.83	0.95	0.96	0.97	0.91	0.83	0.52	0.12	0.26	0.26	0.84	0.05
811	UNILEVER PLC	2010	0.99	0.94	0.73	0.88	0.98	0.97	0.98	0.97	1	0.6	0.99	1	1	0.99	0.12
812	UNITE GROUP PLC	2010	0.04	0	0	0.11	0	0.01	0.01	0.12	0.34	1	0.28	0.6	0.1	0.04	0.93
813	UTV MEDIA PLC	2010	0.06	0.04	0.97	0.3	0.88	0.63	0.66	0.95	0.99	0.93	0.61	0.15	0.08	1	0.02
814	VECTURA GROUP PLC	2010	0.15	0	0	0.76	0	0.01	0.01	0.01	0.01	0.01	0	0.11	0.05	1	0.02
815	VEDANTA RESOURCES	2010	0.07	0.5	0.99	0.14	0	0.11	1	1	0.99	0.64	0.25	1	1	0.03	0.98
816	VICTREX PLC	2010	1	1	1	0.07	0.01	0.12	0.96	0.07	0.35	0.01	1	0.12	0.09	0.08	0.99
817	VITEC GROUP PLC	2010	0.28	0.56	0.29	0.33	0.77	0.99	0.99	0.97	0.95	0.31	0.97	0.12	0.2	0.69	0.21
818	VODAFONE GROUP PLC	2010	0.04	0.05	0.94	0.19	0.27	1	1	0.01	0.01	0.4	0	1	1	0.99	0.07
819	VOLEX GROUP PLC	2010	0.69	0	0.04	0.01	0.49	0.99	0.97	0.87	0.85	0.42	0.02	0.07	0.15	0.05	0.03
820	VP PLC	2010	0.19	0.74	0.5	0.87	0.53	0.01	0.01	1	1	0.8	0.93	0.1	0.09	0.61	0.98
821	WEIR GROUP PLC (THE)	2010	0.78	0.96	0.63	0.3	0.21	1	1	0.88	0.94	0.16	0.96	0.76	0.78	0.99	0.06
822	WETHERSPOON (J.D.)	2010	0.49	0.46	0.32	0.92	0.98	0.01	0.01	0.01	0.01	1	0.07	0.56	0.64	0.04	1
823	WH SMITH PLC	2010	0.95	0.97	0.09	0.97	0.92	0.01	0.01	0.41	0.54	0.01	1	0.31	0.77	0.17	0.56
824	WHITBREAD PLC	2010	0.5	0.9	0.92	0.03	0.95	0.01	0.01	0.73	0.89	0.54	0.99	0.91	0.77	0.07	1
825	WILLIAM HILL PLC	2010	0.37	0.9	1	0.15	0.35	0.01	0.07	0.66	0.59	1	0.58	0.79	0.66	1	0.06
826	WILMINGTON GROUP PLC	2010	0.71	0.16	0.61	0.37	0.44	0.01	0.26	0.37	0.48	0.12	0.2	0.08	0.06	1	0.03
827	WINCANTON PLC	2010	0.37	0.06	0.02	0.83	0.99	0.65	0.61	0.01	0.01	0.37	0.01	0.56	0.92	0.46	0.32

CASES		GROUP	MTB	ROA	ROS	SDROA	SDROA	DGA	DGS	DBA	DBS	TDTA	RETA	SIZEA	SIZES	INTA	TANG
828	WOLSELEY PLC	2010	0.12	0	0.04	0.04	0.91	1	1	0.01	0.01	0.46	0.66	1	1	0.72	0.12
829	WPP PLC	2010	0.08	0.06	0.46	0.98	0.4	1	1	0.98	0.99	0.25	0.64	1	1	0.99	0.02
830	WS ATKINS PLC	2010	0.99	0.74	0.13	0	0.91	0.9	0.77	1	1	0.01	0	0.5	0.78	0.17	0.03
831	WSP GROUP PLC	2010	0.09	0.2	0.12	0.42	0.94	1	1	0.97	0.99	0.22	0.22	0.35	0.55	0.95	0.03
832	XCHANGING PLC	2010	0.53	0.01	0.17	0.01	0.97	0.75	0.9	1	0.99	0.02	1	0.32	0.53	0.98	0.03
833	XP POWER LTD	2010	0.83	0.98	0.75	0.1	0.07	0.96	0.88	0.01	0.01	0.89	0.17	0.09	0.11	0.99	0.04
834	XSTRATA PLC	2010	0.24	0.52	0.99	0.24	0.06	1	1	1	1	0.43	0.6	1	1	0.3	1
835	YELL GROUP PLC	2010	0.06	0.01	0.99	0.01	0.24	0.98	0.97	0.05	0.27	1	0.02	1	0.93	1	0.02
836	YULE CATTO & CO PLC	2010	0.33	0.7	0.18	0.2	0.82	0.99	1	0.78	0.48	0.89	0.04	0.33	0.51	0.8	0.18

APPENDIX 7: COMPARISON OF IFRS 8, IAS 14R, AND IAS 14/SSAP 15[105]

This table compare different issue on segment reporting between international financial reporting standards (IFRS) 8: operating segment and international accounting standards (IAS) 14: segmental reporting. The table indicates that there are no significant differences between SSAP 25 and IAS 14. However, here are some minor differences: SSAP 25 applies to all 'large' companies, whereas IAS 14 applies to all listed companies (and those who decide to disclose the information voluntarily). There is generally more extensive disclosure required by IAS 14, particularly for primary segments as compared to SSAP 15

Criteria	IFRS 8: Operating Segment (effective 2009)	IAS 14R (effective 2005)	IAS 14/SSAP 25: Segmental reporting (effective to 2004)
To which firm does it apply	Entities that have publicly traded securities or are in the process of issuing them in a public securities market	Entities that have publicly traded securities or are in the process of issuing them in a public securities market	Entities that have publicly traded securities or are in the process of issuing them in a public securities market
Primary beneficially of the report.	For internal use: information intended to help management run the business.	External use: information intend to help investor understand risk and rewards, but also information for management was required	External use: information intend to help investor understand risk and rewards
Objective	To increase the volume of segment disclosure and bring more clarity and consistency to in international wide firms.	To increase the volume of segment disclosure and bring more clarity and consistency to in European firms.	To increase the volume of segment disclosure and bring more clarity and consistency to in UK firms.
The 10% materiality rule for identification of segment	10% materiality rule applies	10% materiality rule applies	10% materiality rule applies
Perceive weakness that lead to changes	No weakness has been I identified that require changes	Lack of convergence between IASB and FASB, however this was seen as more political (Aleksanyan and Danbolt, 2012)	No precise guidance to definition, identification, and presentation of segment information, this allows multiple interpretations (Nichols and Street, 2007)
Definition of operating segments?	Business activities that may earn revenues or incur expenses, whose	Business or geography based components that are subject to risks	Business or geography based components that are subject to risks and

[105] Most of this table was mainly produced from information obtained in Aleksanyan and Danbolt, (2012), and from *http://www.pwc.com/gx/en/ifrs-reporting/pdf/segment-reporting.pdf* Visited on 22th August 2013

Criteria	IFRS 8: Operating Segment (effective 2009)	IAS 14R (effective 2005)	IAS 14/SSAP 25: Segmental reporting (effective to 2004)
	operating results are regularly reviewed by the chief operating decision maker and for which discrete financial information is available. However, segments are analysed basing on product/business and or geographic segments	and returns that are different from those of other components.	returns that are different from those of other components.
How segmental information is reported?	One set of segment presented based on internal managerial structuring of segment reporting.	Secondary segment reporting no longer required, but practically they are reported	Primary and secondary segment reporting is used to present segmental information

APPENDIX 8: HOW FSQCA SOFTWARE WORKS.

The calibration process refers to a process of transforming conventional (raw) variables to fuzzy sets values. The process of transforming original variable measures to fuzzy set values is long process The fsQCA software performs three important tasks in configuration analysis when fuzzy set analysis (FSA) is used. The first task is to calibrate/transform interval or scale/ratio variables to fuzzy set values (0 – 1) that have to be used to measure cases' memberships in different sets. Second, connect set memberships for identification of configuration(s) for a desired outcome. Third, the software produces solutions/configurations and assesses the consistency and coverage of the configurations. For the purpose of this section, I present the first task that is calibrations

How the fsQCA software calibrates the original variables?

i. The researcher has to get the original data ready in the software files as shown in table 3.1 (MTB).
ii. The researcher has to identify the original variables that correspond to the three thresholds for full memberships (0.95), cross-over point (0.5), and full nonmembership (0.05). It was established that measures of MTB 2, 1.5, and 1 corresponds to 0.95, 0.5, and 0.05 respectively (section 5.3.1).
iii. The fsQCA will transform the thresholds to memberships log odds using the following formula

$$\ln\left(\frac{threshold}{1-threshold}\right) \qquad example \quad \ln\left(\frac{0.95}{1-0.95}\right) = 3\ full\ membership$$

$$\ln\left(\frac{0.5}{1-0.5}\right) = 0\ cross-over;\ \ln\left(\frac{0.05}{1-0.05}\right) = -3\ full\ nonmembership$$

This means thresholds 0.95, 0.5 and 0.05 corresponds to log odds 3, 0, and -3 respectively

iv. The software calculates the deviation of the scores from the cross-over point (original measures). This enables to identify cases above cross-over as this have positive value and cases below cross-over point which shows negative values see table 3.1 (DEV).

v. The software calculates the scalar. Scalar is the value that is used to scale the variable to produce log odds. There are usually two scalars: scalar for the above cross over values and scalar for below cross over values. Scalars are determined using the following formula:

- Above cross over scalar = full memberships long odds /(original Full membership variable – cross over point). That is

$$above\ scala\ = \left(\frac{3}{2-1.5}\right) = 6$$

- Below cross over scalar = full nonmembership log odds /(original Full nonmembership variable – cross over point). That is

$$below\ scalar = \left(\frac{-3}{1-1.5}\right) = 6$$

Note: it is just coincidence to have similar scalar as scalars can be different

vi. Lastly, the software produces the desired fuzzy set values as indicated in column table 3.1 (FS). These values are calculated using the formula below

$$Fussy\ set\ memberships = \frac{e^{\log odds}}{1+e^{\log odds}}$$

Where log odds represents LO column in table 3.1 for example when log odd is 3 then this will correspond to fuzzy set value (memberships) 0.95

$0.95 = \frac{e^3}{1+e^3}$, in the same way log odds 0 will be 0.5 and log odd -3 will take the value of 0.05 etc. As clearly shown in table 3.1 (FS) below

APPENDIX 8 TABLE: ILLUSTRATION FOR CALIBRATION PROCESS – FSQCA

This table is an illustrative example on how fsQCA transforms original measures to fuzzy sets. MTB is the original measure. DEV = deviation of original measures from the cross-over point which is 1.5. SC = Scalar calculated as in V above. LO = Log odds which is the product of SC and DEV. FS = fuzzy set value calculated using the formula indicated above.

Name	MTB	DEV	SC	LO	FS
ROTORK PLC	4.7	3.2	6	19.2	1
MICRO FOCUS INTL	4.04	2.54	6	15.24	1
EXPERIAN PLC	2.14	0.64	6	3.84	0.98
LSL PROPERTY	2.12	0.62	6	3.72	0.98
JKX OIL & GAS PLC	2.09	0.59	6	3.54	0.97
SMITHS INDUSTRIES	2.01	0.51	6	3.06	0.96
ANTOFAGASTA PLC	1.99	0.49	6	2.94	0.95
WH SMITH PLC	1.99	0.49	6	2.94	0.95
MEARS	1.51	0.01	6	0.06	0.51
HYDER CONSULTING PLC	1.5	0	6	0	0.5
WHITBREAD PLC	1.5	0	6	0	0.5
WETHERSPOON (J.D.)	1.49	-0.01	6	-0.06	0.49
ANITE PLC	1.48	-0.02	6	-0.12	0.47
XSTRATA PLC	1.31	-0.19	6	-1.14	0.24
CARCLO PLC	1.3	-0.2	6	-1.2	0.23
MORGAN SINDALL	1.11	-0.39	6	-2.34	0.09
INTL POWER PLC	1.1	-0.4	6	-2.4	0.08
MILLENNIUM	0.77	-0.73	6	-4.38	0.01
CAPITAL & REGIONAL	0.76	-0.74	6	-4.44	0.01

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